

MOOLARBEN COAL COMPLEX
OC3 EXTENSION PROJECT

ENVIRONMENTAL IMPACT STATEMENT

APPENDIX L

AGRICULTURAL IMPACT ASSESSMENT

YANCOAL
兖煤澳大利亚有限公司
MOOLARBEN COAL

Moolarben Coal Complex OC3 Extension Project

Agricultural Impact Assessment

3/11/2022

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EXECUTIVE SUMMARY

Report Purpose

Moolarben Coal Operations Pty Ltd (MCO) is seeking consent to extend an open cut mining operation referred to as the OC3 Extension Project (the Project). The proposed Project will allow for extraction of additional coal within existing mining and exploration tenements adjacent to approved operations at the Moolarben Coal Complex. This Agricultural Impact Assessment (AIA) forms part of the Environmental Impact Statement (EIS) which has been prepared to accompany the Development Application for the Project and refers to the proposed extension area.

This report should be read in conjunction with the Project EIS and the key findings of the associated specialist reports.

Proposed Project

MCO has identified an opportunity to extend open cut mining operations immediately south of the approved OC3 open cut pit as well as develop four new open cut pits to the east and south-east of the approved OC3 mining area, within existing mining tenements (the Project). The extended open cut mining operations would provide approximately 10 years of mining (from 2025 to 2034), maximise use of the existing mining fleet and maintain steady production of ROM coal at the Moolarben Coal Complex post-completion of mining within the approved OC3 mining area.

If approved, the Project would form a new component of the overall Moolarben Coal Complex. The Project would not change the overall life of the currently approved Moolarben Coal Complex (i.e. 31 December 2038), peak product coal production rate (22 Mtpa coal), or the previously assessed peak workforce.

The Project would result in extension of employment of existing open cut workforce (i.e. within the approved life of the Moolarben Coal Complex) and would generate royalties associated with the additional ROM coal recovery.

Mining would extend south within a valley containing land previously cleared for low-intensity agricultural purposes. Mining would move further away from private landholders in Cooks Gap and closer to Cooyal. The Project mining areas are unlikely to be visible from private land due to intervening topography associated with the Munghorn Gap Nature Reserve.

If approved, the Project would result in no final void remaining in the rehabilitated landform (including the approved OC3 area) as mine voids within the Project Area would be backfilled so that they are free draining. The mining process will include progressive rehabilitation towards the final planned landform which is designed as a mix of land for agriculture and land for conservation purpose as woodland.

Project Area

The Project Area is characterised with low lying grazing land, edged by rocky ridgelines and steep native remnant vegetation that is largely unsuitable for grazing or other agricultural enterprise. The land surface across the valley floor of the Project Area is dominantly flat to very gently undulating open flats with between 0-10% gradient, while the edges of the Project Area become gently inclined to steeply inclined with gradients between 10- >50%. Land and soil capability is dominated by Class 5 low to moderate capability land and Class 7 with very low capability land.

The entirety of the Project Area is owned by Moolarben (excluding small parcels of Crown/Council land) and is located within existing mining and exploration tenements. Land use and land production capability in the Project Area was assessed through: interviews with previous landholders; review and analysis of soil mapping data; and assessment of local and regional agricultural data and summaries.

Previous land use within the Project Area consisted of mixed grazing for cattle, wool and fat lamb production as well as small areas of opportunistic fodder cropping (under favourable conditions). Surface water and natural springs were the main water sources for stock and domestic use.

It is noted that due to mining operations occurring immediately adjacent to the Project Area, only a portion is currently licensed for agricultural use (i.e. 974.9 ha of 1,571.1 ha)

Potential Impacts

An assessment of potential agricultural productivity was undertaken through: survey of relevant former landholders and current leaseholders to gain information on typical non-drought year productivity; and corroboration of survey results with regional summaries and land capability assessment. Typical non-drought year average production was used to estimate production per hectare. Typical production per hectare was then used to estimate non-drought year impact from the removal of 974.9 ha of agricultural land due to the Project. Using this method, a $467,000 loss of production value per annum was estimated which amounts to 0.62% of the gross value generated by the same agricultural industries in the Mid-Western Local Government Area. It should be noted that this value is conservative as it is based on non-drought year production and the most profitable production system operated in the valley historically. With droughts and other production systems average agricultural production is likely to be lower.

The rehabilitation strategy for the Project would return a portion (approximately 500 hectares) of the Project Area to land suitable for agriculture (e.g. grazing).

The Groundwater Assessment (AGE, 2022) and Surface Water and Flood Impact Assessment (WRM Water and Environment, 2022) predicted no significant impacts on groundwater or surface water resources as result of the Project.

Specialist studies concerning noise, dust, traffic and visual amenity found no significant impact on neighbouring properties or land users (TTPP, 2022; Todoroski Air Sciences, 2022; SLR Consulting Australia 2022; MCO, 2022).

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ABBREVIATIONS

Abbreviation	Description
AIA	Agricultural Impact Assessment
AIP	Aquifer Interference Policy
ANAE	(Interim) Australian National Aquatic Ecosystems (Classification Framework)
ASL	Above Sea Level
CCC	Community Consultative Committee
DPE	Department of Planning and Environment
EIS	Environmental Impact Statement
GVP	Gross Value of Production
ha	hectares
km	kilometres
LGA	Local Government Area
LLS	Local Land Services
LSC	Land and Soil Capability
MCM	Moolarben Coal Mines Pty Ltd
ML	Mining Lease
Mt	million tones
mtpa	million tonnes per annum
NSW	New South Wales
ROM	run of mine
SEARS	Secretary's Environmental Assessment Requirement
SEPP	State Environmental Planning Policy
YM	Yancoal Moolarben Pty Ltd

01 INTRODUCTION

The Moolarben Coal Complex is located approximately 40 kilometres (km) north of Mudgee, New South Wales (NSW) (Figure 01-1). The Moolarben Coal Complex is operated by Moolarben Coal Operations Pty Ltd (MCO) on behalf of the Moolarben Joint Venture (Moolarben Coal Mines Pty Ltd [MCM], Yancoal Moolarben Pty Ltd [YM] and a consortium of Korean power companies). Moolarben, MCM and YM are wholly owned subsidiaries of Yancoal Australia Limited (Yancoal).

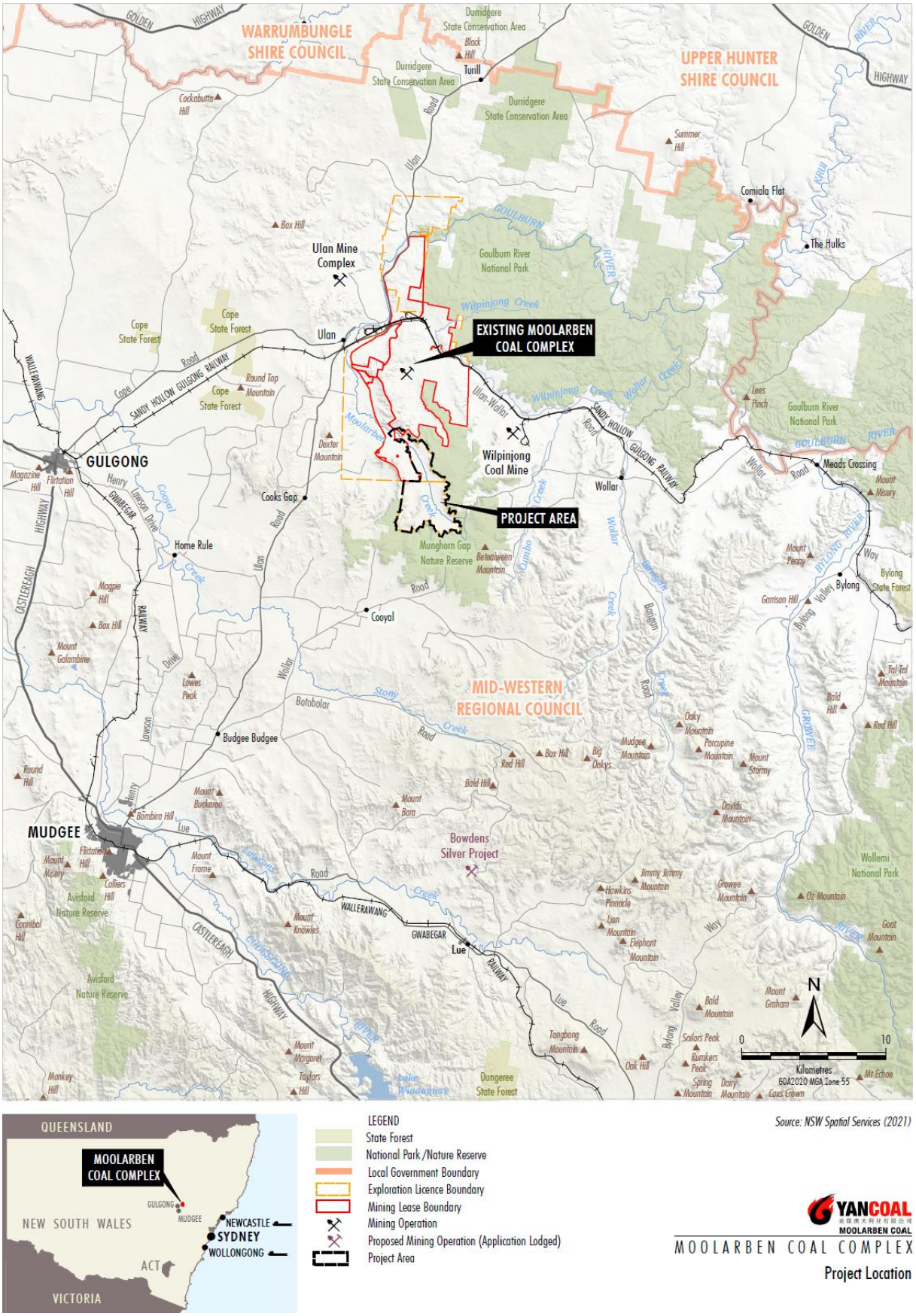
Mining operations at the Moolarben Coal Complex are currently approved until 31 December 2038 with a combined coal production rate of 22 million tonnes per annum (Mtpa) in accordance with Project Approval (05_0117) (Stage 1) (as modified) and Project Approval (08_0135) (Stage 2) (as modified). The Moolarben Coal Complex comprises four approved open cut mining areas (OC1 to OC4), three approved underground mining areas (UG1, UG2 and UG4) and other mining related infrastructure (including coal processing and transport facilities).

MCO currently operates across multiple open cut mining areas and at current production rates, mining (i.e. run of mine [ROM] coal extraction) within the OC3 mining area will likely be completed in 2025. Mining of the remaining Stage 2 open cut mining area (OC4) would continue beyond 2025 within the currently approved mine life of the Moolarben Coal Complex (i.e. 31 December 2038).

MCO is seeking consent to extend approved open cut mining operations, referred to as the OC3 Extension Project (the Project). The proposed Project will allow for extraction of additional coal within existing mining and exploration tenements adjacent to approved operations at the Moolarben Coal Complex. This Agricultural Impact Assessment (AIA) forms part of the Environmental Impact Statement (EIS) which has been prepared to accompany the Development Application for the Project and refers to the proposed extension area. The Secretary's Environmental Assessment Requirement (SEARs) provide the following requirements regarding the agricultural impact assessment:

- The likely agricultural impacts of the development, including biosecurity risks; and
- The compatibility of the development with other land uses in the vicinity of the development in accordance with the requirements of clause 12 of *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries*) *2007* (now the *State Environmental Planning Policy (Resources and Energy) 2021),* paying particular attention to the agricultural land use in the region.

Section 01.3.1 provides relevant extracts from the SEARs and a reconciliation of where these issues are addressed within the EIS and this AIA.



LEGEND
- State Forest
- National Park /Nature Reserve
- Local Government Boundary
- Exploration Licence Boundary
- Mining Lease Boundary
- Mining Operation
- Proposed Mining Operation (Application Lodged)
- Project Area

Source: NSW Spatial Services (2021)

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Project Location

Figure 01-1: Regional location of the Project Area

01.1 Requirements for an Agriculture Impact Assessment

Approval is being sought through a new development application under Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act).

This assessment has been prepared in consideration of:

- The SEARs issued by the NSW Department of Planning and Environment (DPE) (Issued 21/01/2022);
- Agricultural Impact Statement technical notes: A companion to the Agricultural Impact Statement guideline (NSW Department of Primary Industries [DPI], 2013);
- Strategic Regional Land Use Policy Guideline for Agricultural Impact Statements (DPI, 2012);
- Developments adjacent to National Parks and Wildlife Service Lands: Guidelines for consent and planning authorities (NPWS, 2020);
- NSW Aquifer Interference Policy: NSW Government policy for the licensing and assessment of aquifer interference activities (the AIP) (NSW Government, 2012a);
- The NSW *Environmental Planning and Assessment Regulation 2000* and *State Environmental Planning Policy (Resources and Energy) 2021;* and
- The Upper Hunter Strategic Regional Land Use Plan (NSW Government, 2012b).

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 Project Area (Figure 01-1) and surrounds, including identification of the current agricultural enterprises;
- Identification and assessment of 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 Government Departments.

01.2 Purpose of Assessment

The purpose of this report is to provide an AIA in support of the EIS required for the Project.

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

The SEARs for the Project were issued on 21 January 2022. Table 01-1 details the general requirement of the SEARs, including key issues that relate to agricultural resources and production and highlights where each issue is addressed in this AIA.

Table 01-1 Secretary's Environmental Assessment Requirements relevant to this AIA

Assessment Requirement	EIS Reference	Reference within this document
Water Resources including: • an assessment of the likely impacts of the development on the quantity and quality of the region's surface and groundwater resources, having regard to the NSW Aquifer Interference Policy and the advice of DPE Water and the Environment Protection Authority (EPA); • an assessment of the likely impacts of the development on aquifers, watercourses, swamps, riparian land, groundwater dependent ecosystems, water-related infrastructure, basic landholder rights and other water users; • an assessment of all water take for the life of the Project and post-closure, including water taken directly and indirectly and itemised to quantify the contributions from each water source; • an assessment of post-mining groundwater recovery and the potential long-term impacts on water quality and quantity; • a detailed site water balance, including a description of site water demands, water disposal methods (including the location, volume and frequency of any water discharges and management of discharge water quality), water supply and transfer infrastructure and water storage structures, including an assessment of the reliability of water supply, including consideration of a range of climatic conditions and climate change projections; • identification of an adequate and secure authorised water supply for the life of the Project and any licensing requirements or other approvals under the Water Act 1912 and/or Water Management Act 2000, including a description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant water sharing plan or water source embargo, or any alternative mechanisms agreed following consultation with relevant NSW government agencies/ statutory authorities; • a detailed description of the proposed water management system, beneficial water re-use program, water monitoring program and other measures to mitigate surface water and groundwater impacts; • an assessment of the potential flooding impacts of the development; • a description of proposed surface and groundwater monitoring activities and methodologies;	Appendices A and B	**Section 05** Agricultural Resource Analysis **Section 06** Impact Assessment

Assessment Requirement	EIS Reference	Reference within this document
• a description of the reasonable and feasible mitigation and management measures proposed to prevent pollution of waters and to avoid or mitigate impacts to the quality or quantity of surface and groundwater resources, including assessment of the predicted effectiveness and cost of the mitigation measures; and • an independent peer review of the groundwater model and the assessment of groundwater impacts prepared for the development.		
Amenity including: • an assessment of the likely construction, operational and traffic noise impacts of the development, in accordance with *the Interim Construction Noise Guideline, NSW Noise Policy for Industry (EPA) and NSW Road Noise Policy*, and having regard to the *Voluntary Land Acquisition and Mitigation Policy*; • the likely blasting impacts of the development on people, animals, buildings and infrastructure, and significant natural features, having regard to the relevant ANZECC guidelines; • an assessment of the likely air quality impacts of the development in accordance with the Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW; • an assessment of the likely visual impacts of the development from key public and private vantage points, and methods to minimise the lighting impacts of the development; and • the lighting impacts of the development on local receivers and on Siding Spring Observatory in accordance with the *Dark Sky Planning Guideline*, including measures to minimise lighting impacts.	Appendices H, I and N	**Section 06** Impact Assessment
Traffic and Transport including: • an assessment of the likely transport impacts of the development on the capacity, condition, safety and efficiency of the surrounding transport network, including cumulative impacts (considering other mining developments in the locality); and • a description of the measures that would be implemented to mitigate and/or manage any impacts, including any proposed road and rail upgrades, road and rail maintenance contributions, and other traffic control measures developed in consultation with the relevant road and rail authorities.	Appendix O	**Section 06** Impact Assessment
Land and Soil including: • the likely impacts of the development on the soils and land capability of the site and surrounds, and a description of the mitigation and management measures to prevent, control or minimise impacts of the development; • the likely agricultural impacts of the development, including biosecurity risks; and	This Report	**Section 05** Agricultural Resource Analysis **Section 06**

Assessment Requirement	EIS Reference	Reference within this document
• consideration of potential land contamination consistent with the requirements of State Environmental Planning Policy 55 – Remediation of Land.		Impact Assessment **Appendix A** of this report
Rehabilitation and Final Landform including: • a Rehabilitation Strategy, having regard to the advice of the Resources Regulator and addressing: - final land-use options and preferred final land use; - final landform including the conceptual final landform design; - how the rehabilitation of the Project will relate to the rehabilitation strategies of the existing mine complex and neighbouring mines; • inclusion of rehabilitation objectives and completion criteria to achieve the nominated post-mining land use for each mining domain; and • identification and discussion of opportunities to improve rehabilitation and environmental outcomes for existing disturbed areas within the Project site, and barriers or limitations to effective rehabilitation.	Attachment 8	**Section 06** Impact Assessment
Engagements • During the preparation of the EIS, you must consult with the Moolarben Coal Complex Community Consultative Committee (CCC) in accordance with the Community Consultative Committee Guidelines: State Significant Projects. You must also consult with the relevant local, State or Commonwealth Government authorities including the Director of Siding Spring Observatory, service/ utility providers, community groups, Registered Aboriginal Parties and affected landowners. The EIS must detail the engagement undertaken and demonstrate how it was consistent with the Undertaking Engagement Guide: Guidance for State Significant Projects. The EIS must detail how issues raised and feedback provided have been considered and responded to in the Project.	Section 5 Appendix E	**Section 04** Consultation
DPE Water • The identification of an adequate and secure water supply for the life of the project. This includes confirmation that water can be sourced from an appropriately authorised and reliable supply. This is also to include an assessment of the current market depth where water entitlement is required to be purchased; • A detailed and consolidated site water balance; • Assessment of impacts on surface and ground water sources (both quality and quantity), related infrastructure,	Appendices A and B Attachment 14 of the EIS	**Section 06** Impact Assessment

Assessment Requirement	EIS Reference	Reference within this document
adjacent licensed water users, basic landholder rights, watercourses, riparian land, and groundwater dependent ecosystems, and measures proposed to reduce and mitigate these impacts. • Proposed surface and groundwater monitoring activities and methodologies; and • Consideration of relevant legislation, policies and guidelines, including the NSW Aquifer Interference Policy (2012), the Guidelines for Controlled Activities on Waterfront Land (2018) and the relevant Water Sharing Plans (available at https://water.dpie.nsw.gov.au/home).		
DPI Agriculture • Specific guidance on satisfying the requirements for the AIA should be taken from the Department of Primary Industries, Agricultural Impact Statement Technical Notes.	This Report	This AIA

01.4 Supporting Studies

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

- Soil and Land Impact Assessment (Appendix A of this AIA) (Minesoils, 2022);
- Groundwater Bore Census (ENRS Pty Ltd, 2022);
- Groundwater Assessment (Appendix A of the EIS) (AGE, 2022);
- Surface Water and Flood Impact Assessment (Appendix B of the EIS) (WRM Water and Environment, 2022);
- Landscape and Visual Assessment (Appendix N of the EIS) (MCO, 2022);
- Road Transport Assessment (Appendix O of the EIS) (TTPP, 2022);
- Social Impact Assessment (Appendix E of the EIS) (CDM Smith, 2022);
- Air Quality Impact Assessment (Appendix I of the EIS) (Todoroski Air Sciences, 2022); and
- Noise and Blasting Impact Assessment (Appendix H of the EIS) (SLR Consulting Australia, 2022).

02 PROJECT DESCRIPTION

02.1 Project Overview

MCO has identified an opportunity to extend open cut mining operations immediately south of the approved OC3 open cut pit as well as develop four new open cut pits to the east and south-east of the approved OC3 mining area, within existing mining tenements. The extended open cut mining operations would provide approximately 10 years of mining (from 2025 to 2034), maximise use of the existing mining fleet and maintain steady production of ROM coal at the Moolarben Coal Complex post-completion of mining within the Stage 1 open cut mining areas.

It is expected the Project would include the following activities:

- extension of open cut mining operations within mining lease (ML) 1691, exploration licence (EL) 6288, and EL 7073 to allow mining of additional coal resources;
- extraction of up to 9 Mtpa of ROM coal with a total of approximately 40 million tonnes (Mt) over the life of the Project;
- mining operations between approximately 2025 to 2034 (which is within the approved life of the Moolarben Coal Complex ending on 31 December 2038);
- extension of employment of existing open cut workforce;
- construction and operation of ancillary infrastructure, services, plant and equipment in support of mining operations;
- construction and operation of water management and water storage infrastructure in support of mining operations;
- development of an integrated final landform with the approved OC3 mining area;
- ongoing exploration activities in the Project Area;
- construction of haul road creek crossings;
- quarrying and/or excavation of borrow pits within approved disturbance areas to retrieve construction materials;
- conventional open cut mining related activities such as drilling and blasting and other associated activities; and
- rehabilitation, decommissioning and closure.

The Project general arrangement is shown on Figure 02-1.

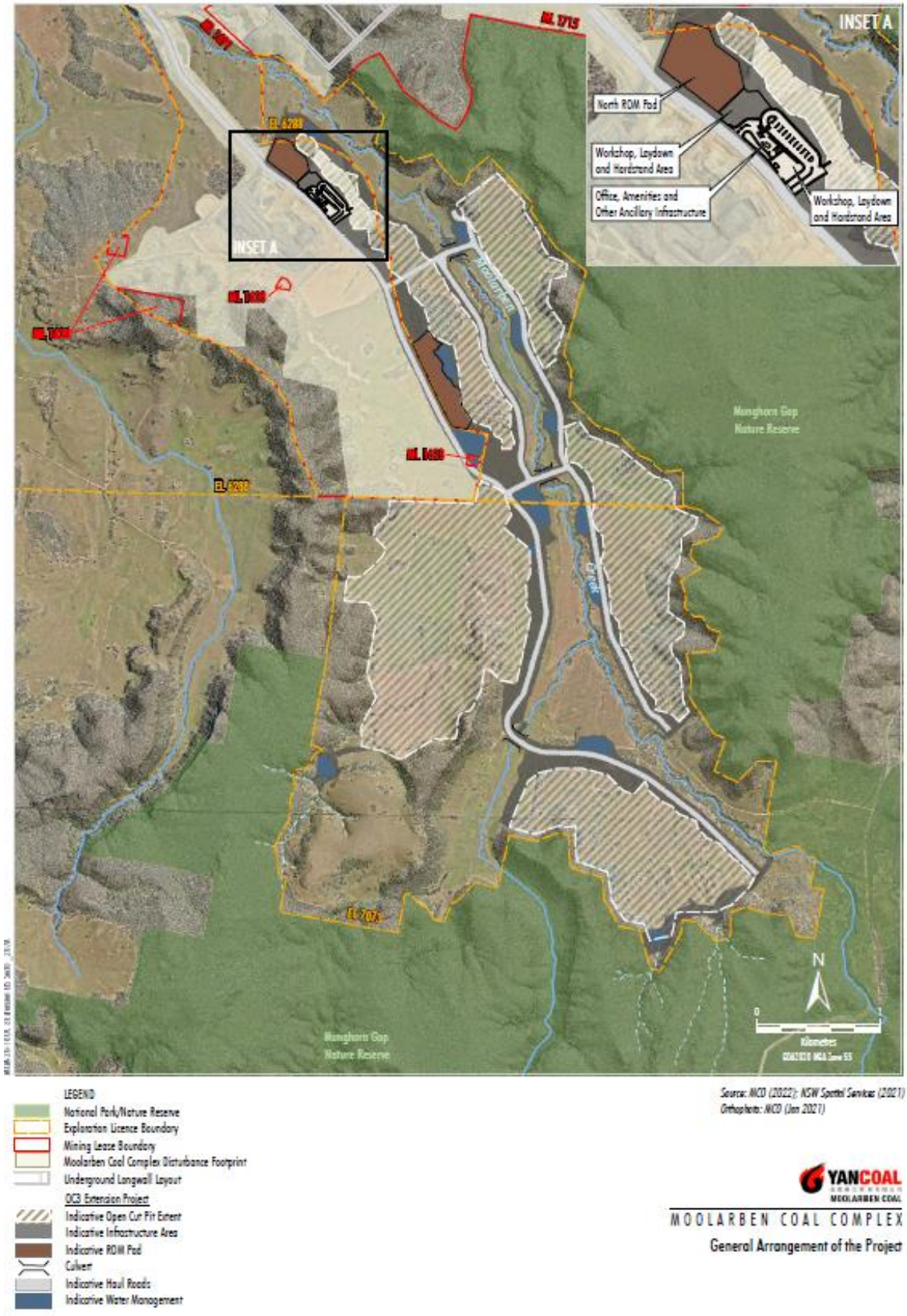


Figure 02-1: General Arrangement of the Project

03 REGIONAL AGRICULTURE OVERVIEW

The Project is situated in the Mid-Western Regional Local Government Area (LGA), part of the Central Tablelands Local Land Services (LLS) Region (Figure 03-1). Information relating to agricultural resources and production within the Central Tablelands LLS region is summarised below. Where available more detail from the Mid-Western Regional LGA is provided.

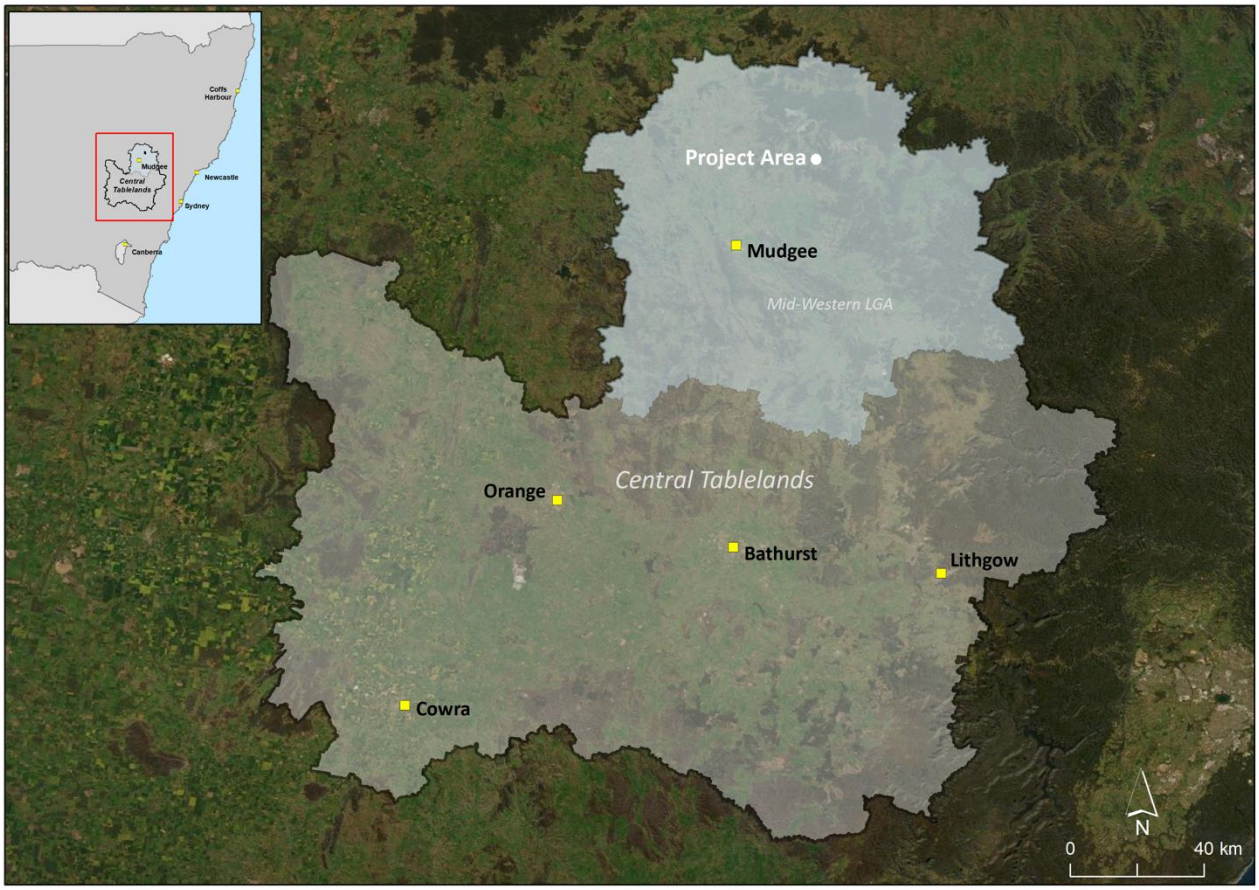


Figure 03-1: Central Tablelands LLS Region (Source: https://www.lls.nsw.gov.au/regions/central-tablelands/region-profile)

03.1 Central Tablelands

The Central Tablelands LLS Region (LLS Region) is located in central NSW and covers an area of approximately 31,365 km^2. The LLS Region includes the major towns of Bathurst, Blayney, Cowra, Lithgow, Molong, Mudgee, Oberon and Orange; falls predominantly within Wiradjuri Aboriginal country; and has a population of 156,000 residents. Major industries include large retail centres, a campus of Charles Sturt University, mining, tourism and agriculture. The LLS Region comprises 8 LGAs and makes up 3% of the Murray-Darling Basin (NRM Regions Australia, n.d).

Agriculture is a key industry for the LLS Region and contributes approximately 4.2% of NSW's annual value of agricultural production. Approximately 7% of the LLS Region population is employed in the Agriculture, Fisheries and Forestry sector. In terms of Gross Value of Production (GVP), beef production is the main livestock industry, with wool and sheep meat production also significant (DPI, 2020). Other agricultural activity includes cropping, grazing, irrigated farming, broad acre crops and horticultural enterprises including areas of fruit and vegetable growing and viticulture (NSW LLS, n.d).

During 2019-2020, agriculture in the LLS Region generated $642 million GVP (Table 03-1). There was 1.4 million hectares (ha) under agricultural production within 2,309 agricultural business (Table 03-2). Cattle production was mainly for meat and was carried out across 1,421 agriculture businesses with approximately 254,240 head. Sheep production was carried out by 1,279 business with over 2 million head for both wool and meat production. Cropping was undertaken on 173,777 ha and included cereals and other crops, hay, silage and horticulture (ABS, 2020a; ABS, 2020c).

Table 03-1: Value of Agricultural Commodities produced in the Central Tablelands LLS Region 2019-2020 (ABS, 2020c)

Commodity Description	GVP ($)
Total agriculture	**642,076,206**
Livestock Products – Wool	78,863,320
Livestock slaughtered and other disposals – Sheep and Lambs	141,625,813
Livestock slaughtered and other disposals – Cattle and Calves	179,795,629
Livestock slaughtered and other disposals – Pigs	605,186
Livestock slaughtered and other disposals – Poultry	20,655,776
Cropping – Other	161,228,589
Cropping – Hay	30,444,189

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

Table 03-2: Agricultural Commodities and production in the Central Tablelands LLS Region 2019-2020 (ABS, 2020a)

Commodity Description	Area (ha)	Estimate (no.)/ Production (t)	Number of Agricultural businesses
Central Tablelands Area of holding – Total	**1,452,966**		**2,309**
Livestock – Cattle – Total cattle	-	254,240	1,421
Livestock – Sheep and lambs – Total	-	2,075,922	1,279
Crops – Total crops (including cereals and other crops, hay, silage and horticulture)[1]	**173,777**	**-**	**1,201**
Cereal crops – Wheat for grain	56,856	59,847	356
Cereal crops – Oats for grain	13,014	6,340	387
Cereal crops – Barley for grain	14,655	14,208	177
Cereal crops – Sorghum for grain	489	858	28
Cereal crops – Maize for grain	17	169	1
Hay and silage – Total pasture, cereal and other crops cut for hay and silage	32,476	111,150	513

[1] Totals do not add as not all categories of crops are provided as they are not significant in the context of this AIA

03.2 Mid-Western Regional Local Government Area

The Mid-Western Regional LGA (Figure 03-2) covers an area of 8,752.3 km^2 and supports a population of 25,367 people (ABS, 2020b). This LGA is approximately 210 km north-west of Sydney, 250 km west of Newcastle and 300 km north of Canberra (DPIE, 2021). The LGA spans from just west of the Great Dividing Range to the boundary of the Dubbo-Narromine-Wellington region. The major towns within the LGA include Mudgee and other smaller towns including Gulgong, Kandos and Rylestone (DPIE, 2021). The Castlereagh and Great Western highways connect Mudgee with Sydney, and the Golden Highway connects to Dubbo and Newcastle. These connections in addition to the rail network provide opportunities to move agricultural products to domestic and export markets (DP&E, 2017).

The LGA offers a range of industry sectors including mining, retail, agriculture, healthcare and construction, and attracts over 691,000 visitors each year to experience local wine, food, heritage and natural scenery (Mid-Western Regional Council, 2018). In 2017, mining accounted for 15% of employment, followed by retail services at 11.9% and agriculture at 10% (DP&E, 2017). The LGA contains areas of highly productive agricultural land and is renowned for its wineries. The LGA is dominated by expanding coal mining having grown by 30% between 2011 and 2016 (Mid-Western Regional Council, 2018).

Figure 03-2 shows the Mid-Western Regional LGA contributions to agricultural GVP in context of all LGA's within the Central Tablelands LLS Region. According to 2015/2016 Australian Bureau of Statistics data, the Mid-Western Regional LGA contributed to 3.4% (i.e. approximately $90.5 million) of the Central Tablelands Regional agricultural GVP, the largest contributors being $45.68 million from beef cattle, $17.9 million from wool production and $12.46 million generated by sheep for meat (DPI, 2020).

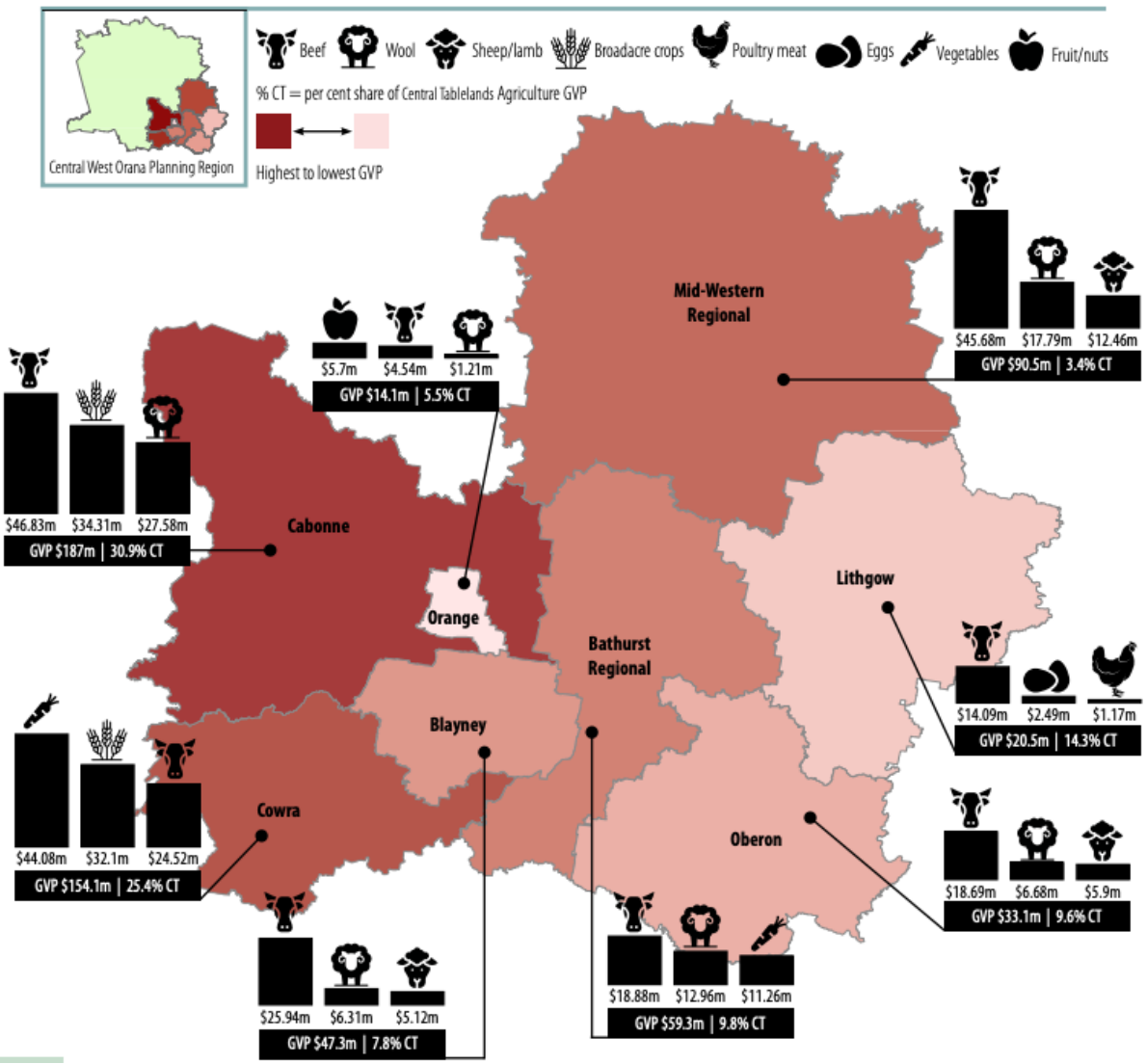


Figure 03-2: Agriculture Industry snapshot for the Central Tablelands LLS Region (DPI, 2020)

REMPLAN collates data from ABS, Gross State Product, June 2021, National Input Output Tables and 2018/ 2019 & Census Place of Work Employment Data (2016) to estimate the regional output. From the combined data sources analysed by Remplan (2022) for the Mid-Western Regional LGA, Table 03-3 shows that mining contributes 54.1% of the LGA's output (approximately $3.2 billion), and Agriculture, Forestry and Fishing contribute 5.5% (approximately $324 million).

Table 03-3: Mid-Western Regional LGA Regional Output by industry. Output data represents the gross revenue generated by businesses/organisations in each of the industry sectors in the Mid-Western Regional LGA. Gross revenue is also referred to as total sales or total income (REMPLAN, 2022)

Industry sector	Mid-Western Regional LGA	
	Dollars ($)	Contribution to the region (%)
Mining	$3,194,865,769	54.10%
Construction	$443,158,334	7.50%
Rental, Hiring & Real Estate Services	$334,153,555	5.70%
Agriculture, Forestry & Fishing	$324,478,351	5.50%
Manufacturing	$290,205,371	4.90%
Health Care & Social Assistance	$145,516,169	2.50%
Retail Trade	$141,032,574	2.40%
Electricity, Gas, Water & Waste Services	$122,303,779	2.10%
Public Administration & Safety	$117,170,422	2.00%
Accommodation & Food Services	$113,542,145	1.90%
Education & Training	$110,774,590	1.90%
Professional, Scientific & Technical Services	$101,570,381	1.70%
Other Services	$90,004,093	1.50%
Transport, Postal & Warehousing	$81,498,863	1.40%
Financial & Insurance Services	$79,354,617	1.30%
Wholesale Trade	$72,579,554	1.20%
Information Media & Telecommunications	$65,109,135	1.10%
Administrative & Support Services	$53,593,902	0.90%
Arts & Recreation Services	$20,813,230	0.40%
Total	**$5,901,724,835**	**100.00%**

03.3 Local and regional environment

03.3.1 Climate

The Project Area is classified as part of the South-Western Slopes bioregion, and is dominated by a sub-humid climate, characterised by hot summers and no dry season (NPWS, 2003). The Central Tablelands region is regarded as being a high rainfall zone with rainfall distributed evenly across the year totalling from 600 to 1000 mm and temperature is variable (DPI, 2020).

Representative climate data for the area has been obtained from the Bureau of Meteorology (BOM) weather station located at Gulgong Post Office (062 031). Gulgong has a mean annual rainfall total of 651.2 mm. Rainfall is generally uniformly spread across the year with April being the lowest rainfall month. The maximum mean temperature of the hottest month is 31.3 ºC in January and minimum mean temperature of the coolest month is 2.6ºC in July. Other Bureau of Meteorology (BOM) statistics for Gulgong are detailed in Table 03-4 (BOM, 2022).

Table 03-4: Bureau of Meteorology statistics for Gulgong Post office (062 031) Temperature data from 1970 to 2022; Rainfall data from 1881 to 2022) (BOM, 2022)

Description	Parameter
Mean maximum temperature of hottest month (January):	31.3 ºC
Mean minimum temperature of hottest month (January)	17.0 ºC
Highest recorded temperature (February 2017):	43.5 ºC
Mean maximum temperature of coolest month (July):	14.9 ºC
Mean minimum temperature of coolest month (July):	2.6 ºC
Lowest recorded temperature (July 1970):	-7.2 ºC
Mean annual rainfall:	651.2 mm
Mean number of rain days (> 1mm):	63

The monthly distribution of temperature and rainfall is recorded at Gulgong Post Office (062 031) is presented in Figure 03-3 & Figure 03-4.

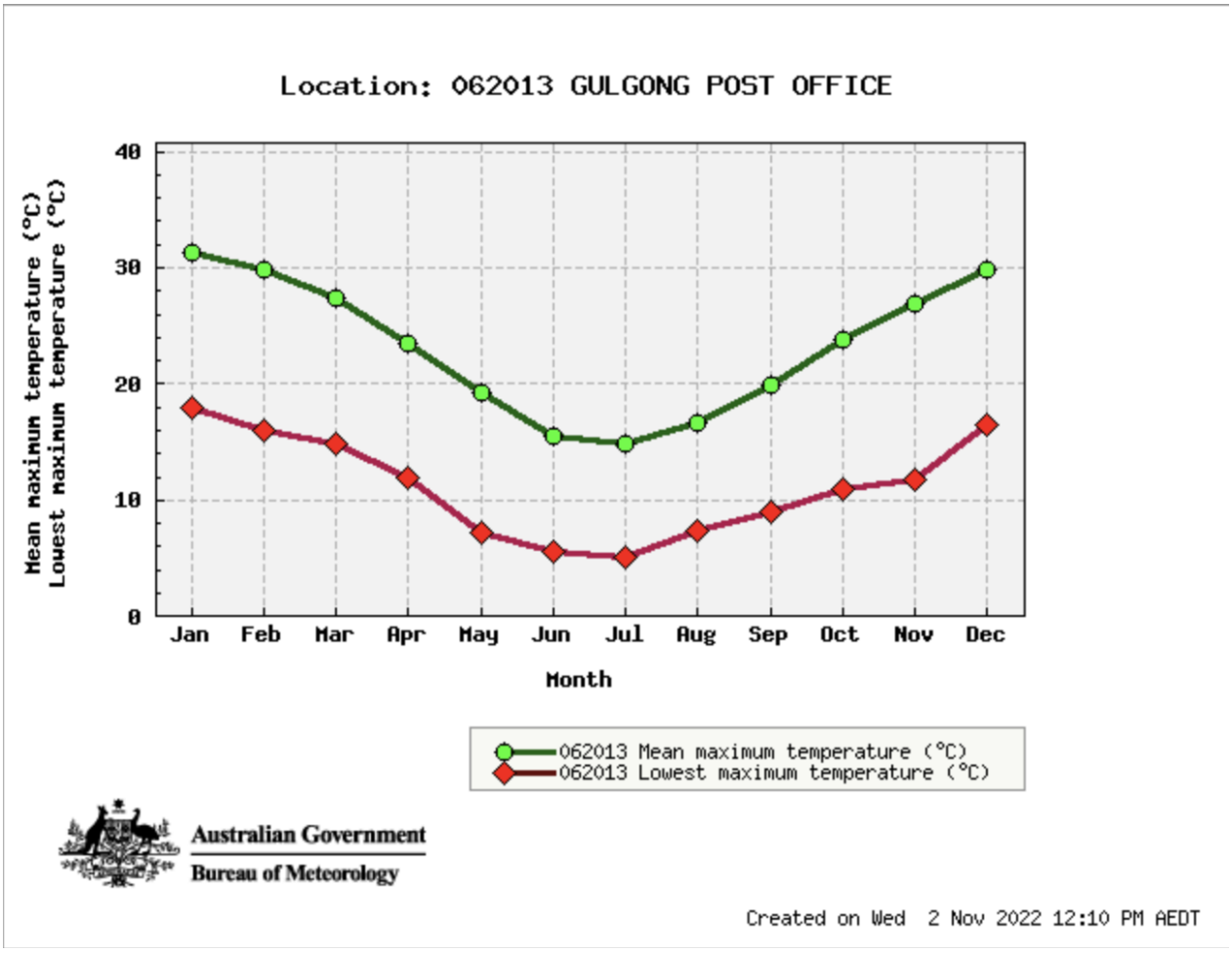


Figure 03-3: Mean monthly temperatures for years 1970 to 2022 (maximum and minimum) recorded at Gulgong Post Office (062 031) (BOM, 2022)

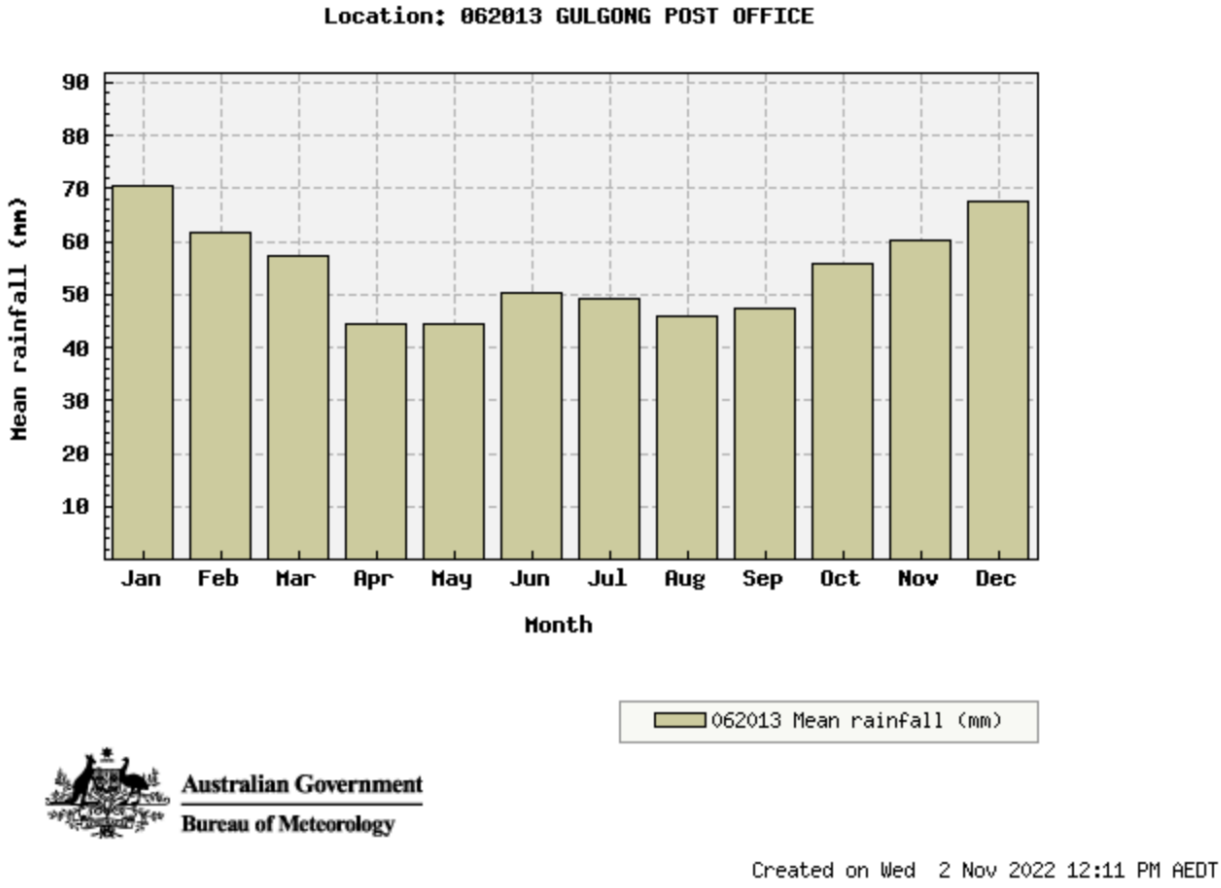


Figure 03-4: Mean monthly rainfall for years 1881 to 2022 recorded Gulgong Post Office (062 031) (BOM, 2022)

03.3.2 Geology and Landform

Landforms within and in the vicinity of the Project Area are characterised by the lower lying areas associated with Moolarben Creek, surrounded by the undulating foothills and ridges of the adjacent Munghorn Gap Nature Reserve. Elevations in the Project Area range from 465 m to 690 m ASL (MCO, 2021).

Groundwater Regime

The Project is located in the western part of the Sydney Basin in the Western Coalfield, which contains sedimentary rock of Triassic and Permian age, including coal measures. The Illawarra Coal Measures, consisting of siltstones, sandstones, claystones and coal seams, contain the coal seams mined by the existing Moolarben Coal Complex which would also be mined for the Project.

The Triassic-aged sandstones overlie the Permian coal measures. Large extents of the Triassic strata are unsaturated, either naturally or from dewatering caused by previous mining activities. Perched water tables might be sustained at high elevations due to the presence of occasional lower permeability beds between the sandstone layers (AGE, 2022).

Recharge to the groundwater system occurs by the direct infiltration of rainfall and downward percolation through the near surface weathered rock. Recharge to the deeper units within the Permian coal measures predominantly occurs by downward seepage into the units where they subcrop beneath the alluvium or weathered rock cover (AGE, 2022).

Groundwater Use

Groundwater use in the vicinity of the Project is regulated by the NSW Government, with two water sharing plans regulating the volumetric allocation of groundwater to each user.

The Permian hard rock groundwater associated with the Sydney Basin-North Coast Groundwater Source is mapped as 'less productive' in accordance with the AIP (NSW Government, 2012a).

The nearest highly-productive alluvial water source is located approximately 10 km north east of the Project on Wilpinjong Creek in the Wollar Creek Water Source (i.e. a different water source to the Project) (NSW Government, 2012a).

A bore census was undertaken for the approved Moolarben Coal Complex in 2005-2006. Of the bores identified during that census, only one remains privately-owned (Census ID SP49, located approximately 14 km north of the Project).

A contemporary census of privately-owned groundwater bores in the vicinity of the Project was undertaken in 2022 (ENRS, 2022). The census involved:

- Characterisation of existing groundwater bores through collation and review of the WaterNSW registered bore database and other regional information (e.g. 1:25,000 topographic maps);
- Writing to local landholders seeking information regarding the potential use of groundwater on their property;
- Site visits with local landholders to confirm the location and use of groundwater bores on their property; and
- Opportunistic collection of baseline data where practical (e.g. water levels and basic water quality parameters).

The bore census indicated there is limited groundwater use in the immediate vicinity of the Project.

03.3.3 Vegetation

The Project Area has been used for grazing and occasional fodder cropping where soil and land capabilities allow. Much of this land has been cleared for agricultural use. A total of 12 Plant Community Types in various conditions were mapped within the Project Area (Niche Environment and Heritage Pty Ltd, 2022):

- PCT 266 - *White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion* – represented by remnant woodland, derived native grassland and scattered trees;

- PCT 281 - *Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion* - represented by remnant woodland, derived native grassland and scattered trees;
- PCT 478 - *Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion* - represented by remnant forest;
- PCT 481 - *Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region* - represented by remnant forest;
- PCT 483 - *Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley* - represented by remnant forest and derived native grassland;
- PCT 1610 - *White Box - Black Cypress Pine shrubby woodland of the Western Slopes* - represented by remnant woodland and regenerating;
- PCT 1614 - *Grey Gum - Grey Myrtle - Narrow-leaved Stringybark - Rusty Fig open forest on ranges of the Upper Hunter* - represented by remnant forest;
- PCT 1629 - *Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin* - represented by remnant forest;
- PCT 1655 - *Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin* - represented by remnant woodland;
- PCT 1656 - *Narrow-leaved Ironbark - Black Pine - Narrow-leaved Wattle shrub - grass open forest on sandstone slopes of the upper Hunter and Sydney Basin* - represented by remnant forest and regenerating;
- PCT 1661 - *Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin* - represented by remnant woodland; and
- PCT 1711 - Tantoon - *Lepyrodia leptocaulis shrubland on sandstone drainage lines of the Sydney Basin* - represented by remnant shrubland.

03.3.4 Surrounding Land Use

Land use other than mining in the vicinity of the Project Area includes agricultural enterprises (grazing and dryland cropping), commercial, industrial, and residential areas of Ulan, rural residential areas of Cooks Gap and Cooyal and conservation areas (Munghorn Gap Nature Reserve and Goulburn River National Park).

Mining due to the Project would progress within the valley surrounding Moolarben Creek, moving further away from private landholders west of the Moolarben Coal Complex in Cooks Gap. Mining activities would occur closer to the suburb of Cooyal, however the distance to the nearest private property would be greater than 2 km and there is significant intervening topography associated with the Munghorn Gap Nature Reserve (elevation difference greater than 100 m).

04 CONSULTATION

04.1 General Consultation

The existing Moolarben Coal Complex has been operating since 2010. In this time considerable community and stakeholder consultation has been undertaken. Community engagement is undertaken through the following mechanisms:

- A dedicated website (http://www.moolarbencoal.com.au//);
- Moolarben Coal Complex Community Consultative Committee (CCC) meetings (with meeting minutes provided on the MCO website and emailed directly to interested stakeholders);
- Maintenance of a community hotline; and
- Community newsletters.

04.2 EIS-specific Consultation

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

- Briefings to the CCC;
- A series of Project-specific newsletters distributed in the Project region;
- Community information sessions held in Cooyal in August 2022;
- Multiple rounds of interviews to support the Social Impact Assessment (Appendix E of the EIS) with the CCC, local landowners, regional business owners, infrastructure providers and other relevant stakeholders;
- Consultation with the Mid-Western Regional Council; and
- Consultation with various Government regulators.

04.3 Consultation Specific to this AIA

Prior to purchase by Moolarben, the Project Area was owned by four individual landholders (Table 04-1 & Figure 04-1). Three of four previous landholders agreed to consultation regarding their agricultural systems and production. Two interviews were in-person and one was undertaken over the phone. Former landholders provided information on productivity within average ‘good years’.

While freehold land within the Project Area is now owned by Moolarben, portions of the Project Area are currently licensed back to rural licensees (who were the previous landholders) for agricultural production.

Table 04-1: Landholdings, landowners and interview status

Property Name	Interviewed
Fernmount, Croydon, Pinemount	Yes (in-person)
Hill View	Yes (in-person)
Coomaroo	Yes (phone)
Jingera	No

Consultation was undertaken using a semi-structured interview method. Each interview covered 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.

Interview details are provided in Section 04.4

Additional Consultation

Managers at both of Mudgee's Nutrien Ag Solutions and Cudgegong Rural Supplies were contacted via the phone for estimates on potential changes in sales as a result of the Project. However, neither store was able to provide an official comment on this issue.

A representative from the Mudgee Office of the Central Tablelands LLS Region was contacted for an estimate of Dry Sheep Equivalents rating of the Project Area but were unable to provide an official estimate for this report.

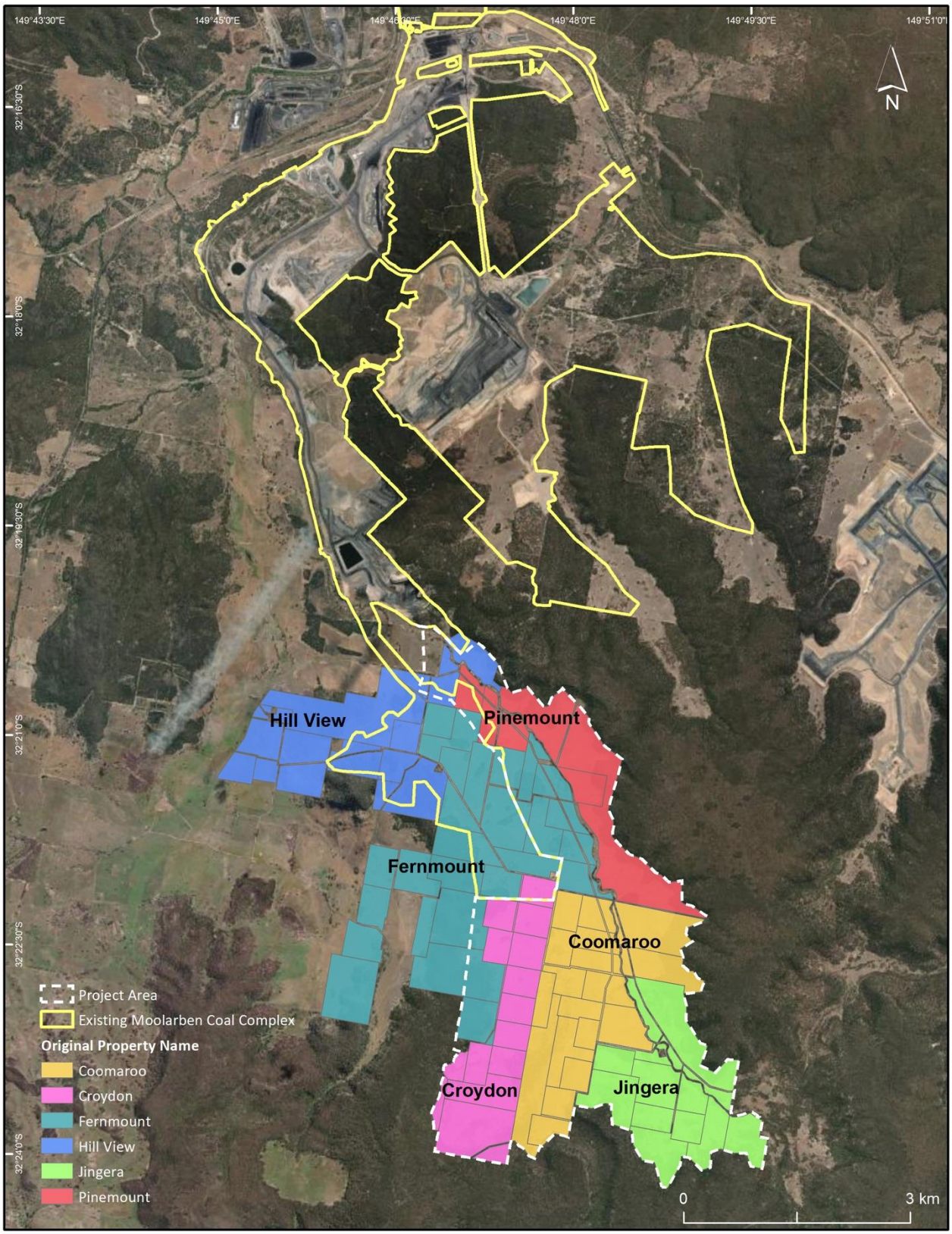


Figure 04-1: Former properties local to the Project Area

04.4 Landholder interviews

04.4.1 Fernmount Croydon/Pinemount

Date: 25/05/22
Time: 12:00pm-1:00pm

This land holding has land capability in the moderate range (classes 4-5) (Figure 04-2 & Figure 04-3), considered suitable for pasture cropping and grazing. Comments from the former landholder confirm that prior to purchase by Moolarben, grazing sheep for wool and cattle were the primary land uses, alongside opportunistic fodder cropping. Since purchase by Moolarben, the former landholder became the rural licensee for portions of the land they previously owned (excluding active mining areas), plus portions of adjacent Moolarben-owned land, for sheep (wool) and cattle production.

Question	Response
How long did you live on or manage the property?	4th Generation family farmer. Grew up on this farm. Property was 3,000 acres in total with an estimated 1,500 acres available for grazing or cropping. Licensed and managed since sale to Moolarben. Licensed adjacent properties in addition to original landholding portions of including Hill View and Coomaroo. Since licensing, the rural licensee has shifted from mainly sheep for wool production to a 50/50 split sheep and cattle. Ran goats for weed control for a short period.
What is your experience in agriculture?	Has spent whole life working on this property Spent only 2 years away from farm for tertiary education at Tocal Agricultural College.
Describe the property history (e.g, ownership, land use, product).	Main land use was mixed grazing (sheep for wool and cattle). Some opportunistic cropping (dual purpose- grazing during vegetative stage and harvesting at maturity), around 200 acres. Harvested hay when possible to feed to stock.
Typical yield/production – what commodities did the property typically produce (and production rate)? What could it produce opportunistically in ideal weather conditions?	Average season could carry: • 1500 ewes + followers. • 100 beef cattle Opportunistic cropping • 200 acres
What/ who were your main markets?	Cattle sold at Mudgee Cattle Yards + Auctions Plus. Wool sold at Sydney markets. Steers sent to feedlot → mostly to Caroona otherwise wherever the best deal could be found.
Who/ where were your major suppliers of goods and services?	Stock and station agent: McDonald Lawson Carter in Mudgee Agricultural supplier – Combined Rural Traders now Nutrien in Mudgee
What water sources did you have access to on this property?	2 x good bores Creeks are unreliable Property dams Spring – reliable water source during droughts and for people use

Question	Response
How many people did you employ?	1 permanent + contractors for shearing and scanning.
Describe the key agricultural infrastructure on your property	3 houses 5 machinery sheds Sheep yards Cattle yards Hay shed Crutching shed



Figure 04-2: Grazing paddock 25 April 2022 on Croydon Property



Figure 04-3: Grazing paddock 25 April 2022 on Fernmount Property

04.4.2 Hill View

Date: 26/05/22
Time: 9:00am – 10:00 am

These land holdings have a land capability in the moderate range (classes 4-5) considered suitable for pasture cropping and grazing. Some land in this holding has a land capability of class 7 which has very low capability restricted to native vegetation that should undergo minimal disturbance. Comments from the former landholder confirm that, prior to purchase by Moolarben, class 4-5 land was used for grazing sheep for wool and cattle as the primary land uses with opportunistic cropping for fodder. Since purchased by Moolarben, the previous landholders continued leasing portions of the land they previously owned (excluding active mining areas) for cattle production.

Question	Response
How long did you live on or manage the property?	Purchased 30 years ago from grandfather. Visited and worked casually on property before purchasing. Lived on the property and ran as part time venture alongside other work, including water sampling for Moolarben. Sold to Moolarben 10 years ago and has since licensed land to run cows.
What is your experience in agriculture?	Experience of 60 years
Describe the property history (e.g, ownership, land use, product)	During ownership the landholder ran sheep for wool and cattle. Total property size 1000 acres Around 500 acres usable for grazing Since licensing back the property off Moolarben only runs cattle due to being lower maintenance.
Typical yield/production – what commodities did the property typically produce (and production rate) What could it produce opportunistically in ideal weather conditions?	Average season, prior to purchase by Moolarben, could carry: • 1,000 head of merino sheep for wool. • 100 beef cattle. Mainly native grass pasture • Small amount of sowed oats as fodder crop • Some super and lime application, some spread by air
What/ who were your main markets?	Sold wool through Nutrien Ag Solutions. Sold cattle and sheep through agent at Mudgee sale yards.
Who/ where were your major suppliers of goods and services?	Dalgety's Winch, Carson – now Nutrien Ag Solutions
What water sources did you have access to on this property?	Swamp 13 surface dams Creek
How many people did you employ?	Only contractors for shearing Family labour
Describe the key agricultural infrastructure on your property	Shearing Shed 2 houses Tractor shed General shed Sheep yards Cattle yards

04.4.3 Coomaroo

Date: 2/06/22
Time: 3:30pm - 4:00pm

This land holding has a land capability in the moderate range (classes 4-5) (Figure 04-4 & Figure 04-5) considered suitable for pasture cropping and grazing. Comments from the former landholder confirm that prior to purchase by Moolarben, grazing sheep for wool and cattle were the primary land uses with opportunistic cropping for fodder.

Question	Response
How long did you live on or manage the property?	Bought in 1987
What is your experience in agriculture?	Lifetime in agriculture
Describe the property history (e.g, ownership, land use, product)	Originally ran wethers for wool, until wool market dropped then shifted to fat lamb production and cattle. Owned 1000 acres all in use.
Typical yield/production – what commodities did the property typically produce (and production rate) What could it produce opportunistically in ideal weather conditions?	Average stocking rate For wool production - bought in • 2000 wethers (average 18 micron fleece) Fat lamb production (cross bred) – bought in • 300-400 ewes Cattle – self replacing herd • 130 Cattle • Vealer market Pasture is mostly improved • On and off super phosphate application Cropping • 200 acres of oats annually as fodder crop
What/ who were your main markets?	Wool sold in Sydney Market Lambs sold in Dubbo Cattle sold in Mudgee Old Cows sold in Dubbo
Who/ where were your major suppliers of goods and services?	Stock and Station agents in Mudgee and Dubbo Agricultural Supplier Dalgety's in Mudgee now Nutrien
What water sources did you have access to on this property?	Springs
How many people did you employ?	Only casual contractors
Describe the key agricultural infrastructure on your property	House Shearing Shed Hay Shed Machinery Shed Cattle Yards Sheep Yards



Figure 04-4: Coomaroo adjacent to house 25 April 2022



Figure 04-5: Coomaroo cropping area beyond fence 25 April 2022

05 AGRICULTURAL RESOURCE ANALYSIS OF PROJECT AREA

Agricultural resource analysis within the Project Area comprised literature and data review, site inspections, and landholder interviews/surveys.

05.1 Summary of Site Inspection and Interviews

Previous agricultural landholdings that intersect with the Project Area are listed in Table 05-1. Analysis of agricultural resources was undertaken for these properties both within and outside of the Project Area where surveys were undertaken with former landholders.

Some portions of these properties that are within the Project Area, are already unavailable for agricultural production due to the existing and operating OC3 open cut mine, including additional buffer areas for properties owned by Moolarben within existing mining/exploration leases (e.g., due to safety concerns).

Moolarben currently licenses 974 ha within the Project Area to rural licensees. Due to the Project. This area would be unavailable for agriculture for the period of at least 2025 to 2038. Figure 05-1 outlines this area, hereafter referred to in this report as the Potential Impact Area, as well as the broader Project Area. The Potential Impact Area is used to estimate impact of the Project on agricultural production.

Table 05-1: Landholdings within the Project Area

Property Name	Ownership	Whole Property Area (ha)	Property Area Currently Licensed to Rural Licensees (ha)	The Potential Impact Area (ha)**
Coomaroo	Moolarben	440.6	385.4	385.4
Croydon	Moolarben	288.4	226.7	226.7
Fernmount	Moolarben	687.7	131.2	6.3
Hill View	Moolarben	375.0	140.2	0
Jingera	Moolarben	317.4	317.2	317.2
Pinemount	Moolarben	242.4	39.3	39.3
Total		**2,351.5**	**1,240.1**	**974.9**

** Note: this area includes portions of the property associated with steeper native remnant vegetation which is largely unsuitable for grazing or other agricultural enterprise.

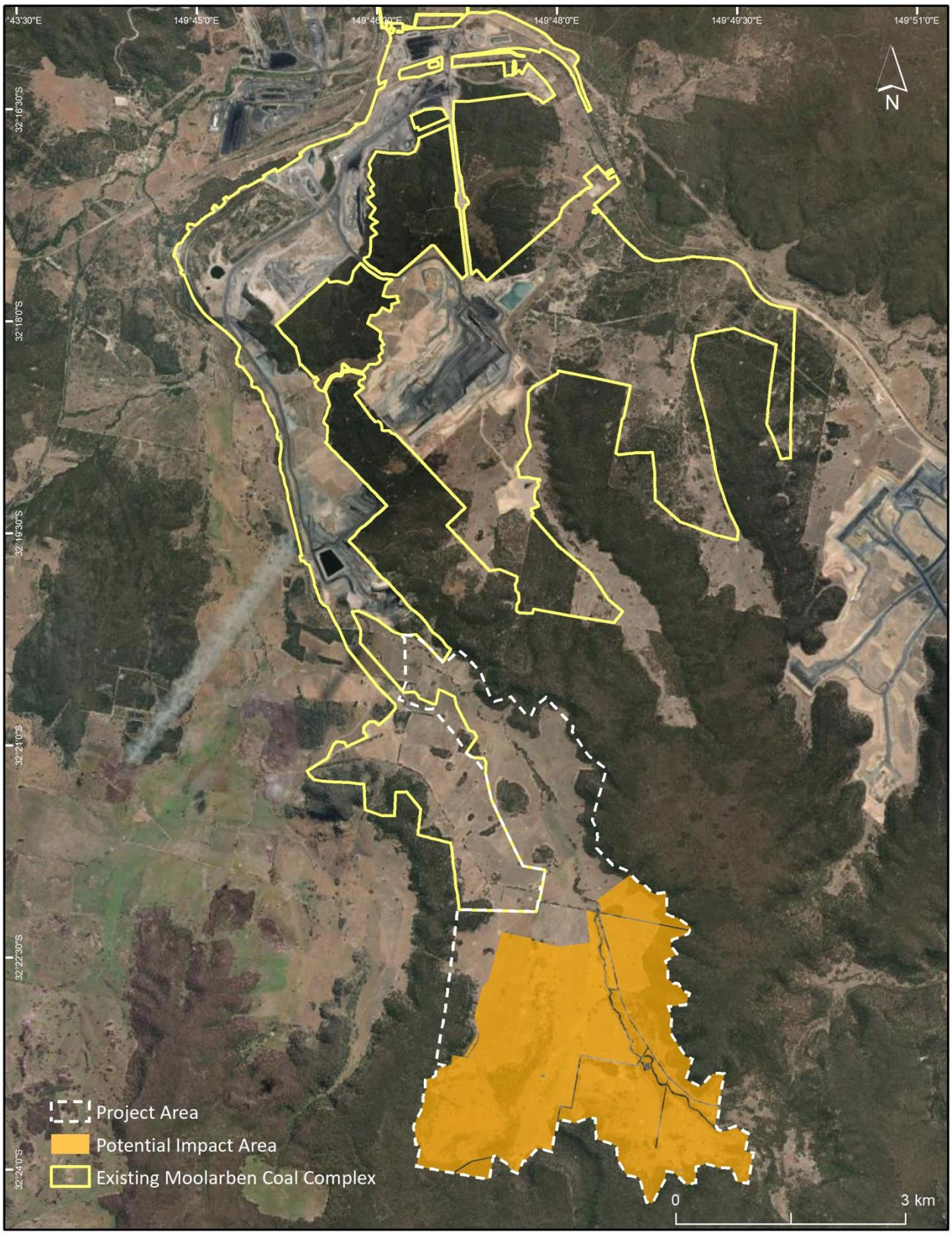


Figure 05-1: The Potential Impact Area

Agricultural land uses and productivity local to the Project Area (combined production of interviewed landholder properties) prior to purchase by Moolarben can be summarised as:

- Grazing sheep for wool, beef cattle and fat lamb production;
- Opportunistic fodder cropping;
- Water for livestock was sourced from creeks, overland flow, natural springs and bores; and
- No irrigated land use in the area.

Previous interviewed landholders within the Project Area sourced agricultural supplies mainly from local suppliers such as:

- Mudgee's Dalgety's Agriculture Supplies – now Nutrien Ag Solutions; and
- Mudgee Combined Rural Traders.

Markets used by previous interviewed landholders include:

- Dubbo Regional Livestock Market;
- Mid-western Regional Council Saleyards (Mudgee);
- Auctions plus (https://auctionsplus.com.au/);
- Sydney Wool Market; and
- Caroona Feedlot.

Agricultural employment prior to purchase by Moolarben included previous interviewed landholders' family as well as:

- 2-3 permanent staff; and
- Seasonal/occasional contractors such as shearers and veterinarians.

A summary of the primary and other land uses, prior to purchase by Moolarben is summarised in Table 05-2.

Table 05-2: Summary of land uses local to the Project Area

Property Name	Whole Property Area (ha)	Primary Land use	Other Land uses
Coomaroo	440.6	Grazing - Sheep & Cattle	Fodder Cropping
Croydon	288.4	Grazing - Sheep	Fodder Cropping
Fernmount	687.7	Grazing - Sheep	Fodder Cropping
Hill View	375.0	Grazing - Sheep	Fodder Cropping
Jingera	317.4	Not Interviewed	Not Interviewed
Pinemount	242.4	Grazing - Sheep	Fodder Cropping
Total	**2351.5**		

05.2 Soil and Land Properties

05.2.1 Land and Soil Capability

The Land and Soil Capability (LSC) Assessment Scheme uses the biophysical features of the land and soil including landform position, slope gradient, drainage, climate, soil type and soil characteristics to derive detailed rating tables for a range of land and soil hazards (OEH, 2012). The LSC class gives an indication of the land management practices that can be applied to a parcel of land. The LSC classes are outlined in

Table 05-3.

Table 05-3: Land and Soil Capability Class (OEH, 2012)

LSC Class	Definition
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.

Minesoils (2022) undertook soil and land resource surveys to identify the LSC of the Project Area (Table 05-4 & Figure 05-2) (Appendix A). The majority of the Project Area is classified as Class 5 (332.8 ha) and Class 6 land (852.4 ha) which is considered to have high and very high limitations for high impact land uses, restricting use to low impact uses such as grazing, forestry and nature conservation. Land that primarily correlates to steeply inclined areas of the Project Area were considered Class 7 (15.0 ha) and Class 8 land (216.9 ha). Class 8 land is considered to have severe limitations, restricting most land uses and should undergo no disturbance of native vegetation. The remaining land within the Project Area includes classes 3 and 4 land.

Table 05-4: Land and Soil Capability Classes of the Project Area (Minesoils, 2022)

Class	Description	Area (ha)
Class 3	High Capability Land	25.2
Class 4	Moderate Capability Land	100.8
Class 5	Moderate to Low Capability Land	332.8
Class 6	Low Capability Land	852.4
Class 7	Very Low Capability Land	15.0
Class 8	Extremely Low Capability Land	216.9
	Total	1542.9

The Project Area is dominated by soils with moderately low fertility. These are present throughout the gently undulating to flat drainage plains along Moolarben Creek. The remainder of the Project Area consists of moderate high fertility, moderate fertility, and low fertility soils (Figure 05-3).

05.2.2 Land Slope

The Project Area is dominated by flat to very gently undulating open flats and drainage plains (0- 10% slope). This becomes gently inclined to steeply inclined on mid and upper slopes leading to ridgeways on the eastern and southern boundary and the plateau to the south-west (10%->50%) (Figure 05-4) (Minesoils, 2022).

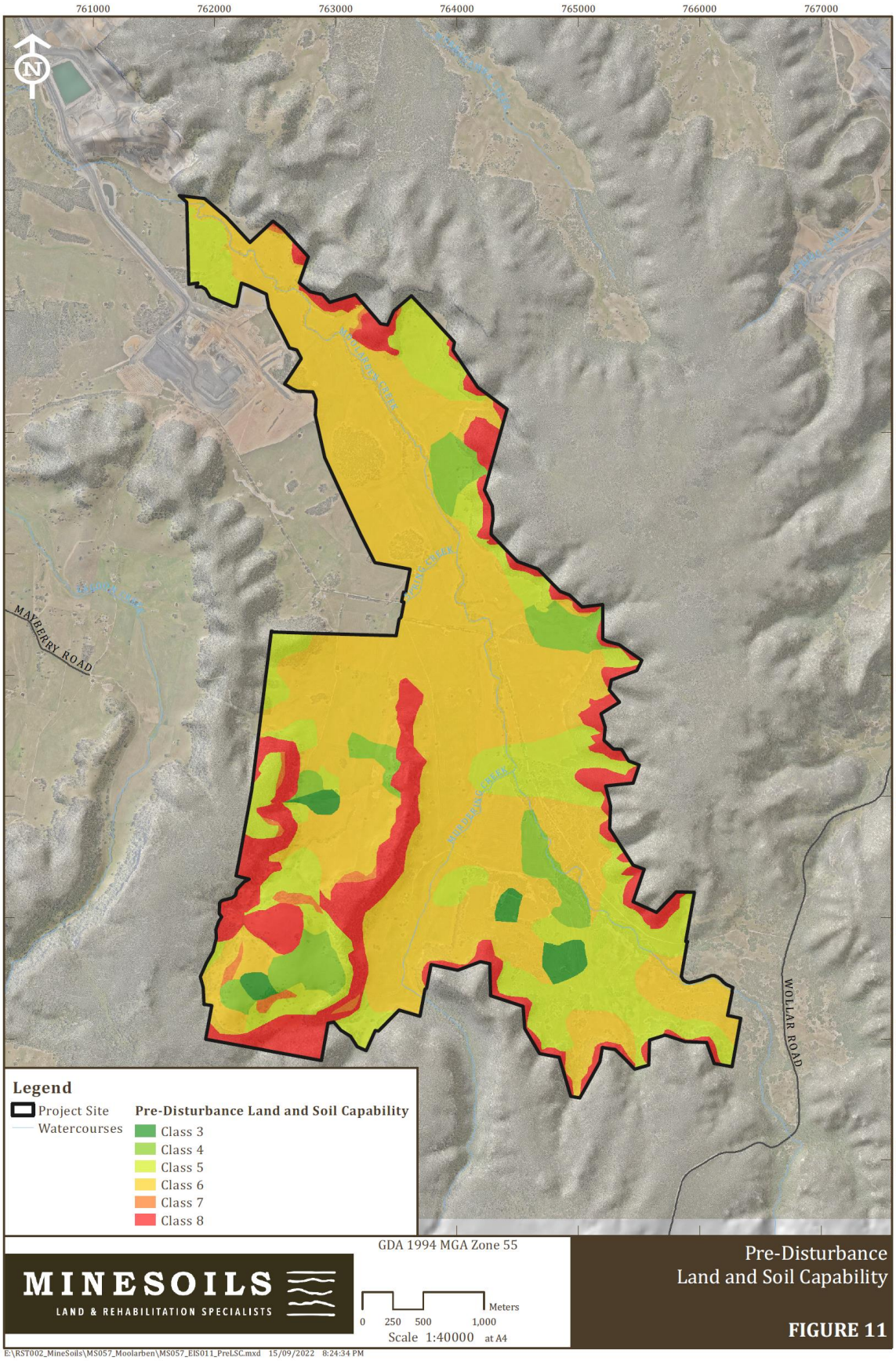


Figure 05-2: Land and soil capability classes within the Project Area (Minesoils, 2022)

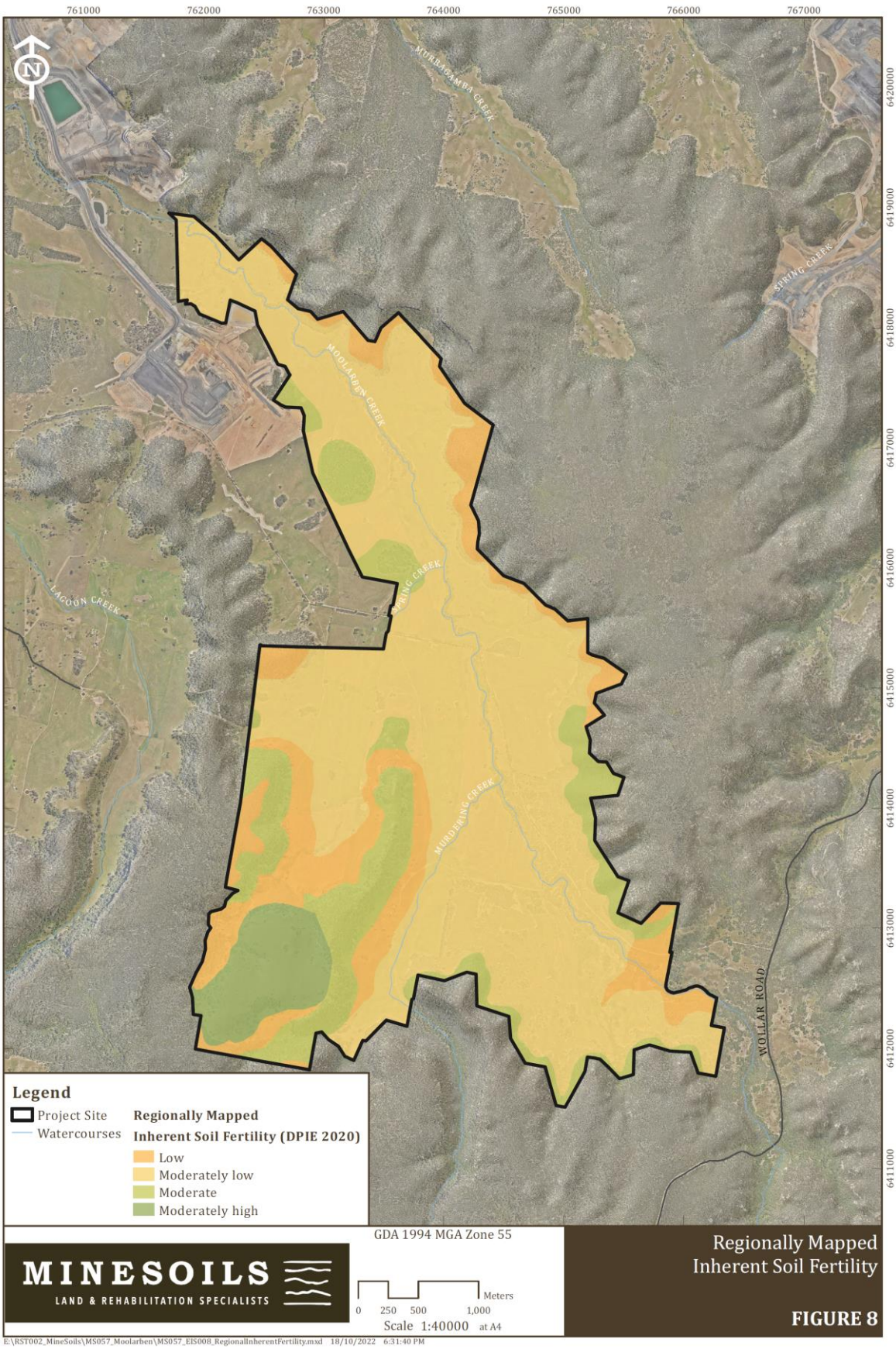


Figure 05-3: Inherent soil fertility within the Project Area (Minesoils, 2022)

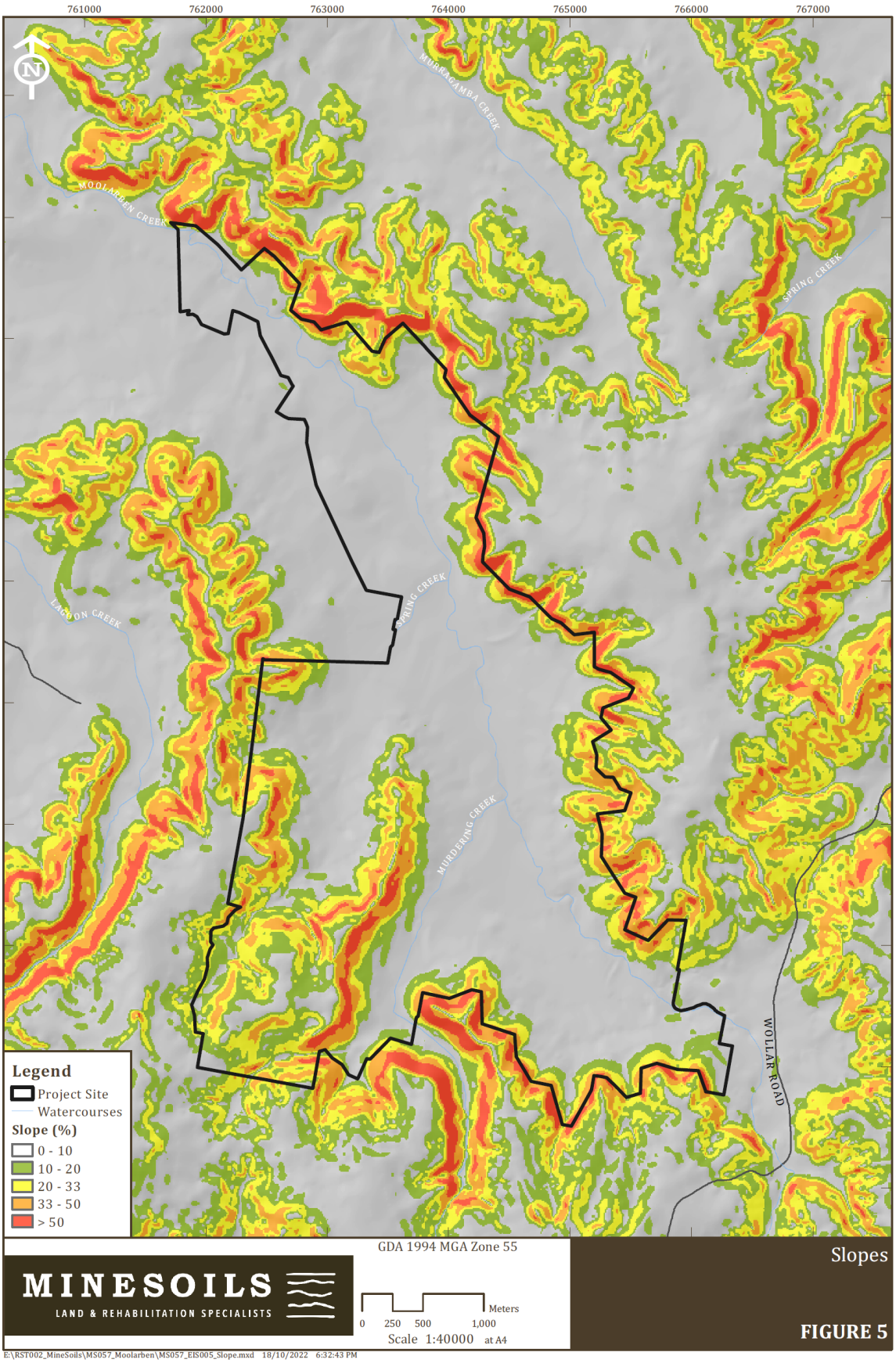


Figure 05-4: Slope of Project Area (Minesoils, 2022)

05.3 Estimated Agricultural Productivity of the Project Area

To estimate agricultural production of properties within the Project Area the following steps were undertaken:

- Assess the historical land use and productivity through landholder surveys. It should be noted that land owner annual production estimates were based on non-drought (relatively good) years and that one former landholder within the Project Area was not available for survey;
- Calculate the possible annual production across the combined property area (based on landholders that were available for surveys) that existed prior to purchase by Moolarben. This was done for a cattle and wool production type and a cattle, wool 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 Impact Area.

Of the landholders interviewed, two maintained the same agricultural production systems until purchased by Moolarben, that is breeding sheep for wool (approximately 1000 and 1500 head respectively) and stocking cattle (approximately 100 head each). The third landholder originally stocked wethers for wool (approximately 2000 head) before switching to buying and selling fat lambs (approximately 400 head) and stocking cattle (approximately 100 head). To account for the change in land use due to the third landholder, average production was considered under two production regimes: Production Type 1 – sheep for wool and cattle; and Production Type 2 - sheep for wool, sheep for fat lambs and cattle.

To represent the average agricultural productivity over time, the two agricultural systems were considered under Production Type 1 (cattle and wool) and Production Type 2 (cattle, wool and fat lambs) (Table 05-5). Calculations were conducted for the combined area of the three landholders (representing 5 properties) that were interviewed for both Production Types 1 & 2. It should be noted that two calculations are provided, representing each scenario individually. Estimated annual agricultural production under each production type is outlined in Table 05-5.

Table 05-5: Number and type of stock produced annually under each production type within the Project Area

Type	Production Type 1	Production Type 2
Cattle	200	300
Ewes	2500	2500
Wethers	2000	-
Lambs	-	400

Based on landholders operating self-replacing herd systems (Appendix B) and taking into account reproduction rate, survival rate, mortality and fecundity (DPI, 2019; DPI, 2020) the number of stock produced for each Production Type was estimated (Table 05-6).

These numbers include only stock that were produced as a result of self-replacing herd structures, hence wethers are not considered as they were bought in and sold for wool production purposes. Under Production Type 1, the properties would produce an estimated 2068 head of sheep and 166 head of cattle annually. Under Production Type 2, 2468 head sheep and 249 head of cattle would be produced for sale annually.

Table 05-6: Estimated number of stock for sale annually from the combined areas of all interviewed landholders within the Project Area

Type	Number of stock for sale annually	
	Production Type 1	Production Type 2
Sheep	2068	2468
Cattle	166	249

05.3.1 Cattle Sales

Most cattle were sold through the Dubbo and Mudgee local saleyards and some were sold to Caroona Feedlot. Saleyard data from Dubbo Regional Saleyards between 2011 and 2021 (National Livestock Reporting Services [NLRS], 2022) was used to determine the dollar value of potential cattle production of these properties based on stock numbers presented in Table 05-6.

Long-term saleyard price data was not available for the Mudgee Saleyards so for the purpose of this estimate values from Dubbo were used.

Under Production Type 1, it was estimated that typical production of 38 cows, 84 yearling steers and 44 yearling heifers on an annual basis with 40 retained to go into the breeding herd. Table 05-7 estimates the value of these sales at around $197,000 gross value. Under Production Type 2 it was estimated that the properties would typically sell 57 cows, 126 yearling steers and 66 yearling heifers annually, around $295,000.

While estimation of cattle fecundity, growth rates and market prices are estimates, these values give an upper range for potential cattle production of the properties.

Table 05-7: Average prices and weights for cattle at Dubbo Sale Yards 2011-2021

Category	No. head	Average Weight	Average Price ($/head)	Average Price (c/kg Liveweight)	Total Value ($)
Production Type 1					
Cows	38	530.59	1191.57	219.25	45,280
Yearling Steers	84	387.11	1239.70	319.87	104,135
Yearling Heifers	44	370.71	1085.08	291.70	47,744
Total	**166**			**Total**	**197,158**
Production Type 2					
Cows	57	530.59	1191.57	219.25	67,920
Yearling Steers	126	387.11	1239.70	319.87	156,202
Yearling Heifers	66	370.71	1085.08	291.70	71,615
Total	**249**			**Total**	**295,737**

05.3.2 Sheep Sales

Sheep production was analysed by estimating annual sheep production from interview information and by relating this to saleyard data (Table 05-8). Saleyard data from Dubbo Regional Saleyards for a 5-year period from 2018-2022 (MLA, 2021) was used to determine the value of potential annual production for the properties.

Under Production Type 1, based on a self-replacing herd system (Appendix B) it was estimated that sheep sale numbers were annually around 1329 weaner lambs, 214 hoggets and 525 ewes on an annual basis with 547 ewes retained to go into the breeding herd. Table 05-8 estimates the value of these sales at around $330,000 gross value. For Production Type 2, the number of stock for sale was estimated to be the same as Production Type 1 plus 400 weaner lambs on an annual basis. Table 05-8 estimates the value of these sales at around $398,000 gross value.

Table 05-8: Estimated value of sheep from average prices and weights for categories of sheep sold at Dubbo Saleyards between 2018-2022

Category	No. head	Avg Price ($/head)	Total Value ($)
Production Type 1			
Weaner Lamb	1329	171	227,259
Hogget	214	145	31,030
Ewes	525	136	71,400
Total	**2068**		**329,689**
Production Type 2			
Weaner Lamb	1729	171	295,659
Hogget	214	145	31,030
Ewe	525	136	71,400
Total	**2468**		**398,089**

05.3.3 Wool Sales

Table 05-9 estimates the number of sheep that were shorn each year under both Production Types 1 & 2. According to the landholder interviews average fleece micron was approximately 18 microns. The average clean fleece weight is estimated at 3.5 kg (DPI, 2007). The price of wool in cents per kilogram (c/kg) was taken from the Australian Wool Exchange Index for the Northern Sale Centre of Sydney and ranged from 1283.8 c/kg to 1825.45 c/kg (AWEX, 2022; Table 05-10). Combining the estimated flock size, average fleece weight, average fleece micron and fleece price gives an estimate value of annual wool sales from the properties of between $280,000 – $370,000 (Table 05-10).

Table 05-9: Estimated number of sheep for shearing for Production Types 1 & 2 annually within Project Area

Wool Sales	Production Type 1	Production Type 2
Ewes	2500	2500
Weaners	2175	2175
Wethers	2000	-
Lambs	-	400
Total	**6,675**	**5,075**

Table 05-10: Estimated value of wool production annually within Project Area

Micron	Upper/ Lower Price estimate	Clean fleece (c/kg)	No. Fleece	Total Weight of fleece combined (kg) (Avg fleece weight 3.5 kg)	Total ($)
Production Type 1					
18 micron	Upper	1825.45	6675	23,363	426,471
	Lower	1509.30			352,610
20 micron	Upper	1707.60			398,938
	Lower	1283.80			299,927
				Average	**369,486**
Production Type 2					
18 micron	Upper	1825.45	5075	17,763	324,246
	Lower	1509.30			268,089
20 micron	Upper	1707.60			303,312
	Lower	1283.80			228,034
				Average	**280,920**

05.3.4 Summary of Possible Production Value within the Potential Impact Area

Data from the former landholders that were available for interview were used to estimate the possible value of agricultural production of their properties based on stocking rate and estimated annual value of production for the total area under their management (2034.1 ha). From this, the estimated value of production per unit area ($ per ha) for each Production Type was calculated.

To assess the possible production value of the Potential Impact Area, the estimated value of production per unit area ratio, for each Production Type was applied to the Potential Impact Area (974.9 ha, Table 05-11). The value of agricultural production within the Potential Impact Area is estimated at approximately $429,000 per annum for Production Type 1 and approximately $467,000 per annum for Production Type 2.

To provide a conservative estimate of the potential impact of the Project on agricultural production in the region the higher estimated agricultural stock numbers and production value associated with Production Type 2 is used for the remainder of this study.

Table 05-11: Estimated annual value of agricultural production from the Project Area and estimate annual value of production for the Potential Impact Area

Type	Annual Value of Project Area ($)		Annual Value / hectare based on Project Area ($)		Estimate Total Value of Potential Impact Area ($)	
	Production Type 1	Production Type 2	Production Type 1	Production Type 2	Production Type 1	Production Type 2
Cattle	197,158	295,737	97	145	94,406	141,609
Sheep	329,689	398,089	162	196	157,867	190,619
Wool	369,486	280,920	182	138	176,923	134,515
Total	**896,333**	**974,746**	**441**	**479**	**429,196**	**466,743**

06 IMPACT ASSESMENT

06.1 Nature of Proposed Mining Activities

The Project proposes open cut mining activities using conventional methods such as drilling and blasting that is consistent with the existing Moolarben Coal Complex. The impact to agricultural productivity will occur within the Potential Impact Area that is currently under rural licence and will be removed from agricultural purposes during the life of mine which is estimated to be at least 2038. All current agricultural infrastructure within this area will be removed.

While it is understood that the mining process will include progressive rehabilitation, for the purpose of this study, this assessment has been based on the conservative assumption that the Potential Impact Area will be unavailable for agricultural production until at least 2038 (including decommissioning and rehabilitation activities).

It is also noted that not all of the Potential Impact Area will be subject to direct disturbance. For example, a 200 m buffer from the open cut pit has been applied from the major drainages in the Moolarben Valley (Moolarben Creek and Murdering Creek) leaving a 400 m corridor where only ancillary infrastructure would be located (e.g. creek crossings).

The final planned landform is designed to comprise a mix of land for agriculture and land for conservation purpose as woodland. The current estimate is that approximately 500 ha of the Project Area will be returned to grazing agriculture land use following completion of mining and rehabilitation (Figure 06-1). This creation of agricultural land would likely return some portion of the Moolarben Valley to agricultural land area (in addition to the areas suitable for agriculture that would remain in-situ as they would not be disturbed) and related agricultural productivity post-mining.

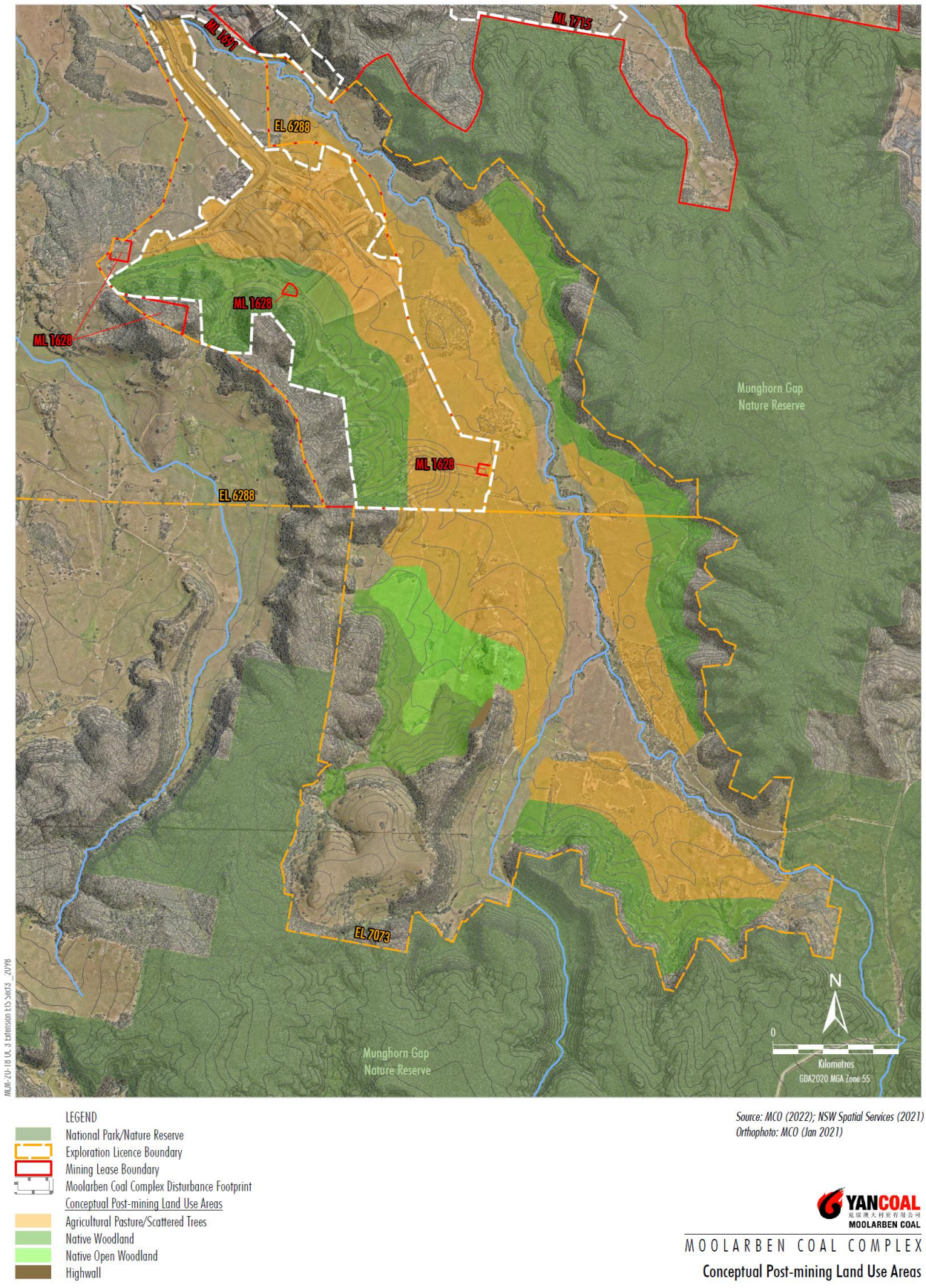


Figure 06-1: Proposed final project landform for Project Area

06.2 Changes in availability and productivity of land for agricultural use.

The entire Potential Impact Area will be removed from its current use for agricultural production until at least 2038.

Estimated annual numbers of stock available for sale from the Potential Impact Area, prior to purchase by Moolarben and based on Production Type 2, were compared to the average number of head transacted annually at the Mudgee and Dubbo saleyards between 2011 and 2021 in Table 06-1. Possible sheep and cattle production from the Potential Impact Area is equivalent to approximately 0.09% of sheep transacted regionally and 0.05% of cattle transacted regionally (Table 06-1).

Table 06-1: Number of stock estimated to potentially be sold from the Potential Impact Area annually as a percentage of the average number of stock sold annually at the Mudgee and Dubbo sale yards between 2011 and 2021

	Number of stock potentially able to be produced within the Potential Impact Area	Saleyard Average no. head transacted annually	Impact stock numbers as a Percentage of local saleyard numbers
Sheep	1182	1,258,732	0.09%
Cattle	119	239,432	0.05%

The annual production value from within the Potential Impact Area associated with Production Type 2 is estimated to be around $467,000 per annum (). Comparison of this estimated production value with regional information from the Central Tablelands Region (ABS, 2020c) and Mid-Western Regional LGA (DPIE, 2021 is presented in Table 06-2. It is estimated that the possible production value from the Potential Impact Area is approximately 0.12% of gross value generated by the Central Tablelands Region (2019-2020) and 0.62% of that in the Mid-Western LGA (2015/16) in the same production types of wool, sheep and cattle.

Table 06-2: Value of Agricultural productivity of Potential Impact Area relative to Central Tablelands and Mid-Western Regional LGA value of agricultural commodities

	Value of Agricultural Commodities produced in 2019-2020 in the Central Tablelands Region ($)	Value of Agricultural Commodities in the Mid-Western Regional LGA 2015/2016 ($)	Estimated Annual value of production from licensed area within Project Area ($)	Project Area value % of Gross Value Central Tablelands Agricultural Commodities	Project Area value % of Mid-Western Regional Council Agricultural Commodities
Livestock Products - Wool	78,863,320	17,790,000	134,515	0.17%	0.76%
Livestock - Sheep and lambs (Slaughtered)	141,625,813	12,460,000	190,619	0.13%	1.53%
Livestock - Cattle and calves (Slaughtered)	179,795,629	45,680,000	141,609	0.08	0.31%
Total	**400,284,762**	**75,930,000**	**466,743**	**0.12%**	**0.62%**

06.3 Groundwater

Groundwater modelling indicates that drawdown from the Project would generally not extend into privately owned land, and that there would be less than 'minimal impact' to water supply works and no significant impact on groundwater quality (AGE, 2022).

In summary, the Groundwater Assessment (AGE, 2022) indicates:

- The Project is located in the North Coast Fractured and Porous Rock Groundwater Sources and Hunter Unregulated and Alluvial Water Sources;
- Groundwater in the Project Area is defined as 'less productive' under AIP;
- No bores outside of the Project Area are predicted to be affected greater than 2 m drawdown, and therefore impacts would be less than the 'minimal impact' criteria for water supply works under the AIP; and
- The setbacks of 200 m from Moolarben and Murdering Creeks would limit impacts to surface water flows.

06.4 Surface Water

The Project design avoids open cut mining within 200 m of the two major drainage features, Moolarben Creek and Murdering Creek that are nearby the defined Project Area.

Runoff from other drainages (e.g. Spring Creek) would be diverted around the Project disturbance areas. Runoff from mine-affected areas would be captured in mine water dams, and preferentially used to meet mine water demands. Runoff from sediment laden areas would be captured in sediment dams. Consistent with the existing MCC Water Management Plan, no uncontrolled releases would occur.

An assessment of potential surface water impacts of proposed modifications relating to the Project was undertaken (WRM Water and Environment, 2022) which assessed that the Project would incur no significant downstream surface water flow or quality impacts.

06.5 Biodiversity Offset Areas

The offset requirements for the Project would be addressed consistent with the NSW Biodiversity Offset Scheme via one, or a combination of the following:

The Project's credit liability would be satisfied via the mechanisms available under the BC Act:

- The retirement of biodiversity credits (either like-for-like or in accordance with the variation rules);
- The funding of a biodiversity conservation action;
- Undertaking ecological mine rehabilitation; and
- Payment into the Biodiversity Conservation Fund.

There is no requirement to provide a specific method for satisfying a Project's offset liability at the EIS stage. As such, any loss of agricultural production as a result of the Project meeting its obligations under the BC Act cannot be meaningfully quantified at this stage, as Moolarben may elect to satisfy its liability via any combination of the above methods.

06.6 Agricultural Impacts on Neighbouring Land

The Project involves an extension to the south of the approved mining area to gain access to additional coal resources. Conservatively, it has been assumed that the Potential Impact Area would be unavailable for agricultural production until at least 2038 (i.e. including decommissioning and rehabilitation activities).

The following subsections provide a summary of the key environmental assessment conclusions related to visual sensitivity, dust, noise and road traffic applicable to neighbouring agricultural enterprises.

06.6.1 Visibility and Visual Sensitivity

The Project location would result in progression of active mining away from publicly visible areas. The Project would be located within the Moolarben Valley. Due to ridgeline formation and existing native vegetation screening, there would be no visibility of the project from privately owned residences, land or publicly accessible vantage points. As such, it is not expected that there would be any direct or cumulative visual impacts to surrounding land users (MCO, 2022).

06.6.2 Air Quality

Todoroski Air Sciences (2022) concluded the following regarding potential impacts to air quality:

- No exceedance of long-term criteria for particulate matter at 2.5 µm or 10 µm diameters, total suspended particulate matter or dust deposition at any privately-owned receptors due to the Project;
- No significant change to the potential air quality impacts of the approved Moolarben Coal Complex;
- Short-term cumulative dust impacts may potentially arise, however are predicted to be adequately managed by existing MCO mitigation measures;
- No adverse air quality impacts associated with rail transport; and
- Blast fume impacts would be mitigated using existing management practices.

Given the above, it is not expected the air quality emissions associated with the Project would materially impact agricultural land uses.

06.6.3 Noise

An assessment of predicted noise impacts from the Project was undertaken by SLR Consulting Australia (2022).

SLR Consulting Australia (2022) found that operational noise predictions from the Project comply with noise trigger levels and existing Moolarben Coal Complex Project Approval criteria for all relevant private residences and community facilities. Likewise, cumulative impacts are predicted to be within recommended noise amenity levels and blast emission levels show no exceedance of human comfort for ground vibration.

Given the above it is not expected the noise emissions associated with the Project would materially impact agricultural land uses.

06.6.4 Road Transport Assessment

TTPP (2022) assessed likely road transport implications of the Project. TTPP (2022) found that future operating conditions on the existing road network would be acceptable with no significant impacts identified on the performance, capacity, efficiency, and safety of the road networks.

Given this assessment, it is not expected that potential traffic associated with the Project would impact the use of local roads for agriculture related activities.

06.7 Summary of Agricultural Impact Assessment

Evidence from modelling and assessment undertaken for the Project (Minesoils, 2022; AGE, 2022; WRM Water and Environment, 2022; MCO, 2022; TTPP, 2022; Todoroski Air Sciences, 2022; SLR Consulting Australia, 2022) 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 (Table 06-3).

06.8 Potential Socio-Economic Impacts

Development of the Project is likely to have negligible impact on agricultural productivity within the region. Estimated value of annual agricultural production forgone in the Project Area is 0.12% of production in the Central Tablelands LLS Region and 0.62% of the Mid-Western Regional LGA (Table 06-2).

Within the LGA, 2016 census data shows that of 24,101 people that are employed, 805 of those are employed within the Agriculture, Forestry and Fishing Cohort. Under former owner ship, the entire Project Area employed only 2-3 permanent staff other than landowners themselves. The reduction of agricultural industry due to the Project incurs a negligible impact on employment rates in the agricultural industry for this area.

With no material change in agricultural production from the Potential Impact Area, it follows there would be negligible outcomes for the regional agricultural industry and related services and employment.

The Project does not increase peak employment for the life of the Moolarben Coal Complex. The land is already owned by Moolarben. There is no land acquisition required due to amenity / dust impacts. As such no social impacts are expected (e.g. in terms of change in local population, increased demand for social services).

Table 06-3: Summary of Agricultural Impact Assessment

Agricultural Resource, Practice or Infrastructure	Potential Impact	Management or Mitigation	Consequence to Agricultural Productivity
Resource			
Soil	Loss of agricultural soil.	Progressive backfilling and rehabilitation.	Removed during life of mine Reconstructed during rehabilitation.
Surface Water	Capture and management of runoff from mining areas and other disturbance areas.	Mitigated through project design which avoids open cut mining within 200 metres of Moolarben and Murdering Creek, incorporates clean water diversions for other drainage lines upstream of the Project disturbance areas	No significant impact to water flows or quality.
Groundwater	No highly productive groundwater associated with Project Area. No exceedance of minimal impact criteria.	Progressive backfilling of mining areas and no residual final voids.	No significant impact to groundwater users.
Weeds	Weeds decrease agricultural productivity (no significant risk anticipated with appropriate management).	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).	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.
Practice			
Grazing	Loss of grazing land within the Potential Impact Area until at least 2038.	No management or mitigation during life of mine. 500.3 ha returned for grazing land use following rehabilitation.	Restriction of access and disturbance of land during life of mine

Agricultural Resource, Practice or Infrastructure	Potential Impact	Management or Mitigation	Consequence to Agricultural Productivity
Fodder cropping	Loss of fodder cropping land within the Potential Impact Area until at least 2038.	No management or mitigation during life of mine. 500.3 ha returned for grazing land use following rehabilitation.	Restriction of access and disturbance of land during life of mine.
Infrastructure			
Fences and Gates, Dams, Machinery and storage sheds, Dams	Removal of all infrastructure in the Project Area.	Create new infrastructure as required with the final landform and land use. Decommission and removal of all Project infrastructure unless a suitable post-mining land use is identified for the infrastructure in consultation with relevant stakeholders.	Removed, as required, during life of mine.
Neighbouring Agricultural Impacts			
Visual Sensitivity	No impact to visual amenity.	Mitigated through project design (e.g., enclosed by natural valley ridgelines).	No significant impact.
Air quality	No adverse air quality impacts at privately-owned properties used for agricultural production.	Mitigated though project design (e.g., no increase on already approved ROM coal mining rates). Extension of air quality monitoring network.	No significant impact.
Noise	No material noise impacts at privately-owned properties used for agricultural production.	Mitigated through project design (e.g. no increase on current activities). Extension of noise and blast monitoring network.	No significant impact.
Road transport	No significant impact on the capacity, safety, or efficiency of the current road network because of the Project.	Mitigated through project design (e.g., no increase to peak workforce, no additional traffic interaction with public roads, no change to transport limits).	No significant impact.

06.8.1 Considerations of Critical Mass Thresholds

The DPI (2013) defines a critical mass as 'Where a project is expected to significantly reduce the portion of agricultural enterprises within a region (that is a reduction greater than 5%) within aggregate or within a specific enterprise (such as dairy, thoroughbred breeding or apple production etc)'.

Estimated impacts on regional agricultural productivity as a result are <1% (Table 06-2), and it follows there would be negligible outcomes for the regional agricultural industry and related services and employment. Therefore, the Project does not create a risk to critical mass thresholds for the agricultural industry in the region.

06.9 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.

06.10 Addressing the SEARs

The SEARs state the following requirements regarding the agricultural impact assessment:

> ***The likely agricultural impacts of the development, including biosecurity risks***

The entire Potential Impact Area will be removed from its current use for agricultural production until at least 2038. Biosecurity risks in terms of introduction or spread of agriculturally significant disease or pest are reduced from the current level of risk (while under rural licence) due to the Project, given that stock will be absent from this area. Other biosecurity risks will be mitigated by MCO weed and feral animal control measures already in place for the existing mine.

> ***The compatibility of the development with other land uses in the vicinity of the development in accordance with the requirements of Clause 12 of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007, paying particular attention to the agricultural land use in the region.***

Section 06.6 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 other agricultural activities within the vicinity of the Project.

07 CONCLUSION

Detailed assessment of potential impacts of the Project has forecast minimal impact on agricultural production within the region.

The Project Area has low to moderately low agricultural capability. Sheep grazing for wool and fat lamb production and beef cattle production is the dominant land use with some small areas of opportunistic fodder cropping. Using historical information on land use, production and typical values it is estimated that the value of annual agricultural production from within the Project Area is approximately 0.62% of the annual production from the Mid-Western Regional LGA and approximately 0.12% of the annual production from the Central Tablelands LLS Region.

Agricultural land in the Project Area was found to be dominated by low capability land with small areas of high and moderate capability land.

The Groundwater Assessment (AGE, 2022) and Surface Water and Flood Impact Assessment (WRM Water and Environment, 2022) predicted no significant impacts on groundwater or surface water resources as result of the Project.

Specialist studies concerning noise, dust, traffic and visual amenity found no significant impact on neighbouring properties or land users (MCO, 2022; TTPP, 2022; CDM Smith, 2022; Todoroski Air Sciences, 2022; SLR Consulting Australia, 2022).

This report represents the Agricultural Impact Assessment undertaken to support the EIS and the Development Application 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 layout.

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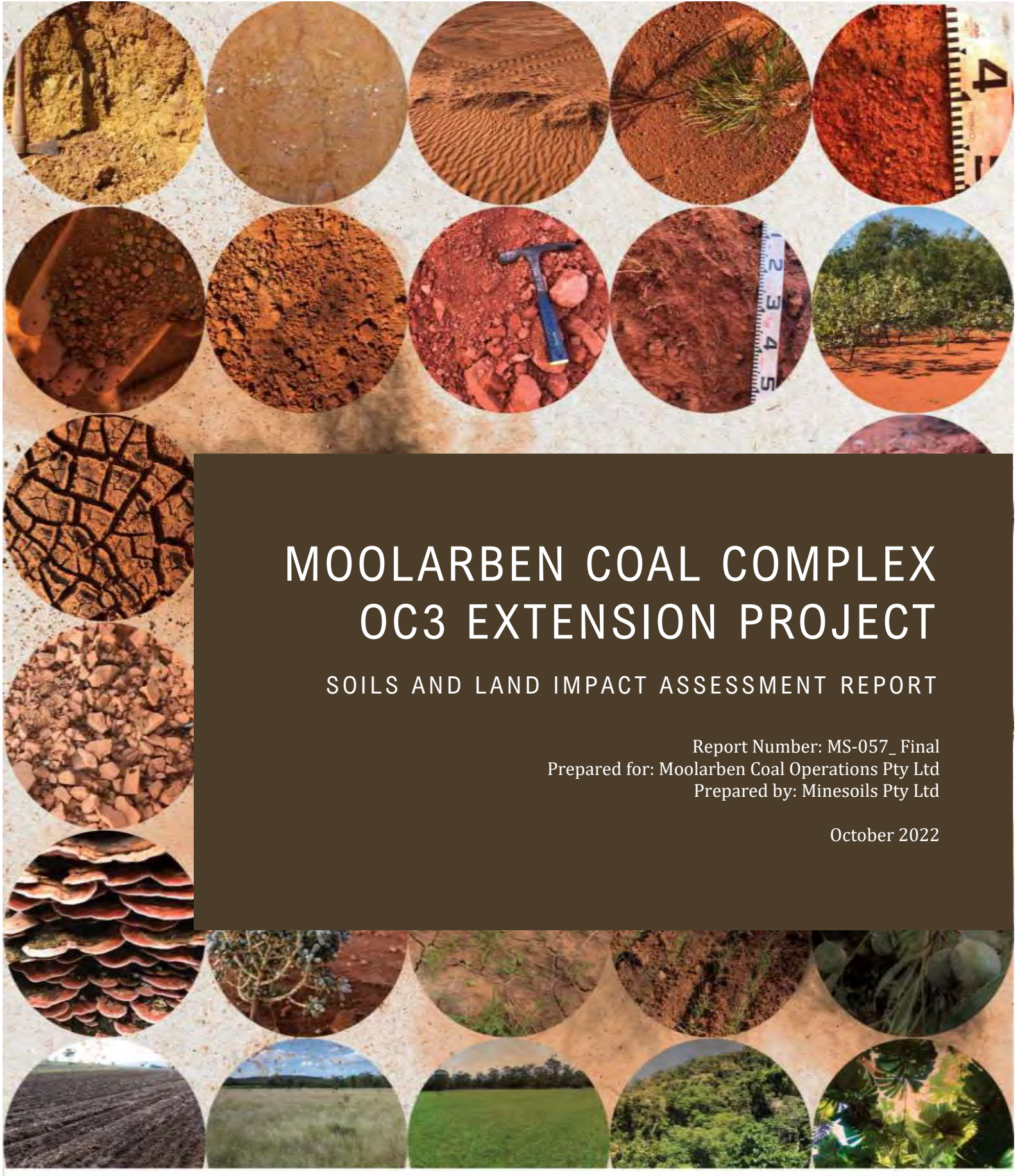
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APPENDIX A: Soils And Land Impact Assessment



MOOLARBEN COAL COMPLEX OC3 EXTENSION PROJECT

SOILS AND LAND IMPACT ASSESSMENT REPORT

Report Number: MS-057_ Final
Prepared for: Moolarben Coal Operations Pty Ltd
Prepared by: Minesoils Pty Ltd

October 2022

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DOCUMENT CONTROL

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MS-057_Draft 1	16 September 2022	Matt Hemingway & Clayton Richards	Clayton Richards
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MS-057_Final	3 November 2022	Matt Hemingway & Clayton Richards	Clayton Richards

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1. INTRODUCTION

Moolarben Coal Operations Pty Ltd (MCO) engaged Minesoils Pty Ltd (Minesoils) to undertake a Soils and Land Impact Assessment for the Moolarben Coal Complex OC3 Extension Project (the Project). It has been prepared as part of the Environmental Impact Statement (EIS) required to accompany the application to the NSW Department of Planning and Environment (DPE) for development consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

1.1 PROJECT BACKGROUND

The Moolarben Coal Complex is located approximately 40 kilometres (km) north of Mudgee, New South Wales (NSW) (**Figure 1**). The Moolarben Coal Complex is operated by MCO on behalf of the Moolarben Joint Venture (Moolarben Coal Mines Pty Ltd [MCM], Yancoal Moolarben Pty Ltd [YM] and a consortium of Korean power companies). MCO, MCM and YM are wholly owned subsidiaries of Yancoal Australia Limited (Yancoal).

Mining operations at the Moolarben Coal Complex are currently approved until 31 December 2038 with a combined coal production rate of 22 million tonnes per annum (Mtpa) in accordance with Project Approval (05_0117) (Stage 1) (as modified) and Project Approval (08_0135) (Stage 2) (as modified). The Moolarben Coal Complex comprises four approved open cut mining areas (OC1 to OC4), three approved underground mining areas (UG1, UG2 and UG4) and other mining related infrastructure (including coal processing and transport facilities).

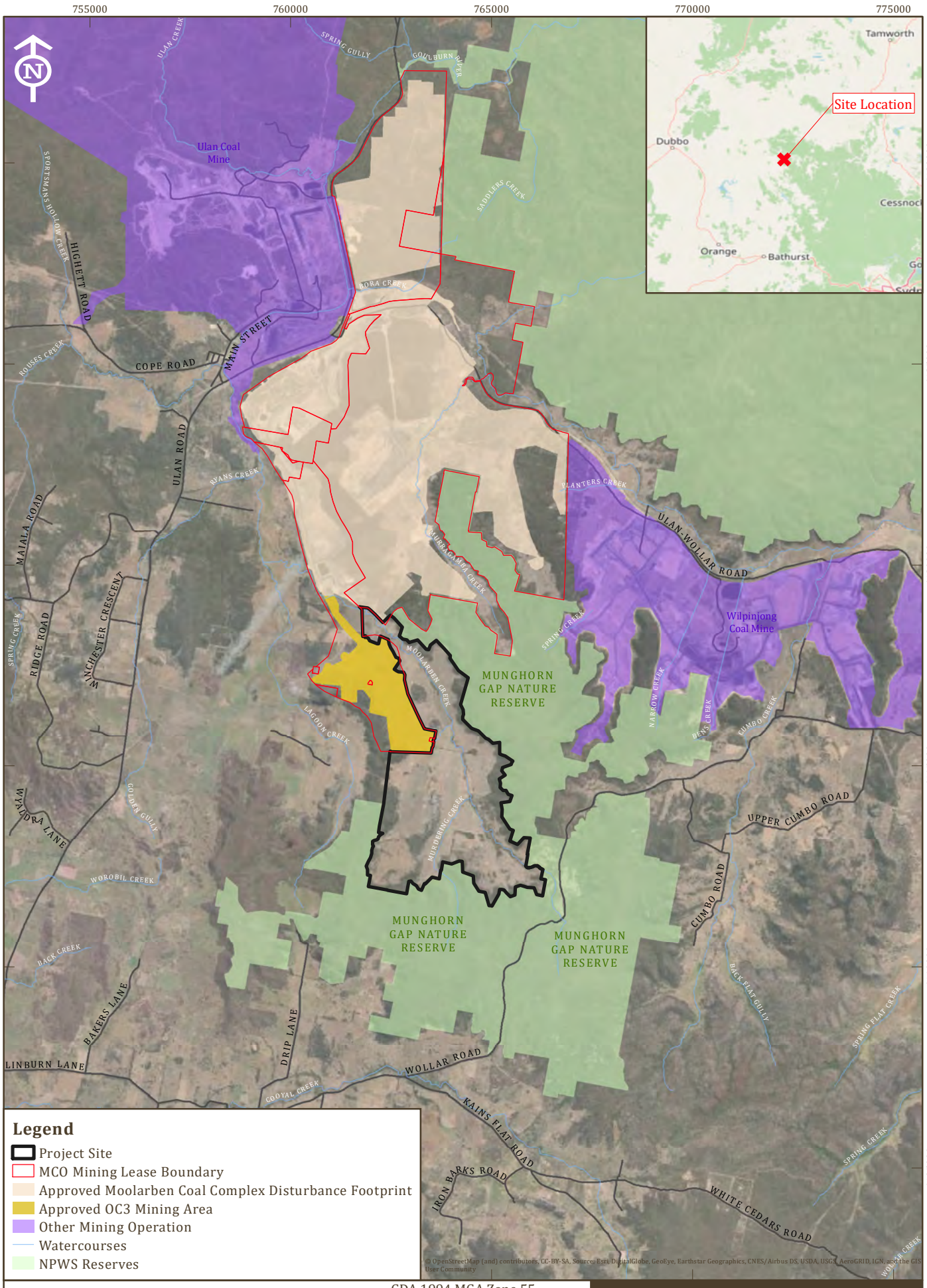
MCO currently operates across multiple open cut mining areas and at current production rates, mining (i.e. run of mine [ROM] coal extraction) within the OC3 mining area will likely be completed in 2025. Mining of the remaining Stage 2 open cut mining area (OC4) would continue beyond 2025 within the currently approved mine life of the Moolarben Coal Complex (i.e. 31 December 2038).

1.2 PROPOSED DEVELOPMENT

MCO has identified an opportunity to extend open cut mining operations immediately south of the approved OC3 open cut pit as well as develop four new open cut pits to the east and south-east of the approved OC3 mining area, within existing mining tenements. The extended open cut mining operations would provide approximately 10 years of mining (from 2025 to 2034), maximise use of the existing mining fleet and maintain steady production of ROM coal at the Moolarben Coal Complex post-completion of mining within the approved OC3 mining areas.

It is expected the Project would include the following activities:

- extension of open cut mining operations within mining lease (ML) 1691, exploration licence (EL) 6288, and EL 7073 to allow mining of additional coal resources;
- extraction of up to 9 Mtpa of ROM coal with a total of approximately 40 million tonnes (Mt) over the life of the Project;
- mining operations between approximately 2025 to 2034 (which is within the approved life of the Moolarben Coal Complex ending on 31 December 2038);
- extension of employment of existing open cut workforce;
- construction and operation of ancillary infrastructure, services, plant and equipment in support of mining operations;
- construction and operation of water management and water storage infrastructure in support of mining operations;
- development of an integrated final landform with the approved OC3 mining area;
- ongoing exploration activities in the Project area;
- construction of haul road creek crossings;


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Site Location
Tamworth
Dubbo
Orange
Bathurst
Cessnock
Ulan Coal Mine
Wilpinjong Coal Mine
MUNGHORN GAP NATURE RESERVE
MUNGHORN GAP NATURE RESERVE
MUNGHORN GAP NATURE RESERVE
ULAN CREEK
SPRING GULLY
GOULBURN RIVER
SADDLERS CREEK
SPORTSMANS HOLLOW CREEK
HIGHETT ROAD
BORA CREEK
ROUSES CREEK
COPE ROAD
MAIN STREET
ULAN ROAD
EVANS CREEK
PLANTERS CREEK
ULAN-WOLLAR ROAD
MURRAGAMBA CREEK
MAIALA ROAD
WINCHESTER CRESCENT
SPRING CREEK
RIDGE ROAD
MOOLARBEN CREEK
SPRING CREEK
NARROW CREEK
BENS CREEK
CUMBO CREEK
LAGOON CREEK
WYDRA LANE
GOLDEN GULLY
MURDERING CREEK
UPPER CUMBO ROAD
CUMBO ROAD
WOROBIL CREEK
BACK CREEK
BAKERS LANE
DRIP LANE
BACK FLAT GULLY
SPRING FLAT CREEK
LINBURN LANE
WOLLAR ROAD
COOYAL CREEK
KAINS FLAT ROAD
IRON BARKS ROAD
WHITE CEDARS ROAD
SPRING CREEK
WINDER CREEK
Legend
Project Site
MCO Mining Lease Boundary
Approved Moolarben Coal Complex Disturbance Footprint
Approved OC3 Mining Area
Other Mining Operation
Watercourses
NPWS Reserves
© OpenStreetMap (and) contributors, CC-BY-SA, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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MINESOILS
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Project Locality
FIGURE 1
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- quarrying and/or excavation of borrow pits within approved disturbance areas to retrieve construction materials;
- conventional open cut mining related activities such as drilling and blasting, and other associated activities; and
- rehabilitation, decommissioning and closure.

The Project site subject to this assessment covers an area of approximately 1,542.9 hectares (ha) (**Figure 2**). The direct impact area subject to surface disturbance associated with mining activity covers 825.6 ha.

As the Project is proposing to integrate the final landform with the adjacent approved OC3 mining area, soil resources and final land use domains associated with the approved OC3 mining area are taken into account as part of this assessment. The approved OC3 mining area covers 395.5 ha and is shown on **Figure 2**.

1.3 SECRETARYS ENVIRONMENTAL ASSESSMENT REQUIREMENTS

This Soil and Land Impact Assessment forms part of an 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 impacts. The SEARs for the Project that are addressed in this report are as follows:

- *the likely impacts of the development on the soils and land capability of the site and surrounds, and a description of the mitigation and management measures to prevent, control or minimise impacts of the development.*

1.4 REPORT STRUCTURE

This report is structured as follows:

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

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

Section 3 Soil Assessment – describes the methodology of the field survey in the soil survey Project site, its results, and an overview of soil resources on re-disturbance areas within the direct mining impact area.

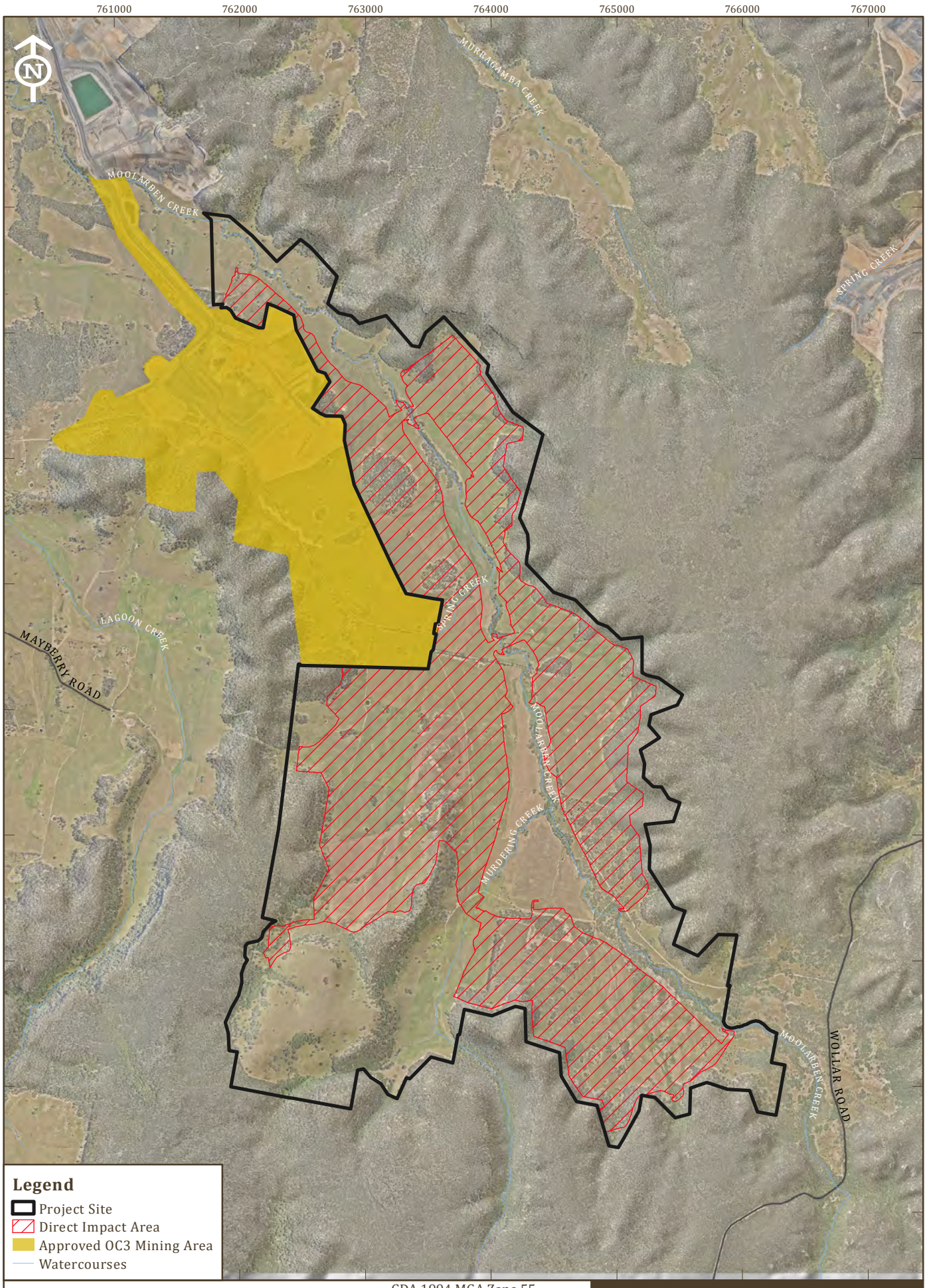
Section 4 Land Capability Impact Assessment – describes the methodology of the land capability impact assessment of the direct mining impact area

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

Appendix A Certificate of Analyses – Results of soil analysis from NATA accredited laboratory



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Project Site

FIGURE 2

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2 EXISTING ENVIRONMENT

2.1 CLIMATE

The climate in the vicinity of the Project site is typical of temperate regions and is characterised by hot dry summers with some thunderstorms, and cold winters with frequent frosts.

Representative rainfall data for the area has been obtained from the Bureau of Meteorology (BOM) weather station located at Ulan Water (Station 062036; BOM, 2022), which is located in the township of Ulan approximately 5 km north of the Project site. Data shows that the area experiences an average rainfall of 641.5 millimetres (mm) per year (BOM, 2022).

The mean daily temperature during January, the hottest month in summer, is 31.0 degrees centigrade (°C). The mean daily temperature in July, the coolest month in winter, is 14.6°C. In summer daily temperatures can exceed 38°C, while winter overnight temperatures occasionally drop below freezing point (Station 062036; BOM, 2022).

2.2 LAND USE

Dominant land uses in the locality include coal mining and grazing on native and improved pastures. Other areas previously subject to clearing have been historically used for light grazing on native and improved pastures, whilst steeper areas remain heavily timbered, with Munghorn Gap Nature reserve located to the immediate east and south of the Project site.

The Project site is largely cleared for agriculture and used for grazing enterprises.

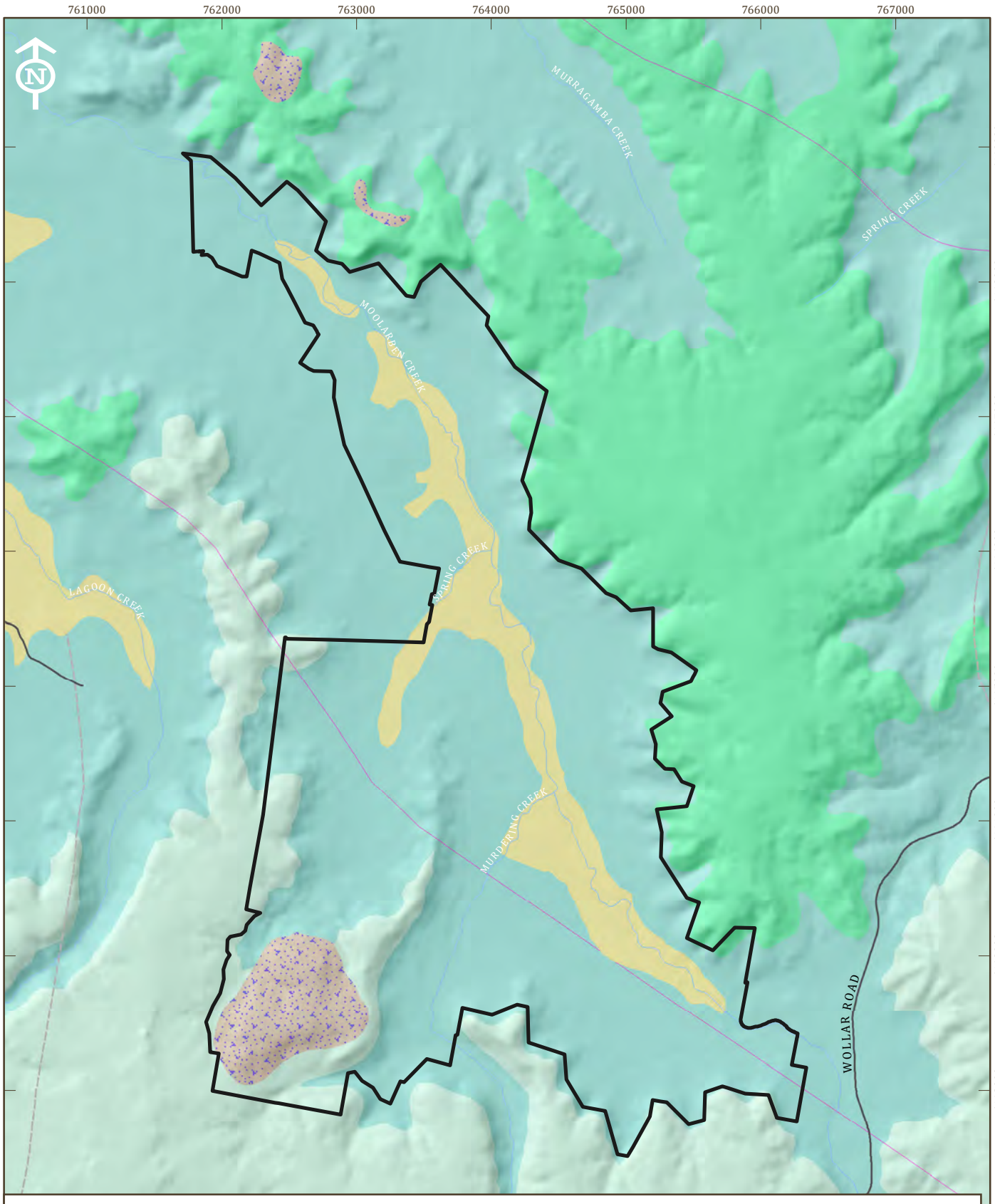
2.3 GEOLOGY, TOPOGRAPHY AND SLOPE

The Project site is located in the northern part of the Western Coalfield and occupies the north west margin of the Sydney Basin in NSW. The geology of the area consists of Permian Illawarra Coal Measures and derived colluvium/alluvium consisting of quartz-lithic sandstone, mudstone (sporadically carbonaceous), claystone, coal, torbanite, rhyolitic tuff and some lenses of polymictic conglomerate (refer **Figure 3**) (Murphy & Lawrie, 1998).

The Project is located in the upper Goulburn River catchment, which drains an area of about 24,550 ha and feeds the Hunter River. Moolarben Creek is the primary creek in this catchment. It flows in a northerly direction and is fed by Spring and Murdering Creek within the Project site before it flows to Moolarben Dam and then joins Sportsmans Hollows Creek to form the headwaters of the Goulburn River. The upper reaches of the Moolarben Creek catchment are characterised by steep, heavily forested slopes of up to 20%, draining into a cleared and relatively flat floodplain.

At a regional scale, small ridges and valleys associated with the Goulburn River and associated creeks and tributaries characterise the area. The topography in the Project site has been controlled by regional geological structures, including various faults and folds, which have in turn formed a number of erosional sandstone escarpments and plateaus. Here, land surface elevation varies from approximately 440 m AHD on the lower open drainage plain that characterises the central and northern areas, to approximately 700 m AHD on a plateau located in the south west of the Project site (refer **Figure 4**).

The Project site is dominated by flat to very gently undulating open flats and drainage plains (0 – 10% slope). This becomes gently inclined to steeply inclined on mid and upper slopes leading to ridgeways on the eastern and southern boundary and the plateau to the south west (10% - >50%) (refer **Figure 5**).



Legend

- Project Site
- Watercourses

Geological Structures (GSNSW 2020)

- Isopach, line joining points of equal seam thickness
- Structural contour, accurate.

Dominant Lithology

- Basalt

Cenozoic Sedimentary Province

- Alluvial valley deposits - terraced (Q_avt)

Cenozoic Igneous Province

- Dubbo Volcanics (NMdud)

Permo Triassic Basins

- Illawarra Coal Measures (Pil)
- Narrabeen Group (Tna)
- Banks Wall Sandstone (Tnrb)

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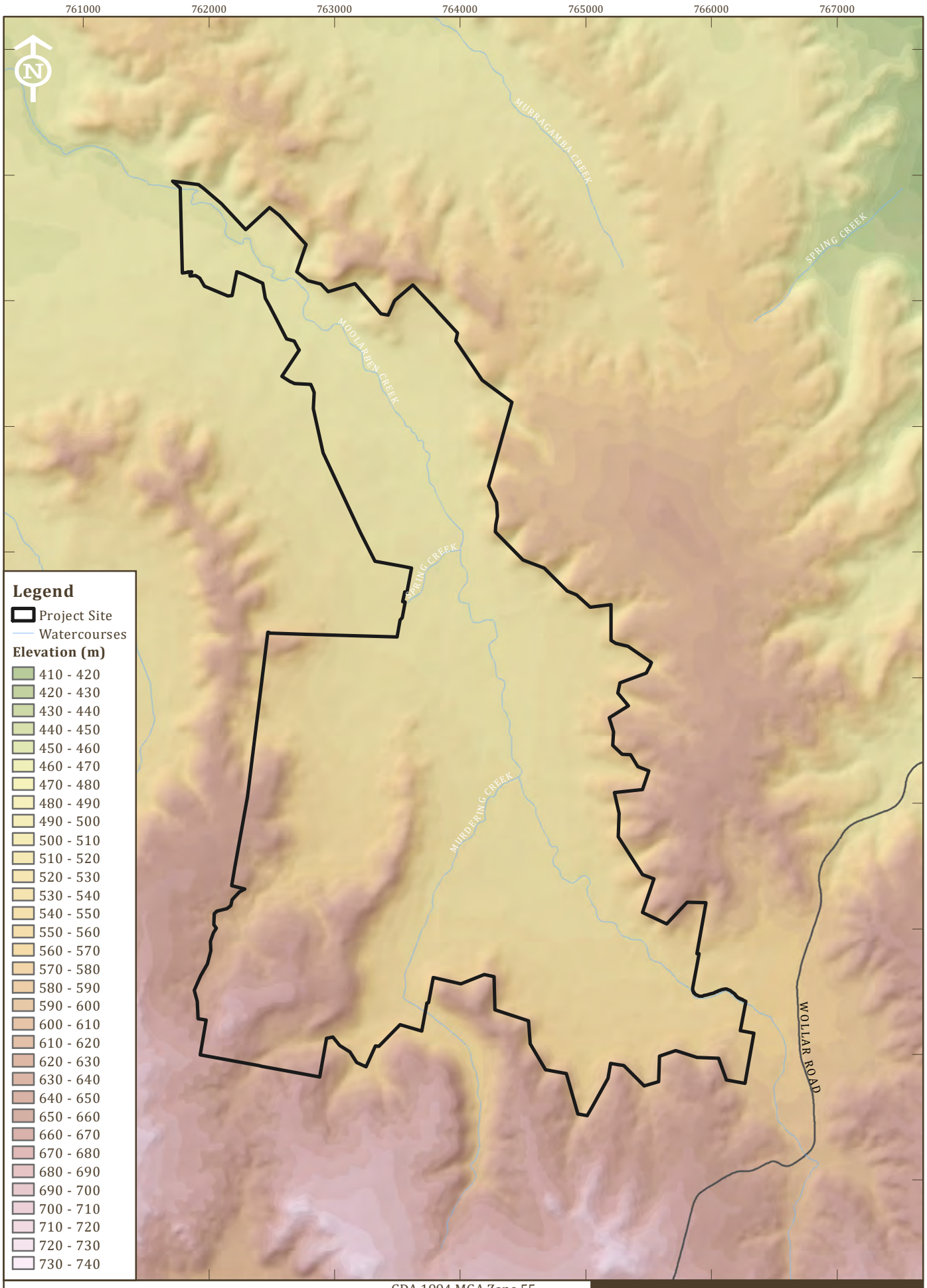
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Surface Geology

FIGURE 3

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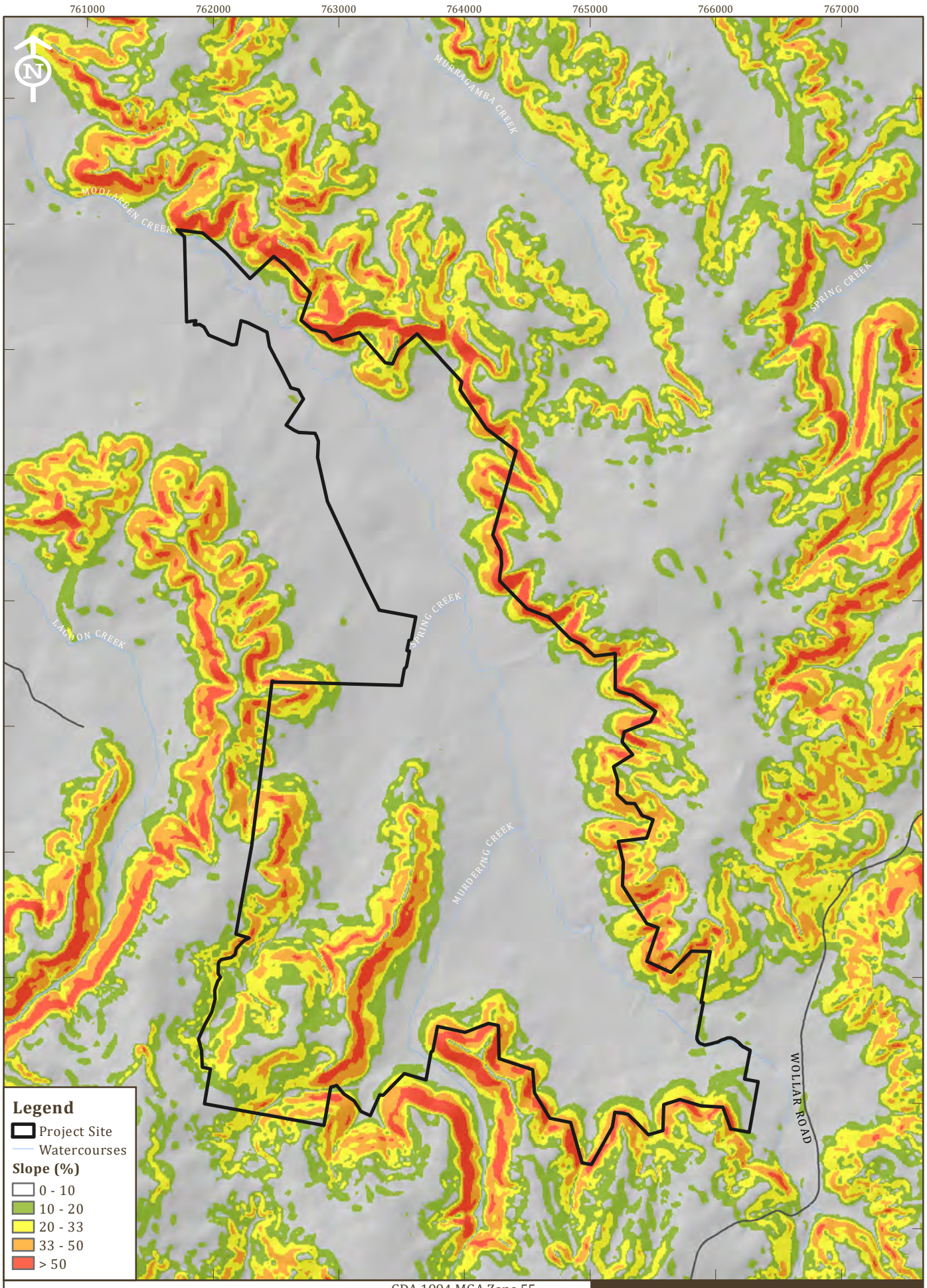
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Topography

FIGURE 4

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Slopes

FIGURE 5

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2.4 SOIL LANDSCAPES

Soil landscape units for the Project site have been mapped by the NSW Office of Environment and Heritage (OEH) (2018), which compiled 40 published soil landscape maps that cover central and eastern NSW, based on standard 1:100,000 and 1:250,000 topographic sheets. The mapping provides an inventory of soil and landscape properties of the area and identifies major soil and landscape qualities and constraints. It integrates soil and topographic features into single units with relatively uniform land management requirements. In the associated reports, soils are described in terms of soil materials in addition to the Australian Soil Classification, the Great Soil Groups, and the Northcote system.

The soil landscape units mapped for the Project site are the Ulan, Ulan variant A, Ulan variant B, Ant Hill, Munghorn Plateau, Lees Pinch, Hands on Rock, Benjang variant B, Cranbourne and Wollangambe soil landscapes (refer **Figure 6**), which are described below.

Ulan Soil Landscape

This landscape consists of gently undulating plains to undulating rises on Permian Illawarra Coal Measures in the western part of the Hunter Region. Slopes 2 - 5%, local relief <30 m, elevation 350 - 550 m. Extensively cleared.

Soils are dominated by deep (100 - <150 centimetres [cm]), imperfectly to poorly drained Bleached / Sodic Brown and Yellow Natric Kurosols (Soloths) and shallow to moderately deep (25 - <100 cm), well-drained Red and Yellow Kurosols (Red Podzolic Soils and Yellow Podzolic Soils).

Qualities and limitations include localised discharge zone, localised salinity hazard, widespread gully erosion hazard, widespread sheet erosion hazard, widespread high run-on, localised poor drainage, and widespread seasonal waterlogging.

Ulan variant A Soil Landscape

This landscape consists of gently undulating to undulating rises on Permian Illawarra Coal Measures and minor areas of Singleton Coal Measures in the western part of the Hunter Central Rivers catchment. Slopes <10%, local relief 10 - 30 m, elevation ranges 350 - 450 m. Extensively cleared woodland.

Soils are dominated by shallow to moderately deep (25 - <100 cm), well-drained, minimal Red and Brown Kurosols (Red Podzolic Soils) and very shallow (<25 cm), rapidly drained Leptic Tenosols (Earthy Sands).

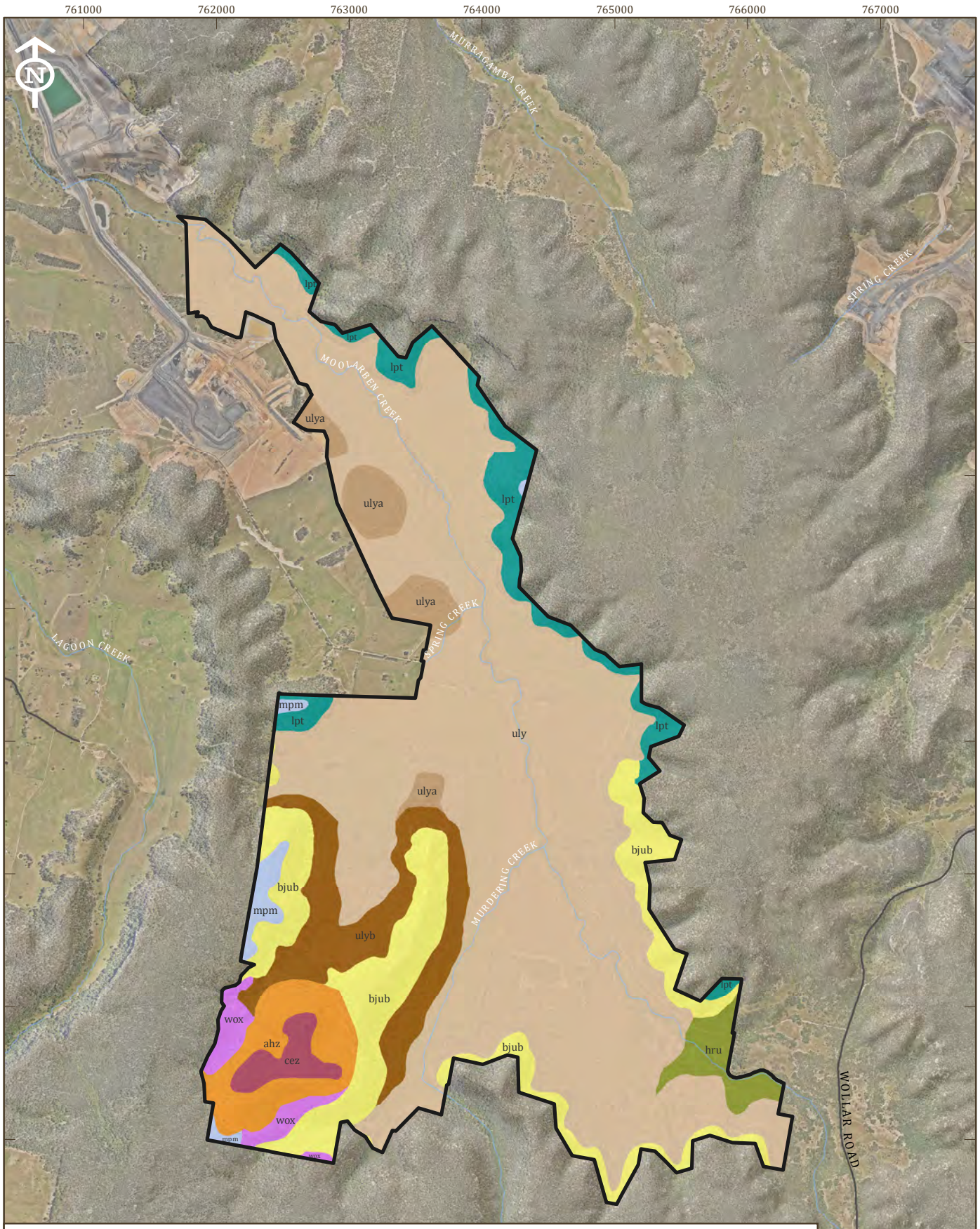
Qualities and limitations include localised shallow soils, localised poor moisture availability, localised rock outcrop hazard, localised foundation hazard, widespread recharge zone, widespread sheet erosion hazard, localised high run-on, and localised seasonal waterlogging.

Ulan variant B Soil Landscape

This landscape consists of rolling low hills on Permian Illawarra Coal Measures in the western part of the Hunter Central Rivers catchment. Slopes mostly 10 - 30% but can occasionally exceed 30%, local relief 30 - 90 m, elevation 340 - 550 m. Partially cleared dry sclerophyll forest or woodland.

Soils are dominated by shallow (25 - <50 cm), well-drained gravelly Bleached Leptic Tenosols (Lithosols).

Qualities and limitations include widespread shallow soils, widespread poor moisture availability, widespread steep slopes, widespread rock outcrop hazard, widespread rockfall hazard, widespread mass movement hazard, localised foundation hazard, widespread recharge zone, widespread sheet erosion hazard, and localised high run-on.



Legend

- Project Site
- Watercourses

Regionally Mapped Soil Landscapes (Soil Land Resources - OEH 2018)

- Ant Hill (ahz)
- Benjang Variant B (bjub)
- Cranbourne (cez)
- Hand on Rock (hru)
- Lees Pinch (lpt)
- Munghorn Plateau (mpm)
- Ulan (uly)
- Ulan Variant A (ulya)
- Ulan Variant B (ulyb)
- Wollangambe (wox)

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Regionally Mapped Soil Landscapes

FIGURE 6

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Ant Hill Soil Landscape

This landscape consists of rolling hills with benched sideslopes on Tertiary Basalt of the Merriwa Plateau occurring mainly in the Hunter Region with some extending into the Central West catchment. Slopes 20 - 32%, local relief 90 - 200 m, elevation 300 - 1160 m. Extensively cleared woodland and open-woodland.

Soils are dominated by moderately deep to very deep (50 - 500 cm), moderately well to well-drained Haplic Eutrophic Black, Red and Brown Dermosols and Chromosols (Chocolate Soils and Euchrozems); shallow to very deep (25 - 500 cm), moderately well to well-drained Black Vertosols (Black Earths) and Red Vertosols and Dermosols (Red Clays); and very shallow to shallow (<25 - <50 cm), well-drained Clastic Rudosols and Tenosols (Lithosols).

Qualities and limitations include localised shallow soils, localised rock outcrop hazard, localised rockfall hazard, localised mass movement hazard, widespread foundation hazard, widespread recharge zone, localised gully erosion hazard, widespread sheet erosion hazard, and localised high run-on.

Munghorn Plateau Soil Landscape

This landscape consists of level plains to undulating plains comprised of flat-topped crests on Triassic sandstone and sediments in the central west of the Hunter Region. Slopes <10%, local relief <9 m, elevation 280 - 570 m. Generally uncleared woodland/dry sclerophyll forest.

Soils are dominated by very shallow to shallow (<25 - <50 cm), rapidly drained Leptic Tenosols and Rudosols (Earthy Sands / Siliceous Sands) and very deep (150 - 500 cm), rapidly drained Yellow and Brown Tenosols (Earthy Sands).

Qualities and limitations include widespread shallow soils, widespread poor moisture availability, widespread non-cohesive soils, localised periodically frozen soils, widespread rock outcrop hazard, localised foundation hazard, widespread recharge zone, and widespread sheet erosion hazard.

Lees Pinch Soil Landscape

This landscape consists of steep to precipitous hills on Triassic sandstone in the south-west of the Hunter catchment. Slopes >30%, local relief 90 - >300 m, elevation 200 - 800 m. Mostly uncleared open-forest and woodland.

Soils are dominated by very shallow to shallow (<25 - <50 cm), rapidly drained Arenic and Clastic Rudosols (Siliceous Sands) and Leptic Tenosols (Lithosols); shallow to deep (25 - <150 cm), well-drained Kandosols (Yellow Earths); and deep (100 - <150 cm), imperfectly drained Yellow Kurosols (Yellow Podzolic Soils and Soloths).

Qualities and limitations include widespread shallow soils, widespread poor moisture availability, widespread non-cohesive soils, widespread steep slopes, widespread rock outcrop hazard, widespread rockfall hazard, widespread mass movement hazard, widespread foundation hazard, widespread recharge zone, widespread sheet erosion hazard, localised high run-on, and localised permanent waterlogging.

Hands on Rock Soil Landscape

This landscape consists of gently undulating plains to rolling low hills comprised of hanging valleys on Triassic sediments mainly in the west of the Hunter Region with a few outliers in the Hawkesbury Nepean catchment. Slopes <15%, local relief <80 m, elevation 180 - 560 m. Mostly uncleared open-forest and woodland.

Soils are dominated by very deep (150 - 500 cm), rapidly drained Arenic Yellow-Orthic Tenosols and Yellow Kandosols (Earthy Sands and Yellow Earths) and shallow (25 - <50 cm), well-drained Tenosols (Siliceous Sands).

Qualities and limitations include localised shallow soils, widespread non-cohesive soils, localised rock outcrop hazard, localised rockfall hazard, widespread recharge zone, localised discharge zone, widespread gully erosion hazard, widespread high run-on, localised poor drainage, and localised seasonal waterlogging.

Benjang variant B Soil Landscape

This landscape consists of steep to very steep flat-topped hills comprising foothills below Narrabeen sandstone escarpments on undifferentiated Singleton Coal Measures in the central west of the Hunter Region. Slopes >30%, local relief 30 - 150 m, elevation 100 - 750 m. Largely uncleared woodland.

Soils are dominated by shallow to moderately deep (25 - <100 cm), gravelly stony Leptic Tenosols (Lithosols), and shallow to moderately deep (25 - <100 cm) Brown and Red Chromosols (Non-calcic Brown Soils and Red-brown Earths).

Qualities and limitations include widespread shallow soils, localised poor moisture availability, widespread steep slopes, widespread rock outcrop hazard, widespread rockfall hazard, widespread mass movement hazard, widespread foundation hazard, widespread recharge zone, widespread gully erosion hazard, widespread sheet erosion hazard, and localised high run-on.

Cranbourne Soil Landscape

This landscape consists of level plains to undulating rises comprised of plateaux and broad benches on Tertiary in the north-west of the Hunter Region and north-east of the Central West catchment. Slopes <5%, local relief <30 m, elevation 360 - 780 m. Open-forests and woodland mostly cleared for grazing and cropping.

Soils are dominated by moderately deep to deep (50 - <150 cm), moderately well-drained Haplic Mesotrophic Black Dermosols (Chocolate Soils) and Haplic Mesotrophic and Eutrophic Red Ferrosols (Euchrozems); very shallow to shallow (25 - <50 cm) moderately well-drained Chernic-Leptic Tenosols and Leptic Rudosols (Lithosols); and moderately deep to deep (50 - <150 cm), imperfectly drained Haplic Self-mulching Red Vertosols (Red Clays).

Qualities and limitations include localised shallow soils, localised poor moisture availability, localised rock outcrop hazard, widespread foundation hazard, widespread recharge zone, and localised sheet erosion hazard.

Wollangambe Soil Landscape

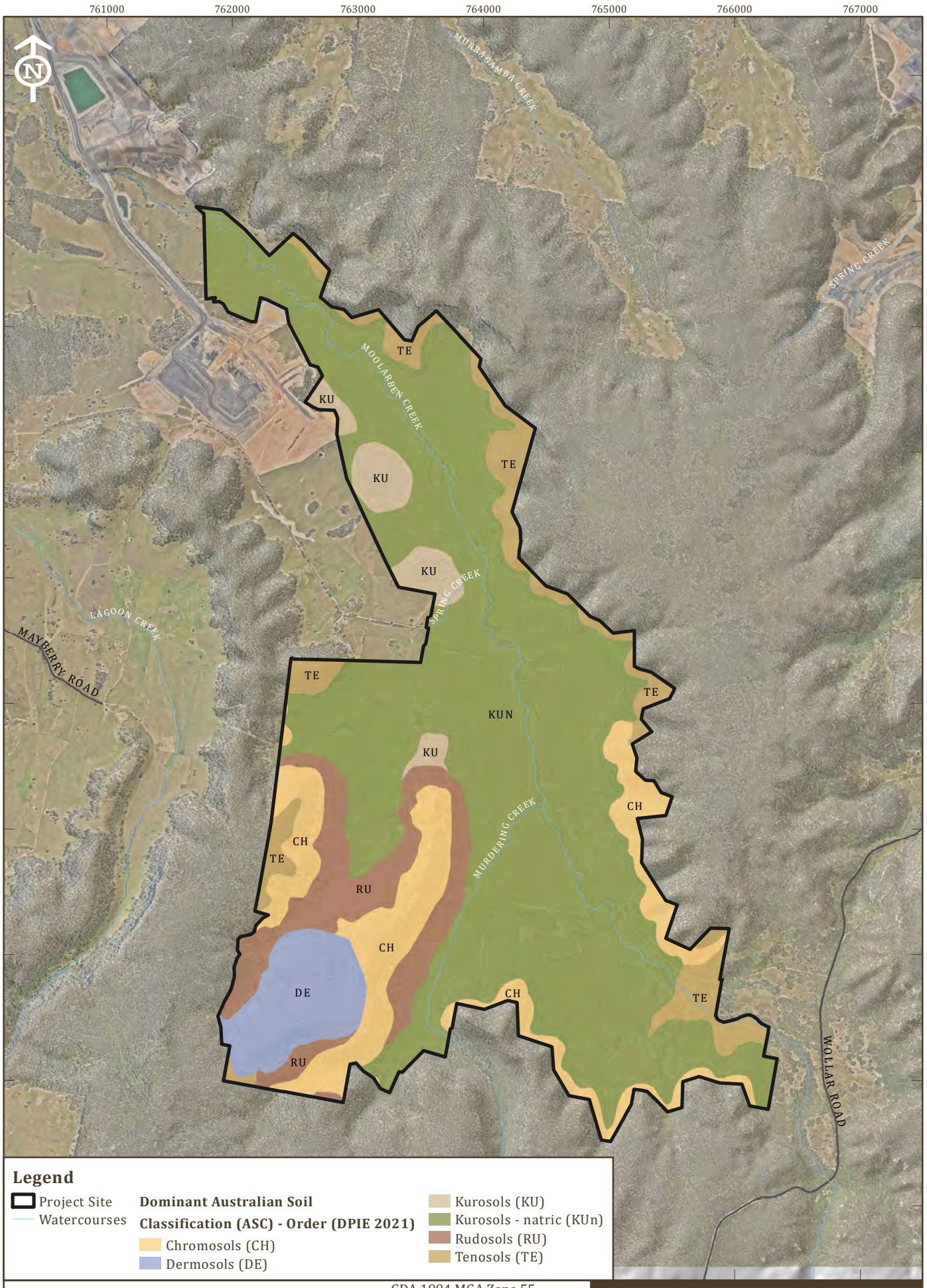
This landscape consists of rolling low hills to steep hills on Narrabeen Group sandstone mainly in the north-west of the Hawkesbury Nepean Catchment but also in the rugged south-west of the Hunter Region. Slopes 20 - 40%, local relief <220 m, elevation 200 - 600 m. Mostly uncleared open-forest and open-woodland.

Soils are dominated by shallow (<50 cm), rapidly drained Rudosols and Tenosols (Lithosols and Siliceous Sands); shallow to moderately deep (<50 - 100 cm), well to rapidly drained Brown Orthic Tenosols and Kandosols (Earthy Sands and Yellow Earths); moderately deep to deep (50 - 150 cm), moderately well-drained Brown Kandosols (Brown Earths) and imperfectly drained Yellow, Brown and Red Kurosols and Chromosols (Yellow, Brown and Red Podzolic Soils); and shallow to moderately deep (<50 - 100 cm), rapidly to well-drained Rudosols and Tenosols (Siliceous Sands).

Qualities and limitations include widespread shallow soils, localised non-cohesive soils, localised steep slopes, localised rock outcrop hazard, localised rockfall hazard, localised mass movement hazard, widespread foundation hazard, widespread recharge zone, and widespread sheet erosion hazard.

2.5 REGIONAL SOIL TYPES

Regional Australian Soil Classification (ASC) mapping indicates the lower slopes and gentle inclines of the Project site are primarily dominated by a Natric Kurosol soil order, with Chromosols on gentle inclines and Tenosols and Rudosols on upper slopes with steeper inclines. Dermosols occur on an elevated plateau in the south-west of the Project site (refer **Figure 7**). An overview of these soil types is detailed below.


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SPRING CREEK
MOOLARBEN CREEK
SPRING CREEK
LAGOON CREEK
MAYBERRY ROAD
MURDERING CREEK
WOLLAR ROAD
TE
KU
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TE
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SPRING CREEK
TE
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KUN
KU
CH
CH
TE
RU
CH
DE
RU
CH
TE
Legend
Project Site
Watercourses
Dominant Australian Soil Classification (ASC) - Order (DPIE 2021)
Chromosols (CH)
Dermosols (DE)
Kurosols (KU)
Kurosols - natric (KUn)
Rudosols (RU)
Tenosols (TE)
GDA 1994 MGA Zone 55
MINESOILS
LAND & REHABILITATION SPECIALISTS
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Regionally Mapped Soil Types
FIGURE 7
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Kurosols

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 strongly acid.

A variant present within the project site is the Natric Kurosols, which have the above characteristics as well as being sodic in the major part of the upper 0.2 m of the B2 horizon.

Chromosols

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 not sodic and not strongly acid.

Rudosols

Soils with negligible (rudimentary) pedologic organisation apart from (a) minimal development of an Al horizon or (b) the presence of less than 10% of B horizon material (including pedogenic carbonate) in fissures in the parent rock or saprolite. The soils are apedal or only weakly structured in the A1 horizon and show no pedological colour changes apart from the darkening of an A1 horizon. There is little or no texture or colour change with depth unless stratified or buried soils are present. Rudosols are mapped over 103 ha or 9% of the Project site.

Tenosols

The Tenosols will differ from Rudosols by virtue of having either a more than weakly developed A1 horizon, an A2, or a weakly developed B horizon. Tenosols do not fit the requirements of any other soil orders and generally have one or more of the following:

I. A peaty horizon.

II. 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.

III. A horizons which meet 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.

IV. 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.

V. 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.

VI. Either a tenic B horizon, or a 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).

VII. A ferric or bauxitic horizon >0.2 m thick.

VIII. A calcareous horizon >0.2 m thick.

Dermosols

Soils that have B2 horizons that have grade of pedality greater than weak throughout the major part of the horizon, and do not have clear or abrupt textural B horizon.

2.6 INHERENT SOIL FERTILITY

NSW regional mapping provides an estimation of the inherent fertility of soils in NSW. It uses the best available soils 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) (CSIRO, 2006).

The Project site is dominated by soils with moderately low fertility (2). These are present throughout the gently undulating to flat drainage plains associated with the mapped Kurosols. The remainder of the Project site consists of moderate high fertility (4), moderate fertility (3), and low fertility (1) (refer **Figure 8**.)

2.7 LAND AND SOIL CAPABILITY

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 4.1.

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.

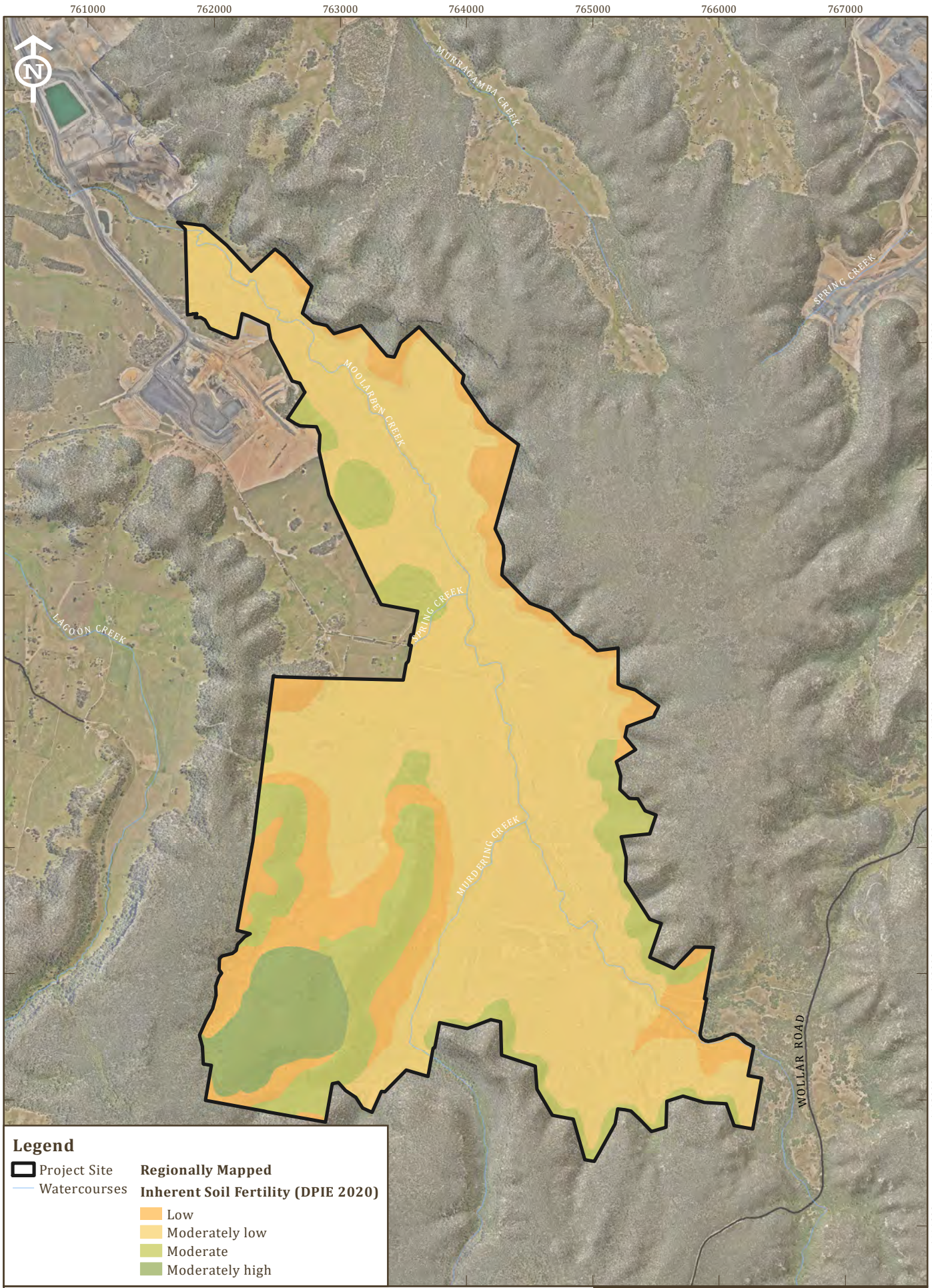
Table 1: Land and Soil Capability Classification

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.

Class	Land and Soil Capability
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.

The LSC classes that occur within Project site are shown on **Figure 9** and detailed below.

- Class 3 lands – restricted to an elevated plateau in the south-west of the Project site and covers 21.6 ha.
- Class 4 lands – mapped in a small portions of the Project site, sporadically in the mid to north western areas and covers 52.6 ha.
- Class 5 lands – the dominantly mapped LSC throughout the central, northern and southern areas of the project site and covers 992.1 ha.
- Class 6 lands – occur on the upper slopes leading up to an elevated plateau in the south-west of the Project site and covers 88.2 ha.
- Class 7 lands – primarily correlate to steeply inclined areas of the Project site and covers 388.5 ha.



GDA 1994 MGA Zone 55

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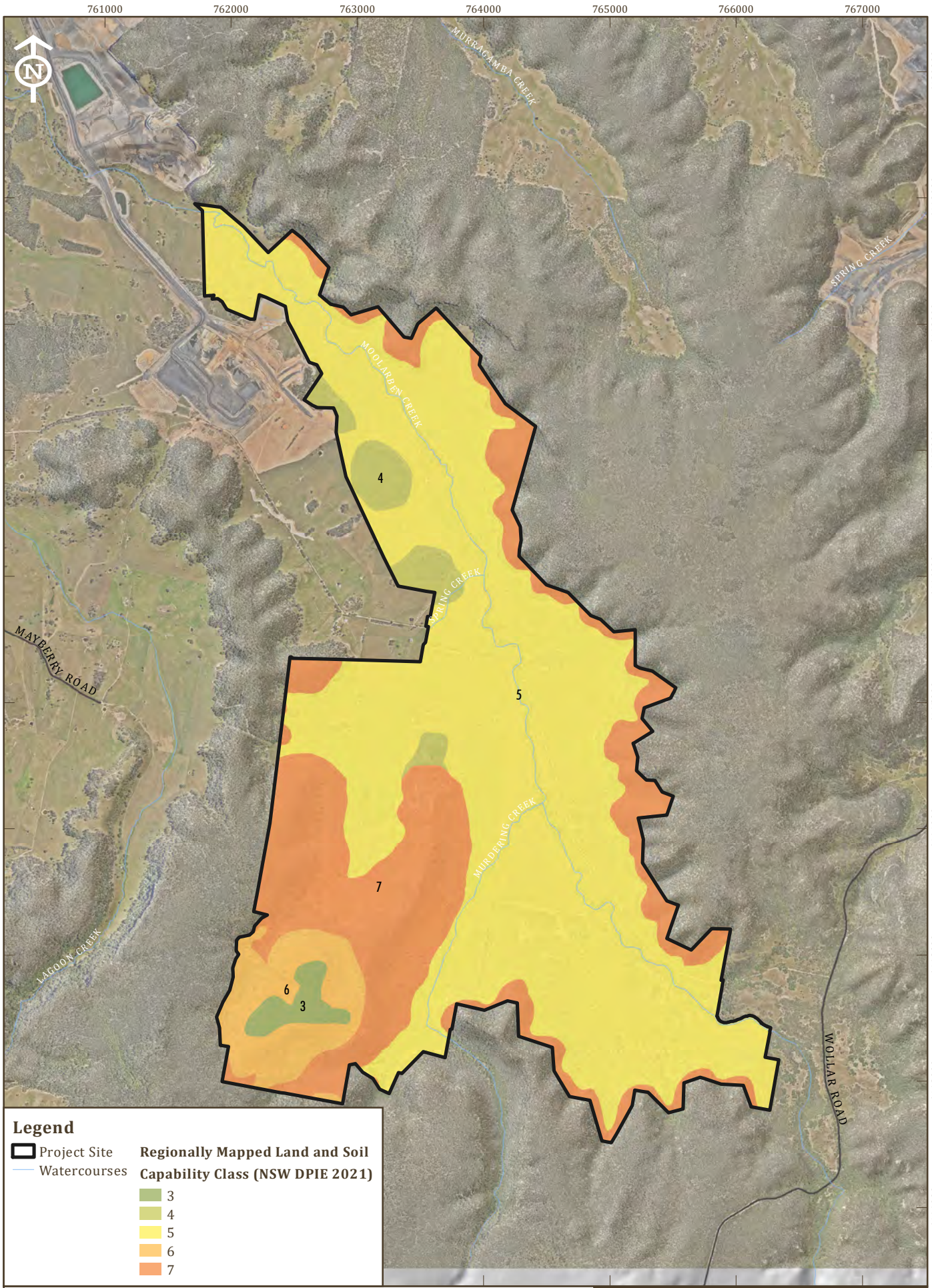
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Regionally Mapped Inherent Soil Fertility

FIGURE 8

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3 SOIL ASSESSMENT

3.1 SOIL SURVEY METHODOLOGY

Minesoils undertook a soil and land resource survey to inform the following tasks to be undertaken throughout the EIS process:

- Soil assessment and fieldwork program, including identifying soil units, soil qualities and risks including erosion, acid sulfate soils risk and salinity;
- LSC Assessment; and
- Management and mitigation measures for handling soil during construction, operations and decommissioning.

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

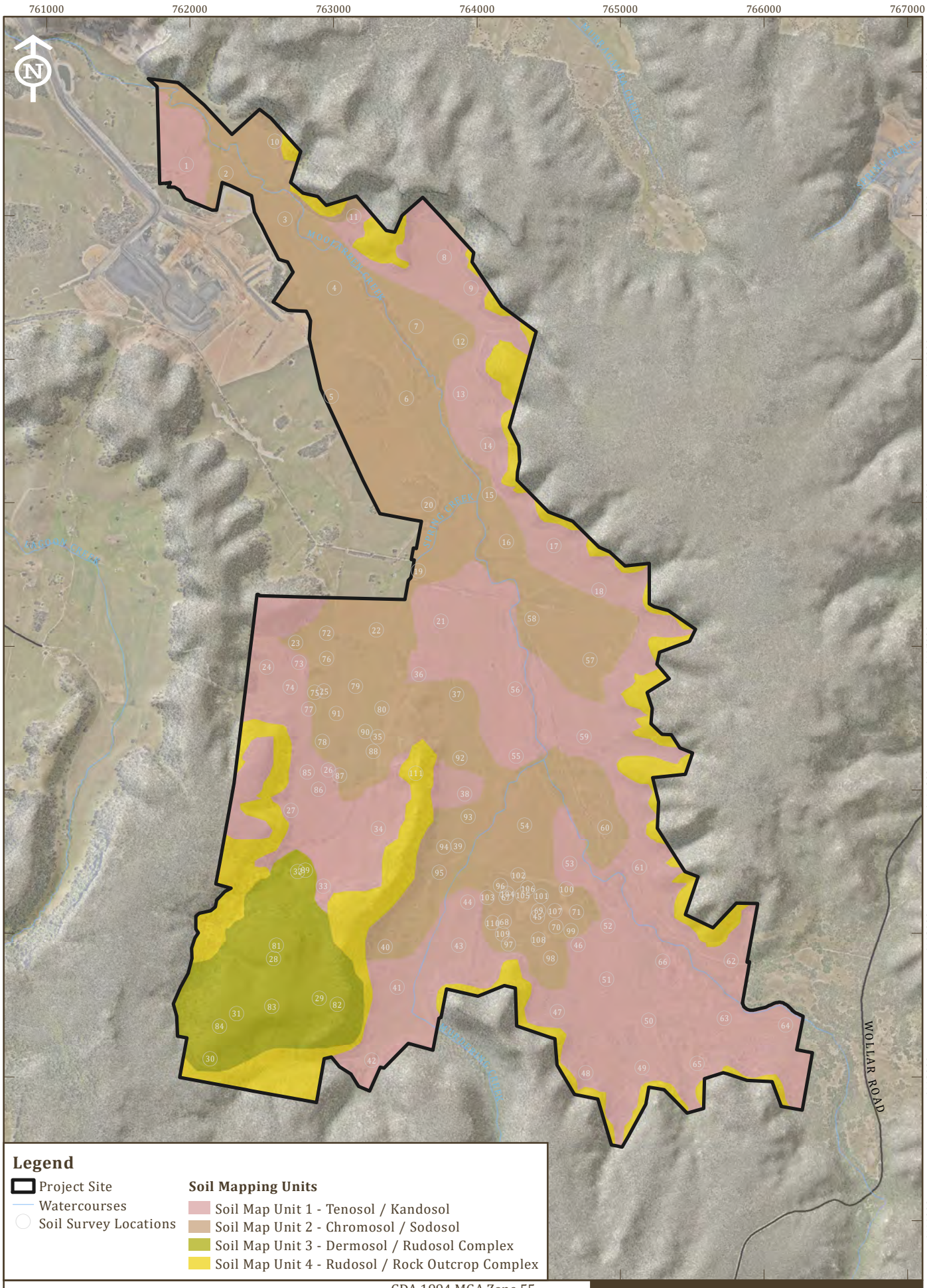
- Soil survey and mapping: This was undertaken at 1:25,000 survey intensity (1 site every 25 ha minimum), and requires collection of landform pattern and element information, soil profile data, and taxonomic parameters to distinguish Soil Units according to the ASC criteria, within the Project site.
- 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 acid sulphate soils (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 1m. Site clearances and dial before you dig (DBYD) plans were undertaken as part of the excavation planning requirements.

The survey area was the full 1,542.9 ha of the Project site. A total of 111 sites were assessed, resulting in a survey intensity of 1 site per 14 ha. Soil profiles within the Project site (refer to **Figure 10**) 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 GPS recordings and photographs of the landforms and soil profiles. Soils were keyed out in accordance with the ASC Revised Edition (2008), as per requirements of the Biophysical Strategic Agriculture Land site verification assessment undertaken for the site (refer *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* (OEH and Department of Primary Industries - Office of Agricultural Sustainability and Food Security (DPI-OAS&FS), 2013).

Soil samples were collected at each of the assessment site's soil horizons to a depth of 1m. A total of 319 samples collected from 80 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). Duplicate samples at every site were collected during the fieldwork and stored until the Project is finalised.





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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) & exchangeable sodium percentage (ESP) and Ca:Mg Ratio	Rayment & Lyons 2011-15J1
Particle Size Analysis (PSA) (Selected samples only)	ISSS Hydrometer plus 0.2 and 2.0 mm Sieving (NCST, 2009)

3.2 SOIL SURVEY RESULTS

The soil survey undertaken by Minesoils found the Project site to contain 4 dominant soil mapping units (refer to **Figure 10**):

- Soil Unit 1: Tenosol/Kandosols Complex – 671.0 ha;
- Soil Unit 2: Chromosol/Sodosol Complex – 563.3 ha;
- Soil Unit 3: Dermosol/Rudosol Complex – 124.5 ha; and
- Soil Unit 4: Rudosol/Rock Outcrop Complex – 184.1 ha.

A summary of the soil mapping units is provided below, with an overview of soil types provided in **Table 4**.

Soil Unit 1: Tenosol/Kandosol Complex

This soil unit is the most spatially extensive across the Project site, covering an area of 671.0 ha. Its distribution covers a range of midslopes throughout the Project site, with more widespread coverage over the gently undulating lower to midslopes and broad drainage lines higher in the landform to the mid-section to the south-east sections of the Project site. In addition to the Tenosol soil type (defined in Section 2.4) this soil is characterised by Kandosols, which have B2 horizons in which the major part has a grade of pedality that is massive or weak, a maximum clay content in some part of the B2 horizon which exceeds 15%, do not have a clear or abrupt textural B horizon, and

are not calcareous throughout the solum, or below the A1 or Ap horizon or to a depth of 0.2 m if the A1 horizon is only weakly developed.

Dominant soil types include a range of soils with negligible to weak pedological development throughout the profile, and includes Brown Tenosols, Grey Tenosols, Black Tenosols in association with Red Kandosols. Sub-dominant soil types include Black Kandosols, Yellow Tenosols, Red Tenosols, Yellow Sodosols, Yellow Chromosols, Red Chromosols, Grey Chromosols, Leptic Rudosols and Red Dermosols.

Soil Unit 2: Chromosol/Sodosol Complex

This soil unit covers an area of 563.3 ha and is distributed across gently undulating lower slopes to flats and broad drainage lines primarily in the mid to northern sections of the Project site. In addition to the Chromosol soil type (defined in Section 2.4) this soil is characterised by Sodosols, which 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.

Dominant soil types are duplex soils with a range in subsoil sodicity from sodic to non-sodic, and includes Grey Sodosols and Grey/ Yellow/ Red Chromosols. Sub-dominant soil types include Red Sodosols, Yellow Sodosols and Yellow Dermosols.

Soil Unit 3: Dermosol/Rudosol Complex

This soil unit is the most spatially limited and covers an area of 124.5 ha in the south-western section of the Project site and is distributed over a broad plateau in the south west and characterised by shallow soil depth. Dominant soil types are Red Dermosols, with a close Leptic Rudosol association where shallow soils become skeletal over rocky material.

Soil Unit 4: Rudosol/Rock Outcrop Complex

This soil unit covers an area of 184.1 ha on high slope, escarpment and plateau landforms dominated by rock outcrops with the presence of skeletal soils over rocky materials. It occurs primarily around the east, west and southern perimeter of the Project site, and along a ridgeline in the central south west portion of the Project site.

Table 4: Soil Map Units and Soil Types Summary

Site #	Soil Map Units		Soil Profile - ASC	ASC Family Criteria
	#	Name		
1	1	Tenosol/ Kandosol Complex	Basic Regolithic Brown-Orthic Tenosol	BEKKW
2	2	Chromosol/ Sodosol Complex	Brown Dermosol	-
3	2	Chromosol/ Sodosol Complex	Mottled-Sodic Eutrophic Red Chromosol	BEMOV
4	2	Chromosol/ Sodosol Complex	Mottled Eutrophic Grey Chromosol	BELOW
5	2	Chromosol/ Sodosol Complex	Mottled-Sodic Eutrophic Brown Chromosol	BELOW
6	2	Chromosol/ Sodosol Complex	Eutrophic Mottled-Mesonatric Yellow Sodosol	BGLOW
7	2	Chromosol/ Sodosol Complex	Eutrophic Mottled-Mesonatric Grey Sodosol	BELMW
8	1	Tenosol/ Kandosol Complex	Basic Arenic Yellow-Orthic Tenosol	BEKKW

Site #	Soil Map Units		Soil Profile - ASC	ASC Family Criteria
	#	Name		
9	1	Tenosol/ Kandosol Complex	Basic Arenic Black-Orthic Tenosol	BFKKW
10	2	Chromosol/ Sodosol Complex	Mottled-Sodic Mesotrophic Grey Chromosol	BELOW
11	1	Tenosol/ Kandosol Complex	Basic Regolithic Black-Orthic Tenosol	BEKLW
12	2	Chromosol/ Sodosol Complex	Mottled-Sodic Eutrophic Yellow Chromosol	BELOW
13	1	Tenosol/ Kandosol Complex	Leptic Tenosol	-
14	1	Tenosol/ Kandosol Complex	Basic Arenic Brown-Orthic Tenosol	AFKKW
15	2	Chromosol/ Sodosol Complex	Mottled-Sodic Mesotrophic Yellow Dermosol	BELMW
16	2	Chromosol/ Sodosol Complex	Mottled-Sodic Eutrophic Yellow Chromosol	BELOW
17	1	Tenosol/ Kandosol Complex	Basic Regolithic Brown-Orthic Tenosol	BEKLW
18	1	Tenosol/ Kandosol Complex	Basic Regolithic Grey-Orthic Tenosol	BELKU
19	2	Chromosol/ Sodosol Complex	Eutrophic Mottled-Subnatric Grey Sodosol	BEKOW
20	2	Chromosol/ Sodosol Complex	-	-
21	1	Tenosol/ Kandosol Complex	Brown-Orthic Tenosol	-
22	2	Chromosol/ Sodosol Complex	Mottled Mesotrophic Grey Chromosol	BEKMW
23	2	Chromosol/ Sodosol Complex	Eutrophic Mottled-Subnatric Grey Sodosol	BELOW
24	1	Tenosol/ Kandosol Complex	Basic Regolithic Brown-Orthic Tenosol	BEKKW
25	2	Chromosol/ Sodosol Complex	Mottled Eutrophic Red Kandosol	BELOW
26	1	Tenosol/ Kandosol Complex	Haplic Eutrophic Brown Kandosol	BFKMW
27	1	Tenosol/ Kandosol Complex	Haplic Eutrophic Black Kandosol	BELMV
28	3	Dermosol/Rudosol Complex	Shallow Brown Dermosol	-
29	3	Dermosol/Rudosol Complex	Haplic Eutrophic Red Dermosol	BHMOW
30	3	Dermosol/Rudosol Complex	-	-
31	3	Dermosol/Rudosol Complex	Haplic Epipedal Red Vertosol	HQRW

Site #	Soil Map Units		Soil Profile - ASC	ASC Family Criteria
	#	Name		
32	3	Dermosol/Rudosol Complex	Bleached Eutrophic Red Dermosol	BELMV
33	1	Tenosol/ Kandosol Complex	Basic Arenic Black-Orthic Tenosol	BFLLW
34	1	Tenosol/ Kandosol Complex	Haplic Eutrophic Red Kandosol	BELMW
35	2	Chromosol/ Sodosol Complex	Mottled Eutrophic Red Chromosol	BEKOV
36	1	Tenosol/ Kandosol Complex	Lithic Leptic Rudosol	-
37	2	Chromosol/ Sodosol Complex	Eutrophic Mottled-Subnatric Yellow Sodosol	BELOV
38	1	Tenosol/ Kandosol Complex	Mottled Eutrophic Red Kandosol	BELOW
39	2	Chromosol/ Sodosol Complex	Mottled Eutrophic Red Kandosol	BELMW
40	2	Chromosol / Sodosol Complex	Mottled Eutrophic Grey Chromosol	BEKOW
41	1	Tenosol/ Kandosol Complex	Bleached Eutrophic Red Kandosol	BELMW
42	1	Tenosol/ Kandosol Complex	Black Arenic Black-Orthic Tenosol	BELKW
43	1	Tenosol/ Kandosol Complex	Mottled Eutrophic Yellow Kandosol	BEKMW
44	1	Tenosol/ Kandosol Complex	Basic Arenic Brown-Orthic Tenosol	BEKLW
45	2	Chromosol/ Sodosol Complex	Haplic Eutrophic Red Dermosol	BEKMW
46	1	Tenosol/ Kandosol Complex	Basic Arenic Brown-Orthic Tenosol	BEKLW
47	1	Tenosol/ Kandosol Complex	Basic Arenic Red-Orthic Tenosol	BEKKW
48	1	Tenosol/ Kandosol Complex	Basic Arenic Red-Orthic Tenosol	BEKKW
49	1	Tenosol/ Kandosol Complex	Mottled Eutrophic Yellow Chromosol	BELOW
50	1	Tenosol/ Kandosol Complex	Basic Arenic Grey-Orthic Tenosol	BEKKW
51	1	Tenosol/ Kandosol Complex	Basic Arenic Yellow-Orthic Tenosol	CEKLW
52	1	Tenosol/ Kandosol Complex	Basic Arenic Brown-Orthic Tenosol	BEKKW
53	1	Tenosol/ Kandosol Complex	Basic Arenic Brown-Orthic Tenosol	BEKKW
54	2	Chromosol/ Sodosol Complex	Eutrophic Mottled-Subnatric Grey Sodosol	BEKMW

Site #	Soil Map Units		Soil Profile - ASC	ASC Family Criteria
	#	Name		
55	1	Tenosol/ Kandosol Complex	Basic Arenic Brown-Orthic Tenosol	BEKKW
56	1	Tenosol/ Kandosol Complex	Acidic Arenic Red-Orthic Tenosol	BEKLW
57	2	Chromosol/ Sodosol Complex	Mottled Eutrophic Grey Chromosol	BEKMW
58	2	Chromosol/ Sodosol Complex	Bleached-Mottled Eutrophic Grey Chromosol	BEKMW
59	1	Tenosol/ Kandosol Complex	Basic Arenic Grey-Orthic Tenosol	BEKKW
60	2	Chromosol/ Sodosol Complex	Eutrophic Mottled-Subnatric Grey Sodosol	BEKOW
61	1	Tenosol/ Kandosol Complex	Bleached Eutrophic Red Kandosol	BEKLW
62	1	Tenosol/ Kandosol Complex	Basic Arenic Brown-Orthic Tenosol	BFKKW
63	1	Tenosol/ Kandosol Complex	Bleached-Mottled Mesotrophic Red Chromosol	BEKOW
64	1	Tenosol/ Kandosol Complex	Shallow Brown Dermosol	-
65	1	Tenosol/ Kandosol Complex	Basic Arenic Brown-Orthic Tenosol	BELLW
66	1	Tenosol/ Kandosol Complex	Basic Arenic Grey-Orthic Tenosol	BEKKW
67	2	Chromosol/ Sodosol Complex	Mottled Eutrophic Red Dermosol	BFKMW
68	2	Chromosol/ Sodosol Complex	Mottled Eutrophic Brown Chromosol	BFLOW
69	2	Chromosol/ Sodosol Complex	Haplic Eutrophic Red Dermosol	BFLMW
70	2	Chromosol/ Sodosol Complex	Bleached-Mottled Eutrophic Red Chromosol	BGKOW
71	2	Chromosol/ Sodosol Complex	Bleached-Sodic Eutrophic Grey Dermosol	BFLMW
72	2	Chromosol/ Sodosol Complex	Mottled-Sodic Eutrophic Grey Chromosol	BFKOW
73	1	Tenosol/ Kandosol Complex	Lithic Leptic Tenosol	-
74	1	Tenosol/ Kandosol Complex	Mottled-Sodic Eutrophic Grey Dermosol	BFKMW
75	2	Chromosol/ Sodosol Complex	Eutrophic Mottled-Mesonatric Grey Sodosol	BGKOW
76	2	Chromosol/ Sodosol Complex	Bleached-Mottled Eutrophic Red Chromosol	BFKOW
77	2	Chromosol/ Sodosol Complex	Brown Chromosol	-

Site #	Soil Map Units		Soil Profile - ASC	ASC Family Criteria
	#	Name		
78	2	Chromosol/ Sodosol Complex	Bleached-Mottled Eutrophic Yellow Chromosol	BFKOW
79	2	Chromosol/ Sodosol Complex	Eutrophic Mottled-Subnatric Grey Sodosol	BFLMW
80	2	Chromosol/ Sodosol Complex	Bleached-Mottled Eutrophic Yellow Chromosol	BGLOW
81	3	Dermosol/Rudosol Complex	Brown Dermosol	-
82	3	Dermosol/Rudosol Complex	Haplic Eutrophic Red Dermosol	BFLOW
83	3	Dermosol/Rudosol Complex	Haplic Eutrophic Red Dermosol	BGMOV
84	3	Dermosol/Rudosol Complex	Haplic Eutrophic Red Dermosol	BFNOW
85	1	Tenosol/ Kandosol Complex	Mottled Eutrophic Yellow Kandosol	BELMW
86	1	Tenosol/ Kandosol Complex	Brown Kandosol	-
87	2	Chromosol/ Sodosol Complex	Red Duplex	-
88	2	Chromosol/ Sodosol Complex	Yellow Duplex	-
89	3	Dermosol/Rudosol Complex	Haplic Eutrophic Red Dermosol	BFLOW
90	2	Chromosol/ Sodosol Complex	Red Duplex	-
91	2	Chromosol/ Sodosol Complex	Yellow Duplex	-
92	2	Chromosol/ Sodosol Complex	Red Duplex	-
93	2	Chromosol/ Sodosol Complex	Yellow Duplex	-
94	2	Chromosol/ Sodosol Complex	Red Duplex	-
95	2	Chromosol/ Sodosol Complex	Red Duplex	-
96	2	Chromosol/ Sodosol Complex	Magnesic Mesonatric Grey Sodosol	BFMOW
97	2	Chromosol/ Sodosol Complex	Bleached-Mottled Eutrophic Red Chromosol	BEMOW
98	2	Chromosol/ Sodosol Complex	Bleached-Mottled Eutrophic Grey Chromosol	BFKOW
99	2	Chromosol/ Sodosol Complex	Bleached-Mottled Eutrophic Grey Chromosol	BGKOW
100	2	Chromosol/ Sodosol Complex	Eutrophic Mottled-Subnatric Yellow-Grey Sodosol	BFKMW

Site #	Soil Map Units		Soil Profile - ASC	ASC Family Criteria
	#	Name		
101	2	Chromosol/ Sodosol Complex	Yellow-Grey Duplex	-
102	2	Chromosol/ Sodosol Complex	Yellow-Grey Duplex	-
103	2	Chromosol/ Sodosol Complex	-	-
104	2	Chromosol/ Sodosol Complex	Eutrophic Mottled-Subnatric Brown Sodosol	BFLOWNR
105	2	Chromosol/ Sodosol Complex	Eutrophic Mottled-Mesonatric Brown Sodosol	BFMOWNR
106	2	Chromosol/ Sodosol Complex	Eutrophic Mottled-Hypernatric Yellow Sodosol	BEMOWNR
107	2	Chromosol/ Sodosol Complex	Eutrophic Mottled-Subnatric Yellow Sodosol	CELOWNR
108	2	Chromosol/ Sodosol Complex	Bleached-Mottled Eutrophic Brown Chromosol	BFKMWNR
109	2	Chromosol/ Sodosol Complex	Brown Chromosol	-
110	2	Chromosol/ Sodosol Complex	Bleached-Mottled Eutrophic Brown Chromosol	CFLMWNR
111	4	Rudosol/ Rock Outcrop Complex	Lithic Leptic Rudosol	-

3.3 ACID SULPHATE SOILS FINDINGS

ASS have been classified into 5 different classes based on the likelihood of the acid sulfate soils being present in particular areas and at certain depths (NSW Department of Planning and Environment, 2018):

- Class 1: ASS in a class 1 area are likely to be found on and below the natural ground surface.
- Class 2: ASS in a class 2 area are likely to be found below the natural ground surface.
- Class 3: ASS in a class 3 area are likely to be found beyond 1 metre below the natural ground surface.
- Class 4: ASS in a class 4 area are likely to be found beyond 2 metres below the natural ground surface.
- Class 5: ASS 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 Sulfate 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 IMPACT ASSESSMENT

4.1 LAND AND SOIL CAPABILITY ASSESSMENT

The LSC classification applied to the Project site was in accordance with the 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 (Section 2.6).

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 Project site 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

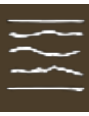
There are four factors used to assess wind erosion hazard for each soil type. Three criteria were assessed to be consistent for each soil type:

- Wind erosive power for the Project site has been mapped as 'Low' (NSW Department of Trade and Investment);
- Exposure of the land to wind was also determined to range from Low to High depending on the landform pattern and landform element in the proximity of the sites throughout the Project site; and
- The average rainfall for the region is 656.4 mm (BOM, 2022), and therefore the Project site 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 656.4 mm, with annual evaporation of 50-220 mm (BOM, 2022). This would suggest a high recharge potential and a low discharge potential.

The Project site according to the Salt Store Map of NSW (OEH, 2012), is located in area of low salt store. However, due the current available scale of this mapping, laboratory tested EC values were used to determine salt store. The entire Project site fell within non saline to moderately saline ECe 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 PRE-DISTURBANCE LSC

An overview of the pre-disturbance land capability for the Project site and direct impact area is presented in **Figure 11**, and summarised in **Table 6**. The findings of the LSC assessment on each soil profile assessed within the Project site are presented in **Table 7**.

Table 6: Pre-Disturbance LSC of the Project Site and Direct Impact Area

LSC	Project Site		Direct Impact Area	
	ha	%	ha	%
3	25.2	2	20.5	2
4	100.8	6	51.5	6
5	332.6	22	171.9	21
6	852.4	55	544.9	66
7	15.0	1	0.3	<1
8	216.9	14	36.5	4
Total	1,542.9	100	825.6	100

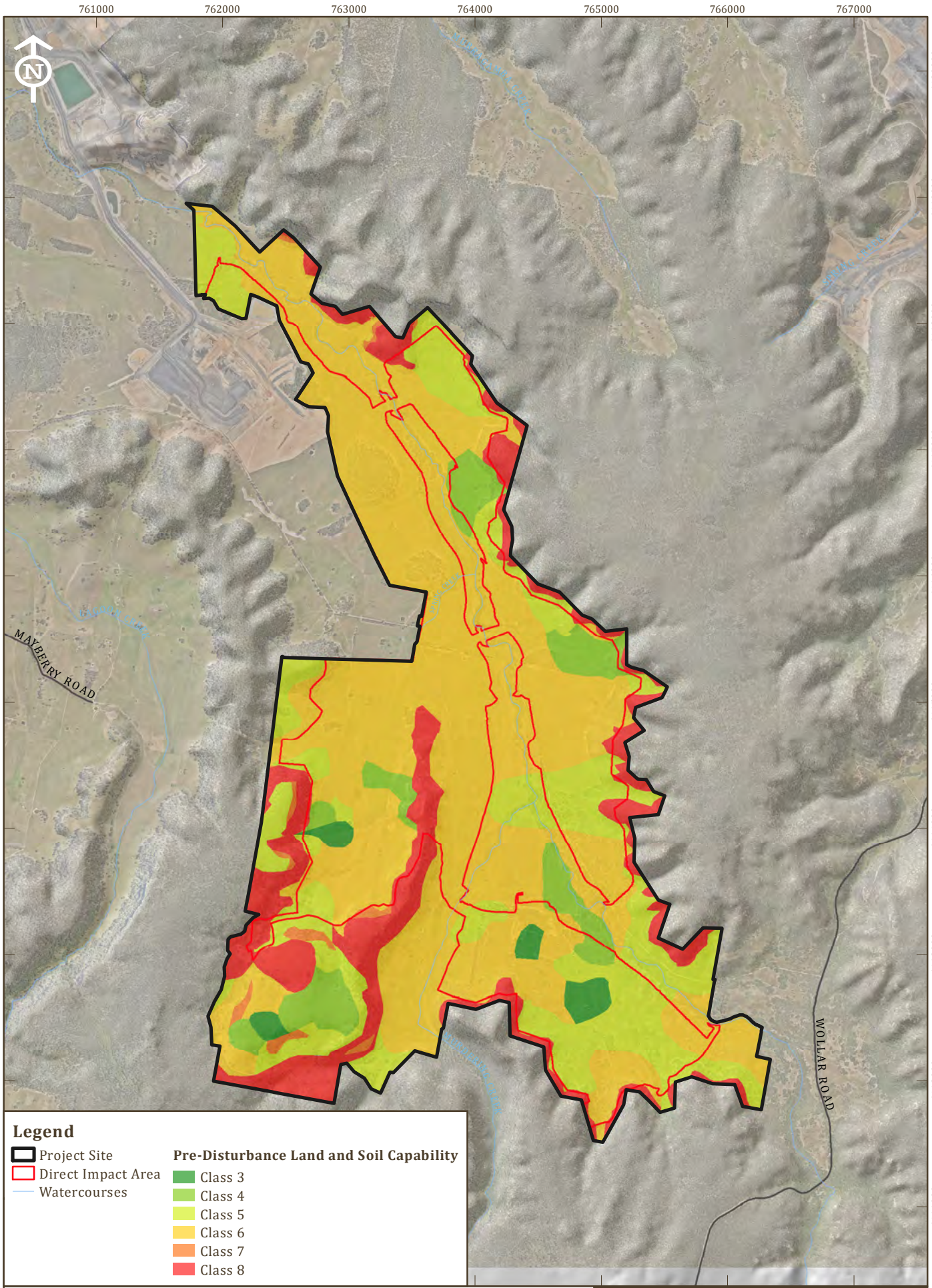
Table 7: Pre-Disturbance LSC

		Hazard Criteria								
		1	2	3	4	5	6	7	8	Overall
Site	Soil Type	Water erosion	Wind erosion	Structure	Acidity	Salinity	Water-logging	Soil depth	Movement	Class
1	Basic Regolithic Brown-Orthic Tenosol	2	4	1	5	1	1	1	1	**5**
2	Brown Dermosol	2	1	3	-	1	2	6	1	**6**
3	Mottled-Sodic Eutrophic Red Chromosol	2	1	3	4	1	6	4	1	**6**
4	Mottled Eutrophic Grey Chromosol	1	1	3	4	1	6	1	1	**6**
5	Mottled-Sodic Eutrophic Brown Chromosol	2	1	3	5	1	6	1	1	**6**
6	Eutrophic Mottled-Mesonatric Yellow Sodosol	2	4	1	5	1	6	1	1	**6**
7	Eutrophic Mottled-Mesonatric Grey Sodosol	1	4	1	5	1	6	1	1	**6**
8	Basic Arenic Yellow-Orthic Tenosol	3	4	1	5	1	1	1	1	**5**
9	Basic Arenic Black-Orthic Tenosol	4	1	3	5	1	1	1	1	**5**
10	Mottled-Sodic Mesotrophic Grey Chromosol	4	1	3	5	1	6	1	1	**6**
11	Basic Regolithic Black-Orthic Tenosol	3	4	1	5	1	1	1	1	**5**
12	Mottled-Sodic Eutrophic Yellow Chromosol	3	1	3	5	1	6	1	1	**6**
13	Leptic Tenosol	3	1	3	-	1	2	4	1	**4**
14	Basic Arenic Brown-Orthic Tenosol	4	4	1	5	1	1	1	1	**5**
15	Mottled-Sodic Mesotrophic Yellow Dermosol	3	1	3	4	1	6	1	1	**6**
16	Mottled-Sodic Eutrophic Yellow Chromosol	3	4	1	5	1	6	1	1	**6**
17	Basic Regolithic Brown-Orthic Tenosol	2	4	1	5	1	1	1	1	**5**
18	Basic Regolithic Grey-Orthic Tenosol	3	1	3	3	1	2	4	1	**4**
19	Eutrophic Mottled-Subnatric Grey Sodosol	1	4	1	5	1	6	1	1	**6**
20	-	2	-	-	-	1	-	6	1	**6**
21	Brown-Orthic Tenosol	2	1	3	-	1	4	6	1	**6**
22	Mottled Mesotrophic Grey Chromosol	2	4	1	5	1	6	1	1	**6**
23	Eutrophic Mottled-Subnatric Grey Sodosol	4	1	3	4	1	6	1	1	**6**
24	Basic Regolithic Brown-Orthic Tenosol	3	4	1	5	1	1	1	1	**5**
25	Mottled Eutrophic Red Kandosol	3	1	3	3	1	6	1	1	**6**
26	Haplic Eutrophic Brown Kandosol	3	4	1	5	1	2	1	1	**5**
27	Haplic Eutrophic Black Kandosol	4	1	3	5	1	2	4	1	**5**
28	Shallow Brown Dermosol	3	-	-	-	1	-	7	1	**7**
29	Haplic Eutrophic Red Dermosol	2	2	3	3	1	2	4	1	**4**
30	-	4	-	-	-	1	-	6	1	**6**
31	Haplic Epipedal Red Vertosol	2	2	3	3	1	2	1	1	**3**
32	Bleached Eutrophic Red Dermosol	3	1	3	5	1	6	1	1	**6**
33	Basic Arenic Black-Orthic Tenosol	4	1	3	5	1	1	1	1	**5**

		Hazard Criteria								
		1	2	3	4	5	6	7	8	Overall
Site	Soil Type	Water erosion	Wind erosion	Structure	Acidity	Salinity	Water-logging	Soil depth	Movement	Class
34	Haplic Eutrophic Red Kandosol	3	1	3	5	1	2	1	1	**5**
35	Mottled Eutrophic Red Chromosol	2	4	1	5	1	6	4	1	**6**
36	Lithic Leptic Rudosol	3	-	-	-	1	-	7	1	**7**
37	Eutrophic Mottled-Subnatric Yellow Sodosol	2	1	3	4	1	6	1	1	**6**
38	Mottled Eutrophic Red Kandosol	3	1	3	3	1	6	1	1	**6**
39	Mottled Eutrophic Red Kandosol	3	1	3	4	1	6	1	1	**6**
40	Mottled Eutrophic Grey Chromosol	4	4	1	5	1	6	1	1	**6**
41	Bleached Eutrophic Red Kandosol	3	1	3	4	1	6	1	1	**6**
42	Black Arenic Black-Orthic Tenosol	2	1	3	5	1	1	1	1	**5**
43	Mottled Eutrophic Yellow Kandosol	3	4	1	6	1	6	1	1	**6**
44	Basic Arenic Brown-Orthic Tenosol	2	4	1	5	1	1	1	1	**5**
45	Haplic Eutrophic Red Dermosol	2	1	3	3	1	2	1	1	**3**
46	Basic Arenic Brown-Orthic Tenosol	3	4	1	5	1	2	1	1	**5**
47	Basic Arenic Red-Orthic Tenosol	3	4	1	5	1	2	1	1	**5**
48	Basic Arenic Red-Orthic Tenosol	3	4	1	5	1	1	1	1	**5**
49	Mottled Eutrophic Yellow Chromosol	3	1	3	3	1	6	1	1	**6**
50	Basic Arenic Grey-Orthic Tenosol	3	4	1	5	1	1	1	1	**5**
51	Basic Arenic Yellow-Orthic Tenosol	1	1	3	3	1	1	1	1	**3**
52	Basic Arenic Brown-Orthic Tenosol	1	4	1	4	1	1	1	1	**4**
53	Basic Arenic Brown-Orthic Tenosol	1	4	1	4	1	1	1	1	**4**
54	Eutrophic Mottled-Subnatric Grey Sodosol	1	4	1	4	1	6	1	1	**6**
55	Basic Arenic Brown-Orthic Tenosol	1	4	1	5	1	1	1	1	**5**
56	Acidic Arenic Red-Orthic Tenosol	1	4	1	5	1	6	1	1	**6**
57	Mottled Eutrophic Grey Chromosol	3	4	1	5	1	6	1	1	**6**
58	Bleached-Mottled Eutrophic Grey Chromosol	3	4	1	5	1	6	1	1	**6**
59	Basic Arenic Grey-Orthic Tenosol	3	4	1	5	1	2	1	1	**5**
60	Eutrophic Mottled-Subnatric Grey Sodosol	3	4	1	5	1	6	1	1	**6**
61	Bleached Eutrophic Red Kandosol	3	1	3	3	1	6	1	1	**6**
62	Basic Arenic Brown-Orthic Tenosol	3	4	1	5	1	2	1	1	**5**
63	Bleached-Mottled Mesotrophic Red Chromosol	3	4	1	5	1	6	1	1	**6**
64	Shallow Brown Dermosol	3	-	-	-	1	-	6	1	**6**
65	Basic Arenic Brown-Orthic Tenosol	3	1	3	5	1	1	1	1	**5**

		Hazard Criteria								
		1	2	3	4	5	6	7	8	Overall
Site	Soil Type	Water erosion	Wind erosion	Structure	Acidity	Salinity	Water-logging	Soil depth	Movement	Class
66	Basic Arenic Grey-Orthic Tenosol	1	4	1	5	1	1	1	1	**5**
67	Mottled Eutrophic Red Dermosol	2	4	1	5	1	6	1	1	**6**
68	Mottled Eutrophic Brown Chromosol	2	4	1	5	1	6	1	1	**6**
69	Haplic Eutrophic Red Dermosol	3	1	3	3	1	2	1	1	**3**
70	Bleached-Mottled Eutrophic Red Chromosol	2	4	1	5	1	6	1	1	**6**
71	Bleached-Sodic Eutrophic Grey Dermosol	2	1	3	3	1	6	1	1	**6**
72	Mottled-Sodic Eutrophic Grey Chromosol	3	4	1	5	1	6	1	1	**6**
73	Lithic Leptic Tenosol	3	-	-	-	1	-	6	1	**6**
74	Mottled-Sodic Eutrophic Grey Dermosol	3	4	1	5	1	6	1	1	**6**
75	Eutrophic Mottled-Mesonatric Grey Sodosol	3	4	1	5	1	6	1	1	**6**
76	Bleached-Mottled Eutrophic Red Chromosol	3	1	3	3	1	6	1	1	**6**
77	Brown Chromosol	3	1	3	-	1	2	5	1	**5**
78	Bleached-Mottled Eutrophic Yellow Chromosol	3	1	3	3	1	6	1	1	**6**
79	Eutrophic Mottled-Subnatric Grey Sodosol	2	1	3	3	1	6	1	1	**6**
80	Bleached-Mottled Eutrophic Yellow Chromosol	3	1	3	4	1	6	1	1	**6**
81	Brown Dermosol	3	3	3	-	1	2	7	1	**7**
82	Haplic Eutrophic Red Dermosol	3	3	3	3	1	2	4	1	**4**
83	Haplic Eutrophic Red Dermosol	2	3	4	3	1	2	3	1	**4**
84	Haplic Eutrophic Red Dermosol	3	3	4	3	1	2	1	1	**4**
85	Mottled Eutrophic Yellow Kandosol	3	4	1	-	1	2	1	1	**4**
86	Brown Kandosol	3	1	3	-	1	1	1	1	**3**
87	Red Duplex	2	4	1	-	1	6	1	1	**6**
88	Yellow Duplex	3	4	1	-	1	6	1	1	**6**
89	Haplic Eutrophic Red Dermosol	3	2	3	-	1	4	1	1	**4**
90	Red Duplex	2	4	1	-	1	2	1	1	**4**
91	Yellow Duplex	2	4	1	-	1	6	1	1	**6**
92	Red Duplex	3	4	1	-	1	6	1	1	**6**
93	Yellow Duplex	3	2	3	-	1	6	1	1	**6**
94	Red Duplex	3	2	3	-	1	6	1	1	**6**
95	Red Duplex	3	2	3	-	1	6	3	1	**6**
96	Magnesic Mesonatric Grey Sodosol	2	4	1	5	1	6	1	1	**6**
97	Bleached-Mottled Eutrophic Red Chromosol	3	1	3	3	1	6	1	1	**6**

		Hazard Criteria								
		1	2	3	4	5	6	7	8	Overall
Site	Soil Type	Water erosion	Wind erosion	Structure	Acidity	Salinity	Water-logging	Soil depth	Movement	Class
98	Bleached-Mottled Eutrophic Grey Chromosol	3	4	1	5	1	6	1	1	**6**
99	Bleached-Mottled Eutrophic Grey Chromosol	3	4	1	5	1	6	1	1	**6**
100	Eutrophic Mottled-Subnatric Yellow-Grey Sodosol	2	4	1	5	1	6	1	1	**6**
101	Yellow-Grey Duplex	3	4	1	-	1	6	1	1	**6**
102	Yellow-Grey Duplex	2	4	1	-	1	6	1	1	**6**
103	-	2	4	1	5	1	6	1	1	**6**
104	Eutrophic Mottled-Subnatric Brown Sodosol	2	1	3	3	1	6	1	1	**6**
105	Eutrophic Mottled-Mesonatric Brown Sodosol	2	1	3	3	1	6	1	1	**6**
106	Eutrophic Mottled-Hypernatric Yellow Sodosol	1	1	3	3	1	6	1	1	**6**
107	Eutrophic Mottled-Subnatric Yellow Sodosol	1	1	3	4	1	6	1	1	**6**
108	Bleached-Mottled Eutrophic Brown Chromosol	0	4	1	5	1	6	1	1	**6**
109	Brown Chromosol	2	4	1	-	1	5	6	1	**6**
110	Bleached-Mottled Eutrophic Brown Chromosol	3	3	3	5	1	6	1	1	**6**
111	Lithic Leptic Rudosol	4	4	1	-	1	2	4	1	**4**



GDA 1994 MGA Zone 55

MINESOILS
LAND & REHABILITATION SPECIALISTS

0 250 500 1,000 Meters

Scale 1:40000 at A4

Pre-Disturbance Land and Soil Capability

FIGURE 11

E:\RST002_MineSoils\MS057_Moolarben\MS057_EIS011_PreLSC.mxd 2/11/2022 7:23:02 PM

4.4 POST-DISTURBANCE LSC

Due to the open cut nature of the Project, major landform modification and soil stripping impacts on pre-disturbance LSC classes in the direct impact area would be high during operations. The LSC class within these areas will be considered LSC class 8 which is not suitable for agriculture, due to mining operations and associated infrastructure during operations.

Following the end of mine life for the Project, the landform of the direct mining impact area will be rehabilitated to the following post mining land use domains:

- Agriculture Pasture/ Scattered Trees;
- Native Woodland; and
- Native Open Woodland.

Direct impact areas to be rehabilitated will be graded into a suitable landform and stockpiled topsoil and subsoil will be placed over the area. These areas will then be revegetated with target species appropriate for the final landuse domains. This strategy, along with good soil management practices as outlined in Section 5, will facilitate the rehabilitation areas achieving the target post mining land uses.

The post-disturbance LSC of the direct impact area is determined by assessing the post mining landform topography in the context of available soil resources and respread depths, which are all further detailed in Section 5. The indicative post-disturbance LSC of the Project site is shown on **Figure 12** and presented in **Table 8** below.

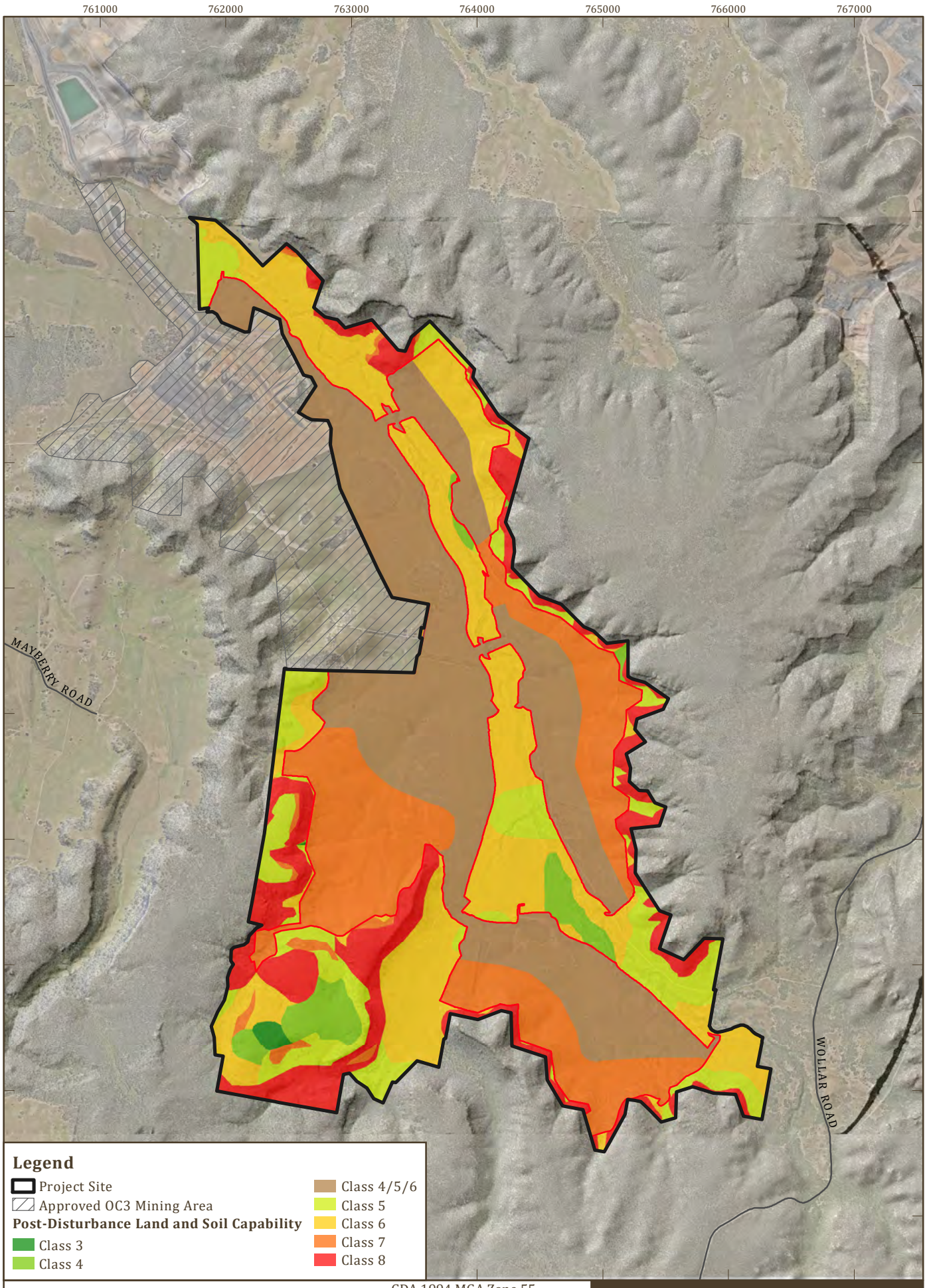
The Agriculture Pasture/ Scattered Trees post mining land use domain has been allocated a classification range of LSC 4 - 6 to suit the final land use objective, which allows for variances in soil respread depth and slope at the final landform establishment stage. The majority of this area is likely to return to LSC 6.

The Native Woodland domain does not require the same soil respread depths as the Agriculture Pasture/ Scattered Trees domain, and are limited by slopes to classes 6 and 7. Native Open Woodland will be limited to LSC class 7.

As the Project is proposing to integrate the final landform with the adjacent approved OC3 mining area, this area is also shown on **Figure 12** for the purpose of soil stripping and soil balance calculations, as detailed in Section 5.

Table 8: Post-Disturbance LSC of the Direct Impact Area

Post Mining Land Use Domain	LSC	Direct Impact Area	
		ha	%
Agriculture Pasture/ Scattered Trees	4/5/6	502.9	61
Native Woodland	6	34.3	4
Native Open Woodland	7	288.4	35
Total		825.6	100



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0 250 500 1,000 Meters

Scale 1:40000 at A4

Post-Disturbance Land and Soil Capability

FIGURE 12

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5 DISTURBANCE 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 for the area within the Project site.

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 9** below lists the key parameters and corresponding desirable selection criteria used as a guide for the selection of soil material for use as topdressing. Given the pre-mining soils present on site, consideration and weight is also given to existing soil material appropriate for establishing similar bushland in the area.

Table 9: Desirable Soil Stripping Characteristics

Parameter	Desirable criteria
Structure Grade	>30% peds
Coherence	Coherent (wet and dry)
Mottling	Absent
Macrostructure	>10cm
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, are considered unsuitable 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 will 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 3.2) to determine the available soil material suitable for recovery and re-use as a topdressing material in rehabilitation, following the life of the mine. 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 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 this soil unit, stripping for re-use in rehabilitation is recommended. This soil unit should be used non-discriminately as topdressing over more chemically unstable materials, such as subsoils associated with Soil Unit 2 if recovered. Stripping for this unit should be to a maximum depth of 1 m, or to bedrock where materials are visually similar to those in the upper profile. Some testing may be required to ensure deeper layers are suitable as topdressing.

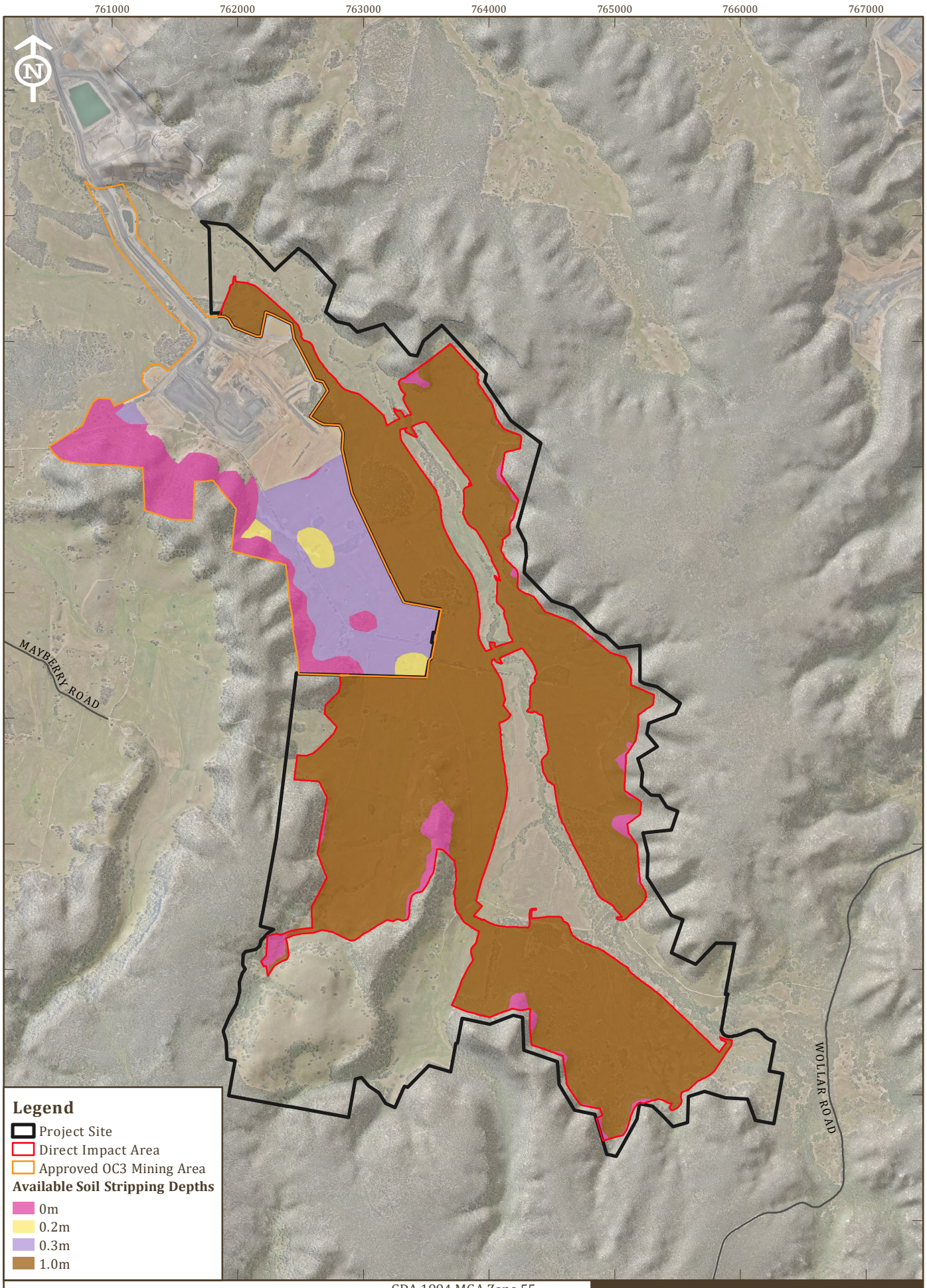
Soil Unit 2 generally contains desirable topsoil material, however the subsoils associated with this unit are inconsistent and problematic due to recurring sodic clays. These would typically be inappropriate for stripping and rehabilitation purposes due to their dispersive nature. However, due to the inconsistent presence of sodic clay subsoils within this soil unit, and this soil units presence within the direct impact area, 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 exclusively as a subsoil, and well encapsulated by the sandy and loamy topsoils and/or subsoils associated with Soil Type 1. Establishing an intermediate layer with soils with a greater clay fraction followed by topdressing with coarser textured materials will be beneficial to reset the soil profile in a way that mimics undisturbed soils and will constitute a control measure to limit the dispersion of sodic clays. Furthermore, this will increase the rehabilitated soil profiles water holding capacity.

A soil testing program and amelioration where required should be included in the rehabilitation management plan. Soil Unit 2 topsoils should be stripped to 0.2 m and subsoils should be stripped from 0.2 to 1.0m. Preferential stripping should be given to the sites around Chromosols (with ESP<6) as these soils require no Gypsum amelioration to offset the sodium levels.

Due to consistent coarse fragment presence and shallow profile depths, Soil Unit 3 represents a limited soil resource for stripping. The topsoil for this unit are consistently well structured and chemically stable. Soil stripping efforts should strategically target areas of this unit where lower levels of rock presence makes stripping effective. Higher rock areas, significant rock outcrop or boulder presence will inhibit stripping activities. For the purpose of the soil balance, an average stripping depth of 0.1 m is nominated for this area.

Generally, no stripping is recommended for Soil Unit 4. Opportunistic recovery of material may be undertaken in pockets of this unit where rock outcrop and slope gradient do not inhibit stripping activities.

The available stripping depths for each unit is displayed in **Figure 13**. The extent of each soil unit is displayed on **Figure 10**.



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0 250 500 1,000 Meters

Scale 1:40000 at A4

Available Soil Stripping Depths

FIGURE 13

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5.3 SOIL 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 rehabilitation purposes and qualifies the final land use domains.

Note the soil balance is largely conceptual. Assessments should be undertaken during stripping activities to determine if greater depths of desirable salvageable soil material (such as the topsoils of Soil Types 2 and 3) can be exploited as required. An accurate record of soil material volumes should be maintained for the site.

In addition, as the Project is proposing to integrate the final landform with the adjacent approved OC3 mining area (395.5 ha) (refer **Figure 13**), soil resources associated with the approved Project are taken into account below. In order to incorporate these resources into the soil balance MCO have provided the current volume of soil stockpiled in the approved OC3 mining area. For areas that are approved for disturbance but are yet to be stripped within the approved OC3 mining area (219.1 ha), Minesoils has used the soil stripping depths nominated in a previous soil assessment for this area (JAMMEL Environmental & Planning Services, 2006).

In order to determine the total required soil volume for rehabilitation activities, soil respread depths for the final land use domains is presented in **Table 10**. Depths are nominated based on best practice in order to achieve the land use objective of each domain and to meet requirements of the associated LSC classes as presented in section 4.4 and based on requirements of the LSC Guideline (OEH, 2012). This shows the total required soil volume as 3,998,750 m^3.

Table 10: Soil Respread Depths and Total Required Volume

Disturbance Area	Post Mining Land Use Domain	LSC	Recommended Respread Depth (m)	Area (ha)	Volume (m^3)
Direct Impact Area	Agriculture Pasture/ Scattered Trees	4/5/6	0.25 – 0.50 (0.4 average)	502.9	2,011,600
	Native Woodland	6	0.25	34.3	85,750
	Native Open Woodland	7	0.2	288.4	576,800
Approved OC3 Mining Area	Agriculture Pasture/ Scattered Trees	4/5/6	0.25 – 0.50 (0.4 average)	223.9	895,600
	Native Woodland	6	0.25	171.6	429,000
				Total	3,998,750

A soil balance based on available stripping depths is presented in **Table 11**. A total volume of approximately 8,724,003 m^3 of suitable soil is available within the direct impact area of the Project site, the areas of the approved OC3 mining area remaining to be stripped, and stockpiled soil.

If soils are stripped to the available stripping depths, this will result in a surplus of 4,725,253 m^3 required to fulfil the soil/ growth media requirements of the nominated post mining land uses, with an average re-spread depth over the direct impact area and the approved OC3 mining area (combined area of 1,221.1 ha) of 0.7 m.

Table 11: Available Soil Balance

Disturbance Area	Soil Resource Name	Direct Mining Impact Area (ha)	Available Stripping Depth (m)	Soil Volume (m^3)
Direct Impact Area	Soil Unit 1	406.9	1.0	4,069,000
	Soil Unit 2	381.7	1.0	3,817,000
	Soil Unit 3	8.9	0.1	8,900
	Soil Unit 4	25.5	0.0	0
Approved OC3 Mining Area	Stockpiled soil			589,903
	Soil Unit: Saline	11.3	0.0	0
	Soil Unit: Yellow Podzolic	78.2	0.3	234,600
	Soil Unit: Red Podzolic	40.5	0.0	0
	Soil Unit: Red Podzolic (Paleo Channel)	0.4	0.0	0
	Soil Type: Lithosol	86.3	0.0	0
	Colluvial	2.3	0.2	4,600
			Total Volume	8,724,003

5.4 STRIPPED SOIL MANAGEMENT

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

- Strip desirable soil material to recommended depths, subject to further investigation as required.
- Soil should ideally be stripped in a slightly moist condition.
- 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, where practicable.
- Soil may be placed directly onto rehabilitation areas or into stockpiles. Where feasible, soil is transferred directly from stripping to re-spreading operations, eliminating the need for stockpiles. However, mine scheduling dictates that soil stockpiles will be necessary on occasion for extended periods. Where stockpiling is required, the following mitigation measures should be adopted:
    - The surface of soil stockpiles should be no greater than 3 m in height or ripped in order to promote infiltration and minimise erosion until vegetation is established, and to prevent anaerobic zones forming.
    - Stockpiles should be preferentially located away from heavily trafficked or active mining areas and watercourses and placed on areas of flat topography or along the contour to minimise erosion.
    - Seed and fertilise stockpiles as soon as possible. An annual cover crop species that produce sterile florets or seeds may be sown. A rapid growing and healthy annual pasture sward will provide sufficient competition to minimise the emergence of undesirable weed species. Final rehabilitation target pasture or native grass species should be established on stockpiles to build up a desirable species seed bank in the topsoil.
    - Soils should be stockpiled separately according to source, nature and history, and characterisation, and records maintained.
    - A register of available soil should be maintained to ensure adequate materials are available for planned rehabilitation activities when the time comes.
    - Inspections of stockpiled soils should be undertaken to inform ongoing management of the resource.

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. Final soil management measures will be included in the Rehabilitation Management Plan for the site and may include alternate measures to manage soil deterioration.

- Following ground preparation and growth medium development works, revegetation activities should commence as soon as possible.
- Where feasible, soils should be placed to rehabilitation areas identified for use based on the soil quality and vegetation history, with consideration to the planned final land use of the rehabilitation area, and with consideration to the mine plan and operational factors.
- Where feasible, soils sourced from the respective mine pit areas should remain predominantly within these areas, either placed to rehabilitation or within stockpile. Therefore, soils consistent with the parent units from these areas are typically found within these areas.
- Where feasible, topsoil should be spread, treated with fertiliser (for pasture) and seeded in one consecutive operation, to reduce the potential for topsoil loss to wind and water erosion. Thorough seedbed preparation should be undertaken to ensure optimum establishment and growth of vegetation.
- All topsoiled areas should be lightly contour ripped (after topsoil spreading) to create a “key” between the soil and material below. Ripping should be undertaken on the contour.

6 SUMMARY

The Project was assessed by Minesoils to determine impacts on soil and land resources within the project site covering 1,542.9 ha. This included a desktop review of available soils and agricultural land use information; completion of a high intensity soil survey of the Project site; interpretation of field and laboratory data; and the provision of methods and findings of a Soil type classification and characterisation assessments 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 Project site:

- Soil Unit 1: Tenosol/Kandosols Complex – 671.0 ha;
- Soil Unit 2: Chromosol/Sodosol Complex – 563.3 ha;
- Soil Unit 3: Dermosol/Rudosol Complex – 124.5 ha; and
- Soil Unit 4: Rudosol/Rock Outcrop Complex – 184.1 ha.

The LSC assessment determined the Project site currently contains the following LSC classes:

- LSC class 3: High capability land – 25.2 ha
- LSC class 4: Moderate capability land – 100.8 ha
- LSC class 5: Moderately low capability land – 332.6 ha
- LSC class 6: Low capability land – 852.4 ha
- LSC class 7: Very low capability land – 15.0 ha; and
- LSC class 8: Extremely low capability land – 216.9 ha

The proposed mining activities of the Project will impact on previously undisturbed land covering an area of 825.6 ha. The proposed post mining LSC for this area is based on the application of available soil materials on a rehabilitated landform to accommodate intended final land uses of agriculture pasture/ scattered trees, native woodland and native open woodland. Final land use and associated LSC is as follows:

- Agriculture pasture/ scattered trees: LSC class range 4/5/6
- Native woodland: LSC classes 6 and 7
- Native open woodland: LSC class 7

Therefore, the post mining landform will facilitate the following LSC class areas for the direct impact area.

- LSC class range 4/5/6: Moderate to low capability land – 502.9 ha
- LSC class 6: Low capability land – 34.3 ha; and
- LSC class 7: Very low capability land – 288.4 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 topsoil material to stripping depths detailed in this report, combined with sound soil management practices during construction and operational phases of the Project, will ensure that the rehabilitation of the direct impact area is capable of facilitating the aforementioned post mining land uses.

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Appendix 1
Soil Profile Descriptions

Site Description – Site 1 (lab #K7399/1 – 4)				
Site Reference	1	**ASC Name**	Basic Regolithic Brown-Orthic Tenosol (BEKKW)	
Average Slope	1%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Lower Slope	**Permeability**	Highly permeable	X: 761974
Surface Condition	Soft	**Drainage**	Well drained	Y: 6418352



Plate 1 – Soil Profile (1)



Plate 2 – Surface (1)



Plate 3 – Landscape (1)

Horizon	Depth (m)	Description
A1	0.00 – 0.15	Dark Brown (Munsell 10YR 3/2) Loamy Sand with weak pedality. Slightly acidic pH, non-saline and non-sodic. Nil coarse fragments. Many fine roots and well drained. Clear boundary.
B2	0.15 – 0.75	Brown to Light Brown (Munsell 7.5YR 5/3 to 7.5YR 6/4) apedal Loamy Sand. Slightly to moderately acidic pH, non-saline and non-sodic grading to sodic at depth. 20% coarse fragments 20 mm after 0.6m. No roots and well drained.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	1.1	Non-saline	6.0	Slightly Acidic	0.5	Non sodic
0.20-0.30	0.3	Non-saline	6.4	Slightly Acidic	1.4	Non sodic
0.40-0.50	0.4	Non-saline	5.7	Moderately Acidic	4.1	Non sodic
0.65-0.75	0.2	Non-saline	6.1	Slightly Acidic	2.0	Non sodic

Site Description – Site 2 (no lab #)				
Site Reference	2	**ASC Name**	Brown Dermosol	
Average Slope	2%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderate	MGA 55
Landform Element	Lower Slope	**Permeability**	Moderately permeable	X: 762250
Surface Condition	Soft	**Drainage**	Imperfectly drained	Y: 6418295



Plate 1 – Soil Profile (2)



Plate 2 – Surface (2)



Plate 3 – Landscape (2)

Horizon	Depth (m)	Description
A	0.00 – 0.10	Brown Loam (field assessment) with moderate pedality. 40% coarse fragments 20 – 100mm. Many fine roots and moderately drained. Gradual boundary.
B/C	0.10 – 0.45	Brown Loam (field assessment) with moderate pedality. 60% coarse fragments 100mm. Many fine roots and moderately drained. Clear boundary.
C	0.45+	Physical barrier: Rock

Due to soil depth limitations of this soil unit, no samples were collected for laboratory analysis.

Site Description – Site 3 (lab #K7399/5 – 8)				
Site Reference	3	**ASC Name**	Mottled-Sodic Eutrophic Red Chromosol (BEMOV)	
Average Slope	1%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Lower Slope	**Permeability**	Highly permeable	X: 762661
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6417974



Plate 1 – Soil Profile (3)



Plate 2 – Surface (3)



Plate 3 – Landscape (3)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Very Dark Greyish-Brown (Munsell 10YR 3/2) Loam with moderate pedality. Strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many fine roots and moderately drained. Clear boundary.
A2	0.20 – 0.30	Reddish- Brown (Munsell 5YR 4/4) Loam with moderate pedality. Slightly acidic pH, non-saline. Non-sodic. 20% coarse fragments <10mm. Nil roots and moderately drained. Clear boundary.
B2	0.30 – 0.50	Reddish- Brown (Munsell 2.5YR 4/4) Heavy Clay with moderate pedality. Neutral pH, non-saline and non-sodic. Nil coarse fragments. Nil roots. Poorly drained. Clear boundary. 20 – 50% distinct grey weathered mottles.
C	0.50+	Weather parent material/rock. (Olive (Munsell 5Y 5/6) Light Medium Clay. Neutral pH, non-saline and sodic. Poor drainage.)

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.5	Non-saline	5.4	Strongly Acidic	1.6	Non sodic
0.20-0.30	0.2	Non-saline	6.3	Slightly Acidic	1.4	Non sodic
0.40-0.50	0.2	Non-saline	6.8	Neutral	1.9	Non sodic
0.65-0.75	0.7	Non-saline	7.2	Neutral	8.5	Sodic

Site Description – Site 4 (lab #K7399/9 – 12)				
Site Reference	4	**ASC Name**	Mottled Eutrophic Grey Chromosol (BELOW)	
Average Slope	0%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Plain/ lower slope	**Permeability**	Moderately permeable	X: 763005
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6417497



Plate 1 – Soil Profile (4)



Plate 2 – Surface (4)



Plate 3 – Landscape (4)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Dark Olive Grey (Munsell 5Y 3/2) Loam with weak pedality. Strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many fine roots and moderately drained. Clear boundary.
A2	0.20 – 0.40	Light Yellowish-Brown (Munsell 10YR 6/4) apedal Silty Loam. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Few fine roots and poorly drained. Clear boundary.
B2	0.40 – 0.90	Olive Grey (Munsell 5Y 5/2 to 4/2) Light Medium Clay with strong pedality. Neutral to mildly alkaline pH, non-saline. Non-sodic. <2% coarse fragments ~20mm. No roots. Poorly drained. 20 – 50% distinct grey weathered mottles.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.3	Non-saline	5.5	Strongly Acidic	1.4	Non sodic
0.20-0.30	0.1	Non-saline	5.9	Moderately Acidic	3.0	Non sodic
0.40-0.50	0.4	Non-saline	6.7	Neutral	3.7	Non sodic
0.65-0.75	0.4	Non-saline	7.4	Mildly Alkaline	4.8	Non sodic

Site Description – Site 5 (lab #K7399/13 – 16)				
Site Reference	5	**ASC Name**	Mottled-Sodic Eutrophic Brown Chromosol (BELOW)	
Average Slope	2%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Lower Slope	**Permeability**	Moderately permeable	X: 762983
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6416740



Plate 1 – Soil Profile (5)



Plate 2 – Surface (5)



Plate 3 – Landscape (5)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Very Dark Brown (Munsell 7.5YR 2.5/2) Sandy Loam with moderate pedality. Moderately acidic pH, non-saline. Non-sodic. Minor gravel present. Many fine roots and moderately drained. Clear boundary.
A2	0.10 – 0.30	Brown (Munsell 7.5YR 4/3) Sandy Loam with weak pedality. Moderately acidic pH, non-saline. Non-sodic. <5% coarse fragments. Few roots and poorly drained. Clear boundary.
B21	0.30 – 0.50	Light Olive Brown (Munsell 2.5Y 5/4) Sandy Clay Loam, with moderate pedality. Moderately acidic pH, non-saline and non-sodic. <5% coarse fragments. Nil roots. Poorly drained. Gradual boundary. 20 – 50% distinct grey weathered mottles.
B22	0.50+	Reddish-Yellow (Munsell 5YR 6/6) Sandy Clay, with moderate pedality. Strongly acidic pH, non-saline and sodic. <5% coarse fragments. Nil roots. Poorly drained. 20 – 50% distinct grey weathered mottles.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	3.3	Slightly saline	5.6	Moderately Acidic	1.8	Non sodic
0.20-0.30	0.6	Non-saline	5.7	Moderately Acidic	2.6	Non sodic
0.40-0.50	0.5	Non-saline	5.7	Moderately Acidic	5.5	Non sodic
0.65-0.75	0.6	Non-saline	5.3	Strongly Acidic	6.9	Sodic

Site Description – Site 6 (lab #K7399/17 – 20)				
Site Reference	6	**ASC Name**	Eutrophic Mottled-Mesonatric Yellow Sodosol (BGLOW)	
Average Slope	1%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Lower slope	**Permeability**	Moderately permeable	X: 763508
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6416728



Plate 1 – Soil Profile (6)



Plate 2 – Surface (6)



Plate 3 – Landscape (6)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Very Dark Brown (Munsell 10YR 2/2) Loamy Sand with weak pedality. Strongly acidic pH, non-saline. Non-sodic. 10% coarse fragments <20mm. Many fine roots and moderately drained. Clear boundary.
A2	0.10 – 0.50	Dark Greyish-Brown to Brown (Munsell 10YR 4/2 to 7.5YR 5/3) apedal Loamy Sand. Moderate trending to slightly acidic pH, non-saline. Non-sodic trending to sodic. 80% coarse fragments <20mm. Few fine roots and moderately drained. Clear boundary.
B	0.50 – 0.90	Brownish-Yellow (Munsell 10YR 6/8) Sandy Clay with weak pedality. Moderately acidic pH, non-saline. Sodic. 50% coarse fragments <20mm. No roots. Poorly drained. 10 – 20% distinct grey weathered mottles.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.8	Non-saline	5.2	Strongly Acidic	3.7	Non sodic
0.20-0.30	0.6	Non-saline	6.0	Moderately Acidic	4.0	Non sodic
0.40-0.50	0.5	Non-saline	6.4	Slightly Acidic	6.7	Sodic
0.65-0.75	0.9	Non-saline	6.0	Moderately Acidic	20.3	Sodic

Site Description – Site 7 (lab #K7399/21 – 24)				
Site Reference	7	**ASC Name**	Eutrophic Mottled-Mesonatric Grey Sodosol (BELMW)	
Average Slope	0%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Drainage flat	**Permeability**	Moderately permeable	X: 763577
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6417229



Plate 1 – Soil Profile (7)



Plate 2 – Surface (7)



Plate 3 – Landscape (7)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Very Dark Brown (Munsell 10YR 2/2) Loamy Sand with weak pedality. Very strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many fine roots and moderately drained. Gradual boundary.
A2	0.20 – 0.50	Brown to Pale Olive (Munsell 7.5YR 5/3 to 5Y 6/4) apedal Loamy Sand. Moderately acidic trending to slightly acidic pH, non-saline. Non-sodic trending to sodic. 40% coarse fragments <20mm. Nil roots and poorly drained. Clear boundary.
B2	0.50+	Grey (Munsell 10YR 6/1) Clay Loam with moderate pedality. Slightly acidic pH, non-saline and sodic. No coarse fragments. No roots and poorly drained. 20 – 50% distinct grey weathered mottles.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	1.9	Non-saline	4.8	Very Strongly Acidic	2.6	Non sodic
0.20-0.30	0.3	Non-saline	5.6	Moderately Acidic	5.9	Non sodic
0.40-0.50	0.4	Non-saline	6.3	Slightly Acidic	16.1	Sodic
0.65-0.75	1.3	Non-saline	6.4	Slightly Acidic	21.7	Sodic

Site Description – Site 8 (lab #K7399/25 – 28)				
Site Reference	8	**ASC Name**	Basic Arenic Yellow-Orthic Tenosol (BEKKW)	
Average Slope	3%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Mid slope	**Permeability**	Highly permeable	X: 763773
Surface Condition	Soft	**Drainage**	Well drained	Y: 6417710



Plate 1 – Soil Profile (8)



Plate 2 – Surface (8)



Plate 3 – Landscape (8)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Very Dark Brown (Munsell 7.5YR 2.5/2) apedal Sand. Very strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many fine roots and well drained. Clear boundary.
B21	0.10 – 0.50	Light Brown to Light Yellowish Brown (Munsell 7.5YR 6/4 to 2.5Y 6/4) apedal Loamy Sand. Strongly acidic trending to moderately acidic pH, non-saline. Non-sodic. <5%coarse fragments <10mm. Very few fine roots and well drained. Gradual boundary.
B22	0.50 – 0.80	Very Pale Brown (Munsell 10YR 7/3) apedal Sandy Loam. Moderately acidic pH, non-saline. Non-sodic. <5%coarse fragments <10mm. Very few fine roots and well drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	1.1	Non-saline	4.9	Very Strongly Acidic	1.3	Non sodic
0.20-0.30	0.2	Non-saline	5.5	Strongly Acidic	2.3	Non sodic
0.40-0.50	0.2	Non-saline	5.7	Moderately Acidic	2.7	Non sodic
0.65-0.75	1.3	Non-saline	5.5	Moderately Acidic	0.6	Non sodic

Site Description – Site 9 (lab #K7399/29 – 32)				
Site Reference	9	**ASC Name**	Basic Arenic Black-Orthic Tenosol (BFKKW)	
Average Slope	9%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Mid Slope	**Permeability**	Highly permeable	X: 763958
Surface Condition	Soft	**Drainage**	Rapidly drained	Y: 6417493



Plate 1 – Soil Profile (9)



Plate 2 – Surface (9)



Plate 3 – Landscape (9)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Black (Munsell 10YR 2/1) Sandy Loam with very weak to no pedality. Moderately acidic pH, non-saline. Non-sodic. <10% coarse fragments. Many fine roots and rapidly drained. Gradual boundary.
B2	0.20 – 1.00	Very Dark Brown to Reddish-Brown (Munsell 7.5YR 2.5/2 to 2.5YR 4/3) Loamy Sand, apedal structure. Moderately acidic pH, non-saline. Non-sodic. <10% coarse fragments. Many fine roots and rapidly drained.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.3	Non-saline	5.8	Moderately Acidic	1.5	Non sodic
0.20-0.30	0.4	Non-saline	5.8	Moderately Acidic	4.1	Non sodic
0.40-0.50	0.4	Non-saline	5.5	Moderately Acidic	1.9	Non sodic
0.65-0.75	0.2	Non-saline	5.7	Moderately Acidic	1.4	Non sodic

Site Description – Site 10 (lab #K7399/33 – 36)				
Site Reference	10	**ASC Name**	Mottled-Sodic Mesotrophic Grey Chromosol (BELOW)	
Average Slope	9%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Mid slope	**Permeability**	Moderately permeable	X: 762591
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6418518



Plate 1 – Soil Profile (10)



Plate 2 – Surface (10)



Plate 3 – Landscape (10)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Very Dark Brown (Munsell 7.5YR 2.5/3) Sandy Loam with moderate pedality. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many fine roots and moderately drained. Clear boundary.
A2	0.20 – 0.40	Dark Greyish-Brown (Munsell 10YR 4/2) Sandy Loam with weak pedality. Slightly acidic pH, non-saline. Non-sodic. No coarse fragments. Few fine roots and poorly drained. Clear boundary.
B2	0.40 +	Grey to Olive Grey (Munsell 5Y 5/1 to 5Y 5/2) Light Clay with strong pedality. Slightly acidic pH, non-saline. Non-sodic trending to sodic at depth. No coarse fragments. No roots. Poorly drained. 20 – 50% distinct grey weathered mottles.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	2.0	Non-saline	5.5	Moderately Acidic	2.3	Non sodic
0.20-0.30	0.5	Non-saline	6.1	Slightly Acidic	2.2	Non sodic
0.40-0.50	0.3	Non-saline	6.2	Slightly Acidic	5.2	Non sodic
0.65-0.75	0.7	Non-saline	6.0	Slightly Acidic	7.9	Sodic

Site Description – Site 11 (lab #K7399/37 – 40)				
Site Reference	11	**ASC Name**	Basic Regolithic Black-Orthic Tenosol (BEKLW)	
Average Slope	6%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Mid Slope Saddle	**Permeability**	Highly permeable	X: 763143
Surface Condition	Soft	**Drainage**	Well drained	Y: 6417996



Plate 1 – Soil Profile (11)



Plate 2 – Surface (11)



Plate 3 – Landscape (11)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Black (Munsell 7.5YR 2.5/1) apedal Sand. Strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many fine roots and well drained. Gradual boundary.
B21	0.20 – 0.40	Black (Munsell 5YR 2.5/1) apedal Sand. Moderately acidic pH, non-saline. Non-sodic. Minor gravel presence. Few fine roots and well drained. Gradual boundary.
B22	0.40 – 0.80	Black (Munsell 5YR 2.5/1 to 7.5Y2.5/1) apedal Sandy Loam. Moderately acidic trending to slightly acidic pH, non-saline. Non-sodic. Minor gravel presence. Few fine roots and well drained.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.9	Non-saline	5.3	Strongly Acidic	1.4	Non sodic
0.20-0.30	0.4	Non-saline	5.7	Moderately Acidic	2.0	Non sodic
0.40-0.50	0.2	Non-saline	5.9	Moderately Acidic	1.6	Non sodic
0.65-0.75	0.2	Non-saline	6.2	Slightly Acidic	2.4	Non sodic

Site Description – Site 12 (lab #K7399/41 – 44)				
Site Reference	12	**ASC Name**	Mottled-Sodic Eutrophic Yellow Chromosol (BELOW)	
Average Slope	3%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Mid Slope	**Permeability**	Moderately permeable	X: 763886
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6417124



Plate 1 – Soil Profile (12)



Plate 2 – Surface (12)



Plate 3 – Landscape (12)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Very Dark Brown (Munsell 7.5YR 2.5/3) Sandy Loam with weak pedality. Very strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many fine roots and moderately drained. Clear boundary.
A2	0.10 – 0.35	Reddish-Yellow (Munsell 7.5YR 6/6) apedal Loam. Moderately acidic pH, non-saline. Non-sodic. 20% coarse fragments 10 – 20mm. Very few fine roots and poorly drained. Clear boundary.
B21	0.35 – 0.50	Brownish-Yellow (Munsell 10YR 6/8) Heavy Clay with moderate pedality. Neutral pH, non-saline. Non-sodic. No coarse fragments. No roots. Poorly drained. Gradual boundary. 20 – 50% distinct grey weathered mottles.
B22	0.50+	Light Grey (Munsell 2.5Y 7/1) Clay Loam with moderate pedality. Neutral pH, non-saline. Sodic. No coarse fragments. No roots. Poorly drained. 20 – 50% distinct grey weathered mottles.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	1.0	Non-saline	4.9	Very Strongly Acidic	1.6	Non sodic
0.20-0.30	0.1	Non-saline	5.6	Moderately Acidic	3.4	Non sodic
0.40-0.50	0.3	Non-saline	6.6	Neutral	4.3	Non sodic
0.65-0.75	0.8	Non-saline	6.9	Neutral	7.9	Sodic

Site Description – Site 13 (no lab #)				
Site Reference	13	**ASC Name**	Leptic Tenosol	
Average Slope	3%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Mid Slope	**Permeability**	Highly permeable	X: 763885
Surface Condition	Soft	**Drainage**	Well drained	Y: 6416758



Plate 1 – Soil Profile (13)



Plate 2 – Surface (13)



Plate 3 – Landscape (13)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Brown Loam (field assessment) with weak pedality. No coarse fragments. Many fine roots and moderately drained. Clear boundary.
B2	0.10 – 0.40	Pale Brown apedal Sand (field assessment). 10% coarse fragments. No fine roots and well drained. Gradual boundary.
BC	0.40 – 0.60	Weathered parent material/rock. (Pale Brown apedal Sand (field assessment). 60% coarse fragments. No roots. Gradual boundary.)
C	0.60+	100% coarse fragment content/ parent material.

Due to soil depth limitations of this soil unit, no samples were collected for laboratory analysis.

Site Description – Site 14 (lab #K7399/45 – 48)				
Site Reference	14	**ASC Name**	Basic Arenic Brown-Orthic Tenosol (AFKKW)	
Average Slope	12%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Mid Slope	**Permeability**	Highly permeable	X: 764076
Surface Condition	Soft	**Drainage**	Well drained	Y: 6416400



Plate 1 – Soil Profile (14)



Plate 2 – Surface (14)



Plate 3 – Landscape (14)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Very Dark Brown (Munsell 7.5YR 2.5/2) apedal Loamy Sand, apedal structure. Strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many fine roots and well drained. Gradual boundary.
B21	0.20 – 0.40	Dark Brown (Munsell 7.5YR 3/3) apedal Loamy Sand, apedal structure. Moderately acidic pH, non-saline. Non-sodic. 20% coarse fragments 10 – 20mm. Very few fine roots and well drained. Gradual boundary.
B22	0.40+	Yellowish-Red (Munsell 5YR 5/6) apedal Loamy Sand, apedal structure. Neutral pH, non-saline. Non-sodic. No coarse fragments. No roots. Well drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	3.0	Slightly saline	5.3	Strongly Acidic	0.7	Non sodic
0.20-0.30	0.6	Non-saline	6.0	Moderately Acidic	1.5	Non sodic
0.40-0.50	0.6	Non-saline	6.7	Neutral	3.9	Non sodic
0.65-0.75	0.6	Non-saline	6.8	Neutral	3.2	Non sodic

Site Description – Site 15 (lab #K7399/49 – 52)				
Site Reference	15	**ASC Name**	Mottled-Sodic Mesotrophic Yellow Dermosol (BELMW)	
Average Slope	6%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Lower Slope	**Permeability**	Highly permeable	X: 764086
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6416056



Plate 1 – Soil Profile (15)



Plate 2 – Surface (15)



Plate 3 – Landscape (15)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Very Dark Brown (Munsell 7.5YR 2.5/2) Loam with moderate pedality. Very strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many fine roots and moderately drained. Clear boundary.
A2	0.10 – 0.35	Greyish-Brown (Munsell 10YR 5/2) Loam with weak pedality. Moderately acidic pH, non-saline. Non-sodic. 20% coarse fragments 10 – 20mm. No roots and poorly drained. Gradual boundary.
B21	0.35 – 0.50	Reddish-Yellow (Munsell 7.5YR 6/8) Clay Loam with moderate pedality. Strongly acidic pH, non-saline. Non-sodic. No coarse fragments. No roots. Poorly drained. Gradual boundary. 20 – 50% distinct grey weathered mottles.
B22	0.50+	Olive-Yellow (Munsell 2.5Y 6/6) Sandy Loam with moderate pedality. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. No roots. Poorly drained. 20 – 50% distinct grey weathered mottles.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	1.2	Non-saline	4.8	Very Strongly Acidic	2.9	Non sodic
0.20-0.30	0.2	Non-saline	5.6	Moderately Acidic	3.6	Non sodic
0.40-0.50	0.2	Non-saline	5.5	Strongly Acidic	3.5	Non sodic
0.65-0.75	0.4	Non-saline	5.8	Moderately Acidic	5.4	Non sodic

Site Description – Site 16 (lab #K7399/53 – 56)				
Site Reference	16	**ASC Name**	Mottled-Sodic Eutrophic Yellow Chromosol (BELOW)	
Average Slope	3%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Lower Slope	**Permeability**	Moderately permeable	X: 764207
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6415725



Plate 1 – Soil Profile (16)



Plate 2 – Surface (16)



Plate 3 – Landscape (16)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Dark Brown (Munsell 7.5YR 3/3) Loamy Sand with weak pedality. Strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many fine roots and moderately drained. Clear boundary.
A2	0.10 – 0.35	Brown (Munsell 7.5YR 5/4) Loamy Sand, apedal structure. Moderately acidic pH, non-saline. Non-sodic. 20% coarse fragments 10 – 20mm. Very few fine roots and poorly drained (bleached horizon). Clear boundary.
B2	0.35 – 0.80	Brownish-Yellow to Grey (Munsell 10YR 6/6 to 5Y 6/1) Loam with moderate pedality. Moderately acidic trending to strongly acidic pH, non-saline. Non-sodic trending to sodic at depth. No coarse fragments. No roots. Poorly drained. 20 – 50% distinct grey weathered mottles.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	1.3	Non-saline	5.2	Strongly Acidic	1.2	Non sodic
0.20-0.30	0.2	Non-saline	6.0	Moderately Acidic	3.3	Non sodic
0.40-0.50	0.3	Non-saline	5.9	Moderately Acidic	2.5	Non sodic
0.65-0.75	0.5	Non-saline	5.1	Strongly Acidic	5.3	Non sodic

Site Description – Site 17 (lab #K7399/57 – 60)				
Site Reference	17	**ASC Name**	Basic Regolithic Brown-Orthic Tenosol (BEKLW)	
Average Slope	7%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Mid Slope	**Permeability**	Highly permeable	X: 764537
Surface Condition	Soft	**Drainage**	Well drained	Y: 6415701



Plate 1 – Soil Profile (17)



Plate 2 – Surface (17)



Plate 3 – Landscape (17)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Very Dark Brown (Munsell 7.5YR 2.5/2) Loamy Sand with weak pedality. Slightly acidic pH, slightly saline. Non-sodic. No coarse fragments. Many fine roots and well drained. Gradual boundary.
B21	0.20 – 0.40	Dark Brown (Munsell 10YR 3/3) apedal Loamy Sand. Neutral pH, non-saline. Non-sodic. <5% coarse fragments. Very few fine roots and well drained. Gradual boundary.
B22	0.40 – 0.80	Red (Munsell 2.5YR 4/6 to 10YR 5/8) apedal Sandy Loam. Moderately alkaline pH, non-saline. Non-sodic. <5% coarse fragments. Very few fine roots and well drained.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	2.0	Slightly saline	6.4	Slightly Acidic	0.3	Non sodic
0.20-0.30	1.1	Non-saline	7.3	Neutral	0.3	Non sodic
0.40-0.50	0.4	Non-saline	7.9	Moderately Alkaline	0.5	Non sodic
0.65-0.75	0.3	Non-saline	8.2	Moderately Alkaline	0.6	Non sodic

Site Description – Site 18 (lab #K7399/61 – 64)				
Site Reference	18	**ASC Name**	Basic Regolithic Grey-Orthic Tenosol (BELKU)	
Average Slope	2%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Drainage Plain	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Mid Slope	**Permeability**	Highly permeable	X: 764852
Surface Condition	Soft	**Drainage**	Imperfectly drained	Y: 6415387



Plate 1 – Soil Profile (18)



Plate 2 – Surface (18)



Plate 3 – Landscape (18)

Horizon	Depth (m)	Description
A1	0.00 – 0.15	Black (Munsell 7.5YR 2.5/1) Loam, apedal structure. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many fine roots and moderately drained. Gradual boundary.
B2	0.15 – 0.50	Dark Greyish-Brown to Brown (Munsell 10YR 4/2 to 10YR 5/3) apedal Loamy Sand. Neutral pH, non-saline. Non-sodic. <10% coarse fragments 10 – 20mm. No roots and moderately drained. Gradual boundary.
BC	0.50+	Weathered parent material/rock. (Grey (Munsell 10YR 5/1) apedal Loamy Sand. Neutral pH, non-saline. Non-sodic trending to sodic at depth. 60% coarse fragments 10 – 20mm. No roots.)

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.5	Non-sodic	5.8	Moderately Acidic	1.1	Non sodic
0.20-0.30	0.4	Non-sodic	6.6	Neutral	2.2	Non sodic
0.40-0.50	0.3	Non-sodic	6.6	Neutral	2.5	Non sodic
0.65-0.75	0.3	Non-sodic	6.7	Neutral	2.2	Non sodic

Site Description – Site 19 (lab #K7399/65 – 68)				
Site Reference	19	**ASC Name**	Eutrophic Mottled-Subnatric Grey Sodosol (BEKOW)	
Average Slope	0%	**Land Use**	Fodder cropping	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Plain	**Permeability**	Moderately permeable	X: 763593
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6415523



Plate 1 – Soil Profile (19)



Plate 2 – Surface (19)



Plate 3 – Landscape (19)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Very Dark Brown (Munsell 10YR 2/2) Loamy Sand, with moderate pedality. Neutral pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Clear boundary.
A2	0.10 – 0.40	Grey (Munsell 2.5Y 6/1) apedal Silty Loam. Strongly alkaline pH, non-saline. Sodic. No coarse fragments. No roots and poorly drained. Abrupt boundary.
B21	0.40 – 0.60	Grey (Munsell 2.5Y 5/1) Heavy Clay, with strong pedality. Moderately alkaline pH, non-saline, and sodic. No coarse fragments. No roots. Poorly drained. Gradual boundary. 20 – 50% distinct grey weathered mottles.
B22	0.60 – 0.80	Grey (Munsell 5Y 5/1) Clay Loam, with strong pedality. Moderately alkaline pH, non-saline, and sodic. No coarse fragments. No roots. Poorly drained. 20 – 50% distinct grey weathered mottles.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	1.4	Non-saline	6.6	Neutral	3.0	Non sodic
0.20-0.30	0.5	Non-saline	8.5	Strongly Alkaline	8.0	Sodic
0.40-0.50	1.4	Non-saline	8.3	Moderately Alkaline	11.2	Sodic
0.65-0.75	1.7	Non-saline	8.1	Moderately Alkaline	10.3	Sodic

Site Description – Site 20 (no lab #)				
Site Reference	20	**ASC Name**	-	
Average Slope	2%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillcrest	**Soil Fertility**	-	MGA 55
Landform Element	Crest	**Permeability**	Highly permeable	X: 763664
Surface Condition	Soft	**Drainage**	Well drained	Y: 6415985



Plate 1 – Landscape (20)



Plate 2 – Surface (20)



Plate 3 – Surface (20)



Plate 3 – Surface (20)

Description

Due to >20% unattached rock fragments >60mm and surface rock outcrop >30% associated with this assessment site, no samples were collected for laboratory analysis.

Site Description – Site 21 (no lab #)				
Site Reference	21	**ASC Name**	Brown-Orthic Tenosol	
Average Slope	1%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Lower Slope	**Permeability**	Highly permeable	X: 763748
Surface Condition	Soft	**Drainage**	Well drained	Y: 6415174



Plate 1 – Soil Profile (21)



Plate 2 – Surface (21)



Plate 3 – Landscape (21)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Brown Sandy Loam (field assessment) with weak structure. Gradual boundary.
A2	0.10 – 0.40	Pale Brown apedal Loam (apedal structure). Clear boundary.
C	0.40	Parent material.

Due to soil depth limitations of this soil unit, no samples were collected for laboratory analysis.

Site Description – Site 22 (lab #K7399/69 – 72)				
Site Reference	22	**ASC Name**	Mottled Mesotrophic Grey Chromosol (BEKMW)	
Average Slope	2%	**Land Use**	Grazing/ Cultivation	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Mid Slope	**Permeability**	Moderately permeable	X: 763299
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6415113



Plate 1 – Soil Profile (22)



Plate 2 – Surface (22)



Plate 3 – Landscape (22)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Very Dark Brown (Munsell 10YR 2/2) Loamy Sand, with weak structure. Slightly acidic pH, non-saline. Non-sodic. No coarse fragments. Many fine roots and moderately drained. Clear boundary.
A2	0.20 – 0.60	Dark Grey to Grey (Munsell 2.5Y 4/1 to 2.5Y 5/1) Loamy Sand, apedal structure. Moderately alkaline trending to mildly alkaline pH, slightly saline. Sodic trending to non-sodic. <10% coarse fragment. No roots and poorly drained. Clear boundary.
B2	0.60+	Greyish-Brown (Munsell 2.5Y 5/2) Loam trending to Loamy Sand, with strong structure. Mildly alkaline pH, non-saline. Non-sodic. No coarse fragments. No roots. Poorly drained. 20 – 50% distinct grey weathered mottles.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	1.6	Non-saline	6.3	Slightly Acidic	1.1	Non sodic
0.20-0.30	2.7	Slightly saline	8.1	Moderately Alkaline	7.5	Sodic
0.40-0.50	0.3	Non-saline	7.5	Mildly Alkaline	2.2	Non sodic
0.65-0.75	0.6	Non-saline	7.8	Mildly Alkaline	2.1	Non sodic

Site Description – Site 23 (lab #K7399/73 – 76)				
Site Reference	23	**ASC Name**	Eutrophic Mottled-Subnatric Grey Sodosol (BELOW)	
Average Slope	12%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Mid Slope	**Permeability**	Slowly permeable	X: 762736
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6415025



Plate 1 – Soil Profile (23)



Plate 2 – Surface (23)



Plate 3 – Landscape (23)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Very Dark Brown (Munsell 10YR 2/2) Loam, with moderate pedality. Strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Clear boundary.
A2	0.10 – 0.40	Dark Grey (Munsell 10YR 4/1) apedal Clay Loam. Neutral pH, non-saline. Non-sodic. 10% coarse fragment. No roots and poorly drained. Clear boundary.
B2	0.40+	Reddish-Grey to Light-Grey (Munsell 2.5YR 5/1 to 2.5Y 7/1) Heavy Clay, with strong structure. Mildly alkaline pH, non-saline. Sodic. No coarse fragments. No roots. Poorly drained. 20 – 50% distinct orange weathered mottles.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.5	Non-saline	5.5	Strongly Acidic	1.3	Non sodic
0.20-0.30	0.2	Non-saline	6.7	Neutral	2.7	Non sodic
0.40-0.50	0.5	Non-saline	7.5	Mildly Alkaline	7.3	Sodic
0.65-0.75	1.7	Non-saline	7.7	Mildly Alkaline	13.6	Sodic

Site Description – Site 24 (lab #K7399/77 – 80)				
Site Reference	24	**ASC Name**	Basic Regolithic Brown-Orthic Tenosol (BEKKW)	
Average Slope	6%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Mid Slope	**Permeability**	Highly permeable	X: 762533
Surface Condition	Soft	**Drainage**	Well drained	Y: 6414856



Plate 1 – Soil Profile (24)



Plate 2 – Surface (24)



Plate 3 – Landscape (24)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Very Dark Brown (Munsell 7.5YR 2.5/2) Loamy Sand, with moderate pedality. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many fine roots and well drained. Clear boundary.
B2	0.20+	Dark Brown to Reddish-Brown to Brown (Munsell 7.5YR 3/3 to 5YR 4/4 to 7.5YR 5/4) Loamy Sand, with weak pedality. Neutral pH, non-saline. Non-sodic. 10% coarse fragments 10 – 20mm. Few fine roots and well drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	1.0	Non-saline	5.9	Moderately Acidic	0.6	Non sodic
0.20-0.30	0.4	Non-saline	6.9	Neutral	0.6	Non sodic
0.40-0.50	0.3	Non-saline	7.3	Neutral	1.0	Non sodic
0.65-0.75	0.3	Non-saline	7.3	Neutral	1.2	Non sodic

Site Description – Site 25 (lab #K7399/81 – 84)				
Site Reference	25	**ASC Name**	Mottled Eutrophic Red Kandosol (BELOW)	
Average Slope	4%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderate	MGA 55
Landform Element	Mid Slope	**Permeability**	Highly permeable	X: 762933
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6414687



Plate 1 – Soil Profile (25)



Plate 2 – Surface (25)



Plate 3 – Landscape (25)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Dark Brown (Munsell 7.5YR 3/2) apedal Loam. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many fine roots and moderately drained. Clear boundary.
A2	0.10 – 0.40	Yellowish-Red (Munsell 5YR 5/8) apedal Loamy Sand. Neutral pH, non-saline. Non-sodic. 20% coarse fragments. Many fine roots and moderately drained. Gradual boundary.
B21	0.40 – 0.60	Red (Munsell 2.5YR 5/6) Light Clay, with weak pedality. Mildly alkaline pH, non-saline. Non-sodic. <10% coarse fragments. No roots. Poorly drained. Gradual boundary. 10 – 20% prominent orange weathered mottles.
B22	0.60 – 0.80	Red (Munsell 10R 5/8) Clay Loam, with weak pedality. Mildly alkaline pH, non-saline. Non-sodic. <10% coarse fragments. No roots. Poorly drained. 20 – 50% distinct orange weathered mottles.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.6	Non-saline	5.7	Moderately Acidic	0.3	Non sodic
0.20-0.30	0.4	Non-saline	6.8	Neutral	1.1	Non sodic
0.40-0.50	0.3	Non-saline	7.4	Mildly Alkaline	1.1	Non sodic
0.65-0.75	0.5	Non-saline	7.5	Mildly Alkaline	1.9	Non sodic

Site Description – Site 26 (lab #K7399/85 – 88)				
Site Reference	26	**ASC Name**	Haplic Eutrophic Brown Kandosol (BFKMW)	
Average Slope	4%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Mid Slope	**Permeability**	Highly permeable	X: 762963
Surface Condition	Soft	**Drainage**	Imperfectly drained	Y: 6414139



Plate 1 – Soil Profile (26)



Plate 2 – Surface (26)



Plate 3 – Landscape (26)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Very Dark Brown (Munsell 10YR 2/2) Loamy Sand, with moderate pedality. Strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Gradual boundary.
A2	0.20 – 0.55	Brown (Munsell 7.5YR 4/3 to 10YR 5/3) Loamy Sand, with weak pedality. Neutral pH, non-saline. Non-sodic. 20% coarse fragments 20mm, trending to 60% at base of horizon. Few fine roots and moderately drained. Gradual boundary.
B2	0.55+	Yellow (Munsell 2.5Y 7/8) Loam, with weak trending to moderate pedality at depth. Mildly alkaline pH, non-saline. Non-sodic. No coarse fragments. No roots. Moderately drained.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	1.7	Non-saline	5.5	Strongly Acidic	0.4	Non sodic
0.20-0.30	0.4	Non-saline	6.8	Neutral	0.8	Non sodic
0.40-0.50	0.5	Non-saline	7.1	Neutral	0.9	Non sodic
0.65-0.75	0.2	Non-saline	7.4	Mildly Alkaline	0.8	Non sodic

Site Description – Site 27 (lab #K7399/89 – 91)				
Site Reference	27	**ASC Name**	Haplic Eutrophic Black Kandosol (BELMV)	
Average Slope	12%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderate	MGA 55
Landform Element	Mid Slope	**Permeability**	Highly permeable	X: 762705
Surface Condition	Soft	**Drainage**	Imperfectly drained	Y: 6413857



Plate 1 – Soil Profile (27)



Plate 2 – Surface (27)



Plate 3 – Landscape (27)

Horizon	Depth (m)	Description
A	0.00 – 0.10	Very Dark Grey (Munsell 5Y 3/1) Sandy Loam, with weak pedality. Moderately acidic pH, non-saline. Non-sodic. 10% coarse fragments 10mm. Many fine roots and well drained. Gradual boundary.
B	0.10 – 0.60	Dark brown to Dark Reddish-Brown (Munsell 7.5YR 3/2 to 5YR 3/4) Loam, with weak pedality. Neutral pH, non-saline. Non-sodic. 10% coarse fragments 10mm. No roots and moderately drained. Clear boundary.
C	0.60+	Physical barrier: parent material.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.5	Non-saline	5.9	Moderately Acidic	0.3	Non sodic
0.20-0.30	0.2	Non-saline	6.9	Neutral	0.4	Non sodic
0.40-0.50	0.2	Non-saline	7.3	Neutral	0.5	Non sodic

Site Description – Site 28 (no lab #)				
Site Reference	28	**ASC Name**	Shallow Brown Dermosol	
Average Slope	7%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillcrest	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Crest	**Permeability**	Highly permeable	X: 762583
Surface Condition	Soft/ Rocky	**Drainage**	Well drained	Y: 6412822



Plate 1 – Soil Profile (28)



Plate 2 – Surface (28)



Plate 3 – Landscape (28)

Horizon	Depth (m)	Description
Due to soil depth limitations of this soil unit, no samples were collected for laboratory analysis.		

Site Description – Site 29 (lab #K7399/92 – 95)				
Site Reference	29	**ASC Name**	Haplic Eutrophic Red Dermosol (BHMOW)	
Average Slope	2%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillcrest	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Crest Saddle	**Permeability**	Highly permeable	X: 762903
Surface Condition	Soft	**Drainage**	Imperfectly drained	Y: 6412548



Plate 1 – Soil Profile (29)



Plate 2 – Surface (29)



Plate 3 – Landscape (29)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Very Dark Brown (Munsell 7.5YR 2.5/3) Loam, with strong pedality. Slightly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Gradual boundary.
B2	0.20 – 0.55	Red to Yellowish-Red (Munsell 2.5YR 5/8 to 5YR 6/8) Heavy Clay, with moderate pedality. Neutral pH, non-saline. Non-sodic. No coarse fragments. Few fine roots and moderately drained. Gradual boundary.
BC	0.55+	Weathered parent material/rock. (Grey (Munsell 5Y 6/1) Clay Loam, with moderate pedality. Moderately alkaline pH, non-saline. Non-sodic. 40% coarse fragments. No roots. Moderately drained.)

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.6	Non-saline	6.1	Slightly Acidic	0.1	Non sodic
0.20-0.30	0.2	Non-saline	6.7	Neutral	0.3	Non sodic
0.40-0.50	0.4	Non-saline	7.3	Neutral	0.2	Non sodic
0.65-0.75	0.9	Non-saline	8.2	Moderately Alkaline	0.2	Non sodic

Site Description – Site 30 (no lab #)				
Site Reference	30	**ASC Name**	-	
Average Slope	15%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillcrest	**Soil Fertility**	-	MGA 55
Landform Element	Crest	**Permeability**	Highly permeable	X: 762139
Surface Condition	Soft	**Drainage**	Well drained	Y: 6412125



Plate 1 – Landscape (30)



Plate 2 – Surface (30)



Plate 3 – Surface (30)



Plate 3 – Surface (30)

Description

Due to >20% unattached rock fragments >60mm and surface rock outcrop >30% associated with this assessment site, no samples were collected for laboratory analysis.

Site Description – Site 31 (lab #K7399/96 – 99)				
Site Reference	31	**ASC Name**	Haplic Epipedal Red Vertosol (HQRW)	
Average Slope	2%	**Land Use**	Grazing. Rock outcrop >30% on surrounding hillcrest areas	**Coordinates**
Landform Pattern	Hillcrest	**Fertility**	Moderately High	MGA 55
Landform Element	Crest Saddle	**Permeability**	Highly permeable	X: 762323
Surface Condition	Soft	**Drainage**	Imperfectly drained	Y: 6412441



Plate 1 – Soil Profile (31)



Plate 2 – Surface (31)



Plate 3 – Landscape (31)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Very Dark Brown (Munsell 7.5YR 2.5/2) Silty Clay Loam, with strong pedality. Neutral pH, non-saline. Non-sodic. 40% coarse fragments 20 – 50mm. Many fine roots and moderately drained. Gradual boundary.
B21	0.20 – 0.60	Dark Reddish-Brown to Dark Red (Munsell 2.5YR 2.5/3 to 10R 3/6) Silty Clay, with strong pedality. Neutral trending to mildly alkaline pH, non-saline. Non-sodic. 60% coarse fragments 20 – 150mm. Few fine roots and moderately drained. Gradual boundary.
B22	0.60+	Red (Munsell 2.5YR 4/6) Heavy Clay, with strong pedality. Moderately alkaline pH, non-saline. Non-sodic. 60% coarse fragments 20 – 150mm. Few fine roots and moderately drained.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	1.8	Non-saline	6.7	Neutral	0.1	Non sodic
0.20-0.30	0.6	Non-saline	7.3	Neutral	0.2	Non sodic
0.40-0.50	0.6	Non-saline	7.7	Mildly Alkaline	0.3	Non sodic
0.65-0.75	0.4	Non-saline	7.8	Moderately Alkaline	0.3	Non sodic

Site Description – Site 32 (lab #K7399/100 – 103)				
Site Reference	32	**ASC Name**	Bleached Eutrophic Red Dermosol (BELMV)	
Average Slope	3%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Lower Slope	**Permeability**	Moderately permeable	X: 762752
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6413431

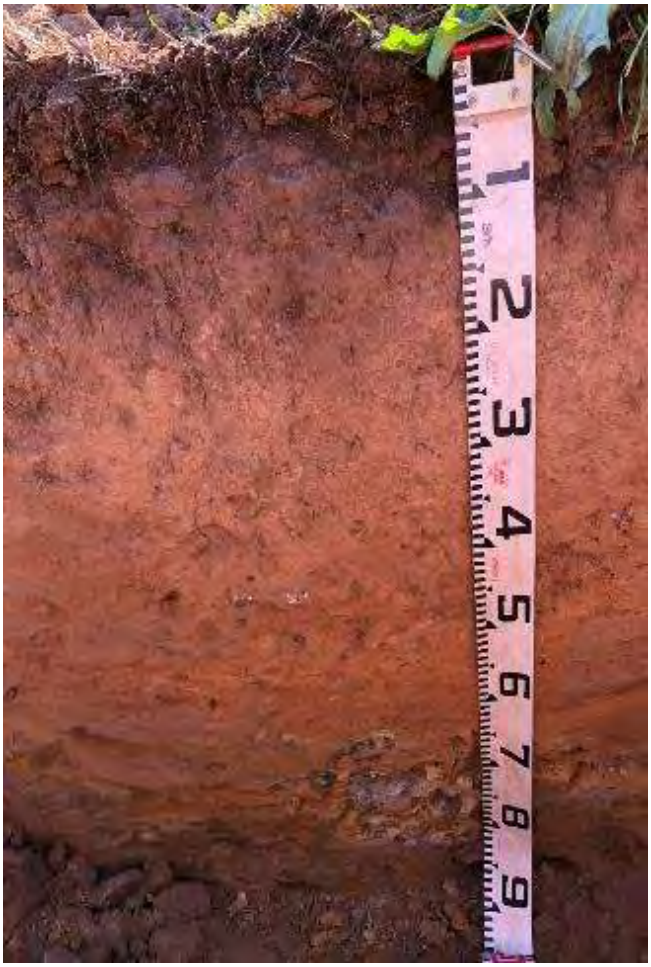


Plate 1 – Soil Profile (32)



Plate 2 – Surface (32)



Plate 3 – Landscape (32)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Dark Brown (Munsell 7.5YR 3/3) Sandy Loam, with moderate pedality. Slightly acidic pH, non-saline. Non-sodic. No coarse fragments. Many fine roots and well drained. Clear boundary.
A2	0.10 – 0.40	Brown (Munsell 7.5YR 4/4) Loam, apedal structure. Slightly acidic pH, non-saline. Non-sodic. <2% coarse fragments <10mm. Few roots and poorly drained (bleached horizon). Gradual boundary.
B2	0.40 – 0.65	Reddish-Yellow (Munsell 5YR 6/8) Clay Loam, with moderate pedality. Neutral pH, non-saline. Non-sodic. 10% coarse fragments. No roots. Clear boundary.
BC	0.65 – 0.75	Weathered parent material/rock. (Light Red (Munsell 2.5YR 6/8) Clay Loam. Neutral pH, non-saline. Non-sodic. No roots. Moderately drained.)

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.5	Non-saline	6.3	Slightly Acidic	0.6	Non sodic
0.20-0.30	0.2	Non-saline	6.3	Slightly Acidic	1.0	Non sodic
0.40-0.50	0.2	Non-saline	7.0	Neutral	1.2	Non sodic
0.65-0.75	0.2	Non-saline	7.1	Neutral	0.6	Non sodic

Site Description – Site 33 (lab #K7399/104 – 107)				
Site Reference	33	**ASC Name**	Basic Arenic Black-Orthic Tenosol (BFLLW)	
Average Slope	12%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Gully Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Upper Slope	**Permeability**	Highly permeable	X: 762928
Surface Condition	Soft	**Drainage**	Well drained	Y: 6413328



Plate 1 – Soil Profile (33)



Plate 2 – Surface (33)



Plate 3 – Landscape (33)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Very Dark Brown (Munsell 10YR 2/2) apedal Sandy Loam. Neutral pH, non-saline. Non-sodic. Very minor gravel presence. Many fine roots and well drained. Gradual boundary.
B21	0.10 – 0.60	Very Dark Brown (Munsell 10YR 2/2) apedal Sandy Loam. Neutral pH, non-saline. Non-sodic. <2% coarse fragments. Common fine roots in upper horizon and well drained. Gradual
B22	0.60 – 0.80	Very Dark Brown (Munsell 10YR 2/2) apedal Loam. Neutral pH, non-saline. Non-sodic. <2% coarse fragments. Common fine roots in upper horizon and well drained. Gradual

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.8	Non-saline	6.6	Neutral	0.2	Non sodic
0.20-0.30	0.5	Non-saline	6.6	Neutral	0.3	Non sodic
0.40-0.50	0.4	Non-saline	6.7	Neutral	0.8	Non sodic
0.65-0.75	0.3	Non-saline	6.8	Neutral	1.2	Non sodic

Site Description – Site 34 (lab #K7399/108 – 111)				
Site Reference	34	**ASC Name**	Haplic Eutrophic Red Kandosol (BELMW)	
Average Slope	6-8%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderate	MGA 55
Landform Element	Mid Slope	**Permeability**	Highly permeable	X: 763314
Surface Condition	Soft	**Drainage**	Imperfectly drained	Y: 6413728



Plate 1 – Soil Profile (34)



Plate 2 – Surface (34)



Plate 3 – Landscape (34)

Horizon	Depth (m)	Description
A1	0.00 – 0.15	Dark Brown (Munsell 7.5YR 3/3) Sandy Loam, weak pedality. Slightly acidic pH, non-saline. Non-sodic. No coarse fragments. Many fine roots and well drained. Gradual boundary.
A2	0.15 – 0.40	Dark Reddish-Brown (Munsell 5YR 3/3) Silty Loam, weak pedality. Neutral pH, non-saline. Non-sodic. No coarse fragments. Common fine roots and well drained. Gradual boundary.
B2	0.40+	Reddish-Brown to Red (Munsell 2.5YR 4/4 to 10R 5/6) Loam, with weak pedality. Neutral trending to moderately alkaline pH, non-saline. Non-sodic trending to sodic at depth. No coarse fragments. No roots. Moderately drained.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.6	Non-saline	6.0	Slightly Acidic	0.4	Non sodic
0.20-0.30	0.2	Non-saline	6.7	Neutral	0.5	Non sodic
0.40-0.50	0.2	Non-saline	7.1	Neutral	1.0	Non sodic
0.65-0.75	0.3	Non-saline	8.1	Moderately Alkaline	3.0	Non sodic

Site Description – Site 35 (lab #K7399/112 – 115)				
Site Reference	35	**ASC Name**	Mottled Eutrophic Red Chromosol (BEKOV)	
Average Slope	2%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Lower Slope	**Permeability**	Moderately permeable	X: 763309
Surface Condition	Soft	**Drainage**	Imperfectly drained	Y: 6414370



Plate 1 – Soil Profile (35)



Plate 2 – Surface (35)



Plate 3 – Landscape (35)

Horizon	Depth (m)	Description
A1	0.00 – 0.15	Brown (Munsell 7.5YR 4/2) Loamy Sand, with moderate structure. Moderately acidic pH, slightly saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Gradual boundary.
A2	0.15 – 0.30	Brown (Munsell 7.5YR 5/4) apedal Loamy Sand. Mildly alkaline trending to moderately alkaline pH, non-saline. Non-sodic. 60% coarse fragments 10 – 20mm. No roots and poorly drained (bleached horizon). Clear boundary.
B2	0.30 – 0.60	Red (Munsell 2.5YR 5/6) Light Medium Clay, with strong structure and moderate consistence. Moderately alkaline pH, non-saline. Non-sodic. No coarse fragments. No roots. Poorly drained. Gradual boundary. 20 – 50% faint grey weathered mottles.
BC	0.60+	Weathered parent material/rock. (Reddish- Brown (Munsell 2.5YR 4/4) Clay Loam, strong structure. Moderately alkaline pH, non-saline. Non-sodic. No roots. Moderately drained.)

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	2.1	Slightly saline	5.6	Moderately Acidic	0.2	Non sodic
0.20-0.30	1.2	Non-saline	7.3	Mildly Alkaline	0.6	Non sodic
0.40-0.50	0.9	Non-saline	7.9	Moderately Alkaline	1.2	Non sodic
0.65-0.75	1.4	Non-saline	8.3	Moderately Alkaline	3.3	Non sodic

Site Description – Site 36 (no lab #)				
Site Reference	36	**ASC Name**	Lithic Leptic Rudosol	
Average Slope	4%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Low	MGA 55
Landform Element	Ridge Line	**Permeability**	Highly permeable	X: 763596
Surface Condition	Hard Set	**Drainage**	Well drained	Y: 6414806



Plate 1 – Soil Profile (36)



Plate 2 – Surface (36)



Plate 3 – Landscape (36)

Horizon	Depth (m)	Description
A1	0.00 – 0.15	Shallow, skeletal soil with high coarse fragment content.

Due to soil depth limitations of this soil unit, no samples were collected for laboratory analysis.

Site Description – Site 37 (lab #K7399/116 – 118)				
Site Reference	37	**ASC Name**	Eutrophic Mottled-Subnatric Yellow Sodosol (BELOV)	
Average Slope	1%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Lower Slope	**Permeability**	Moderately permeable	X: 763857
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6414665



Plate 1 – Soil Profile (37)



Plate 2 – Surface (37)



Plate 3 – Landscape (37)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Brown (Munsell 7.5YR 4/3) Silty Loam, with weak pedality. Strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Clear boundary.
A2	0.10 – 0.20	Brownish-Yellow (Munsell 10YR 6/6) Silty Clay Loam, with weak pedality. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Few fine roots and moderately drained. Clear boundary.
B2	0.20 – 0.50	Olive Yellow (Munsell 2.5Y 6/6) Heavy Clay with strong pedality. Slightly acid pH, non-saline, Sodic. No coarse fragments. No roots. poorly drained. 20 - 50% distinct grey weathered mottling.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.5	Non-saline	5.3	Strongly Acidic	2.1	Non sodic
0.10-0.20	0.2	Non-saline	5.9	Moderately Acidic	4.0	Non sodic
0.30-0.40	0.5	Non-saline	6.1	Slightly Acidic	9.9	Sodic

Site Description – Site 38 (lab #K7399/119 – 122)				
Site Reference	38	**ASC Name**	Mottled Eutrophic Red Kandosol (BELOW)	
Average Slope	3%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderate	MGA 55
Landform Element	Mid/Lower Slope	**Permeability**	Highly permeable	X: 763916
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6413971



Plate 1 – Soil Profile (38)



Plate 2 – Surface (38)



Plate 3 – Landscape (38)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Dark Brown (Munsell 7.5YR 3/3) Loam, with moderate pedality. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Clear boundary.
A2	0.20 – 0.40	Reddish-Brown (Munsell 2.5YR 4/4) Loam, with weak pedality. Slightly acidic pH, non-saline. Non-sodic. <5% coarse fragments. No roots and moderately drained. Gradual boundary.
B21	0.40 – 0.60	Reddish-Yellow (Munsell 5YR 6/8) Clay Loam, with weak pedality. Neutral pH, non-saline. Non-sodic. <5% coarse fragments. No roots and poorly drained. Clear boundary.
B22	0.60+	Olive Yellow (Munsell 5Y 6/6) Light Clay, with weak pedality. Neutral pH, non-saline. Non-sodic. No coarse fragments. No roots and poorly drained. Distinct gley weathered mottles (20-50%).

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.5	Non-saline	5.6	Moderately Acidic	1.1	Non sodic
0.20-0.30	0.2	Non-saline	6.3	Slightly Acidic	1.1	Non sodic
0.40-0.50	0.1	Non-saline	6.6	Neutral	1.2	Non sodic
0.65-0.75	0.2	Non-saline	7.2	Neutral	3.6	Non sodic

Site Description – Site 39 (lab #K7399/123 – 126)				
Site Reference	39	**ASC Name**	Mottled Eutrophic Red Kandosol (BELMW)	
Average Slope	8%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderate	MGA 55
Landform Element	Mid/ Lower Slope	**Permeability**	Highly permeable	X: 763867
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6413608



Plate 1 – Soil Profile (39)



Plate 2 – Surface (39)



Plate 3 – Landscape (39)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Dark Brown (Munsell 7.5YR 3/3) Loam, with moderate pedality. Strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Clear boundary.
A2	0.20 – 0.40	Yellowish-Red (Munsell 5YR 5/6) Loamy Sand, with weak pedality. Neutral pH, non-saline. Non-sodic. <5% coarse fragments. Very few roots and moderately drained. Gradual boundary.
B21	0.40 – 0.60	Yellowish-Red (Munsell 5YR 5/8) Loam, with weak pedality. Mildly alkaline pH, non-saline. Non-sodic. <5% coarse fragments. No roots and poorly drained. Clear boundary.
B22	0.60+	Red (Munsell 10R 5/8) Clay Loam, with weak pedality. Mildly alkaline pH, non-saline. Non-sodic. No coarse fragments. No roots and poorly drained. Distinct grey weathered mottles (20-50%).

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.9	Non-saline	5.2	Strongly Acidic	0.7	Non sodic
0.20-0.30	0.6	Non-saline	6.8	Neutral	1.3	Non sodic
0.40-0.50	0.3	Non-saline	7.3	Mildly Alkaline	1.9	Non sodic
0.65-0.75	0.6	Non-saline	7.5	Mildly Alkaline	3.7	Non sodic

Site Description – Site 40 (lab #K7399/127 – 130)				
Site Reference	40	**ASC Name**	Mottled Eutrophic Grey Chromosol (BEKOW)	
Average Slope	11%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Mid Slope	**Permeability**	Moderately permeable	X: 763361
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6412906



Plate 1 – Soil Profile (40)



Plate 2 – Surface (40)



Plate 3 – Landscape (40)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Very Dark Brown (Munsell 7.5YR 2.5/2) Loamy Sand, with weak pedality. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Clear boundary.
A2	0.20 – 0.55	Brown to Yellowish-Brown (Munsell 7.5YR 4/4 to 10YR 5/4) Loamy Sand, with weak pedality. Neutral pH, non-saline. Non-sodic. 30% coarse fragments <20mm. No roots and moderately drained. Clear boundary.
B2	0.55+	Grey (Munsell 10YR 6/1) Light Medium Clay, with moderate pedality. Mildly alkaline pH, non-saline. Non-sodic. No coarse fragments. No roots and poorly drained. 20 – 50% distinct grey weathered mottling.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	1.1	Non-saline	5.8	Moderately Acidic	2.6	Non sodic
0.20-0.30	0.2	Non-saline	6.5	Neutral	1.9	Non sodic
0.40-0.50	0.8	Non-saline	6.6	Neutral	3.2	Non sodic
0.65-0.75	0.2	Non-saline	7.4	Mildly Alkaline	3.2	Non sodic

Site Description – Site 41 (lab #K7399/131 – 134)				
Site Reference	41	**ASC Name**	Bleached Eutrophic Red Kandosol (BELMW)	
Average Slope	4%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderate	MGA 55
Landform Element	Lower Slope	**Permeability**	Moderately permeable	X: 763444
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6412625



Plate 1 – Soil Profile (41)



Plate 2 – Surface (41)



Plate 3 – Landscape (41)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Dark Brown (Munsell 7.5YR 3/3) Loam, with weak pedality. Strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and well drained. Clear boundary.
A2	0.10 – 0.35	Yellowish-Red (Munsell 5YR 5/6) Silty Loam, apedal structure. Slightly acidic pH, non-saline. Non-sodic. <10% coarse fragments. Few fine roots and poorly drained. Gradual boundary.
B21	0.35 – 0.60	Reddish-Yellow (Munsell 5YR 6/8) Silty Loam, with weak pedality. Neutral pH, non-saline. Non-sodic. <10% coarse fragments. No roots. poorly drained. Gradual boundary.
B22	0.60 – 0.80	Yellowish-Red (Munsell 5YR 5/6) Clay Loam, with weak pedality. Mildly alkaline pH, non-saline. Non-sodic. <10% coarse fragments. No roots. Poorly drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.3	Non-saline	5.4	Strongly Acidic	2.0	Non sodic
0.20-0.30	0.1	Non-saline	6.2	Slightly Acidic	1.0	Non sodic
0.40-0.50	0.1	Non-saline	6.9	Neutral	0.8	Non sodic
0.65-0.75	0.1	Non-saline	7.3	Mildly Alkaline	0.5	Non sodic

Site Description – Site 42 (lab #K7399/135 – 138)				
Site Reference	42	**ASC Name**	Black Arenic Black-Orthic Tenosol (BELKW)	
Average Slope	1%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Drainage Gully	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Gully	**Permeability**	Highly permeable	X: 763266
Surface Condition	Soft/ Sandy	**Drainage**	Well drained	Y: 6412115



Plate 1 – Soil Profile (42)



Plate 2 – Surface (42)



Plate 3 – Landscape (42)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Black (Munsell 10YR 2/1) Sandy Loam, with moderate pedality. Strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and well drained. Gradual boundary.
B21	0.20 – 0.55	Black (Munsell 10YR 2/1 to 2.5Y 2.5/1) Sandy Loam to Loamy Sand, with weak pedality. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and well drained. Gradual boundary.
B22	0.55+	Dark Grey (Munsell 2.5Y 4/1) Loamy Sand, with moderate pedality. Slightly acidic to moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and well drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	2.1	Slightly saline	5.2	Strongly Acidic	2.0	Non sodic
0.20-0.30	0.2	Non-saline	5.8	Moderately Acidic	1.8	Non sodic
0.40-0.50	0.3	Non-saline	6.0	Slightly Acidic	2.3	Non sodic
0.65-0.75	0.2	Non-saline	6.0	Moderately Acidic	1.7	Non sodic

Site Description – Site 43 (lab #K7399/139 – 142)				
Site Reference	43	**ASC Name**	Mottled Eutrophic Yellow Kandosol (BEKMW)	
Average Slope	4%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderate	MGA 55
Landform Element	Mid/ Lower Slope	**Permeability**	Highly permeable	X: 763872
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6412914



Plate 1 – Soil Profile (43)



Plate 2 – Surface (43)



Plate 3 – Landscape (43)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Very Dark Brown (Munsell 7.5YR 2.5/3) Loamy Sand, with weak pedality. Very strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and poorly drained. Clear boundary.
A2	0.10 – 0.50	Brownish-Yellow to Olive Yellow (Munsell 10YR 6/8 to 2.5Y 6/8) Loamy Sand to Loam, apedal structure. Moderately acid trending to neutral pH, non-saline. Non-sodic. 20% coarse fragments <20mm. No roots and poorly drained. Gradual boundary.
B2	0.50+	Red (Munsell 10R 5/8) Clay Loam, with strong pedality. Mildly alkaline pH, non-saline. Non-sodic. No coarse fragments. No roots and poorly drained. 20 – 50% distinct grey weathered mottles.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	1.8	Non-saline	4.5	Very Strongly Acidic	0.9	Non sodic
0.20-0.30	0.3	Non-saline	5.6	Moderately Acidic	1.4	Non sodic
0.40-0.50	0.1	Non-saline	6.8	Neutral	2.9	Non sodic
0.65-0.75	0.2	Non-saline	7.4	Mildly Alkaline	1.9	Non sodic

Site Description – Site 44 (lab #K7399/143 – 146)				
Site Reference	44	**ASC Name**	Basic Arenic Brown-Orthic Tenosol (BEKLW)	
Average Slope	1%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Lower Slope	**Permeability**	Highly permeable	X: 763935
Surface Condition	Soft	**Drainage**	Well drained	Y: 6413218



Plate 1 – Soil Profile (44)



Plate 2 – Surface (44)



Plate 3 – Landscape (44)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Dark Brown (Munsell 7.5YR 3/3) apedal Loamy Sand. Very strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and well drained. Gradual boundary.
B21	0.20 – 0.50	Brown to Yellowish-Red (Munsell 7.5YR 4/3 to 5YR 5/8) apedal Loamy Sand. Strongly acidic trending to moderately acidic pH. Non-saline. Non-sodic. No coarse fragments. No roots and well drained. Gradual boundary.
B22	0.50 – 0.80	Red (Munsell 10R 4/8) apedal Sandy Loam. Slightly acidic pH with depth. Non-saline. Non-sodic. No coarse fragments. No roots and well drained.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.9	Non-saline	4.9	Very Strongly Acidic	0.7	Non sodic
0.20-0.30	0.2	Non-saline	5.4	Strongly Acidic	1.2	Non sodic
0.40-0.50	0.3	Non-saline	6.0	Moderately Acidic	3.6	Non sodic
0.65-0.75	0.2	Non-saline	6.4	Slightly Acidic	0.9	Non sodic

Site Description – Site 45 (lab #K7399/147 – 150)				
Site Reference	45	**ASC Name**	Haplic Eutrophic Red Dermosol (BEKMW)	
Average Slope	1%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Lower Slope	**Permeability**	Highly permeable	X: 764420
Surface Condition	Soft	**Drainage**	Imperfectly drained	Y: 6413117



Plate 1 – Soil Profile (45)



Plate 2 – Surface (45)



Plate 3 – Landscape (45)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Dark Reddish-Brown (Munsell 5YR 3/4) Loam, with moderate pedality. Slightly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Gradual boundary.
B21	0.20 – 0.40	Red (Munsell 2.5YR 5/8) Loam with moderate pedality. Neutral pH, non-saline. Non-sodic. No coarse fragments. No roots. Moderately drained. Gradual boundary.
B22	0.40 – 0.80	Red to Yellowish-Red (Munsell 2.5YR 4/8 to 5YR 5/8) Clay Loam, with moderate pedality. Mildly alkaline trending to moderately alkaline pH, non-saline. Non-sodic. No coarse fragments. No roots. Moderately drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.3	Non-saline	6.5	Slightly Acidic	0.3	Non sodic
0.20-0.30	0.2	Non-saline	7.3	Neutral	0.4	Non sodic
0.40-0.50	0.2	Non-saline	7.6	Mildly Alkaline	0.8	Non sodic
0.65-0.75	0.3	Non-saline	7.9	Moderately Alkaline	0.6	Non sodic

Site Description – Site 46 (lab #K7399/151 – 154)				
Site Reference	46	**ASC Name**	Basic Arenic Brown-Orthic Tenosol (BEKLW)	
Average Slope	4%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Lower Slope	**Permeability**	Highly permeable	X: 764706
Surface Condition	Soft	**Drainage**	Imperfectly drained	Y: 6412919



Plate 1 – Soil Profile (46)



Plate 2 – Surface (46)



Plate 3 – Landscape (46)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Very Dark Brown (Munsell 7.5YR 2.5/2) apedal Loamy Sand. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Gradual boundary.
B21	0.10 – 0.60	Olive to Brown (Munsell 5Y 5/3 to 10YR 5/3) apedal Loamy Sand. Neutral pH, non-saline. Non-sodic. <10% coarse fragments. Very few roots. Moderately drained. Gradual boundary.
B22	0.60 – 0.80	Olive Yellow (Munsell 5Y 6/8) apedal Loam. Neutral pH, non-saline. Non-sodic. <10% coarse fragments. Very few roots. Moderately drained.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.5	Non-saline	6.0	Moderately Acidic	0.5	Non sodic
0.20-0.30	0.2	Non-saline	6.5	Neutral	0.4	Non sodic
0.40-0.50	0.2	Non-saline	6.8	Neutral	0.8	Non sodic
0.65-0.75	0.1	Non-saline	7.3	Neutral	1.7	Non sodic

Site Description – Site 47 (lab #K7399/155 – 158)				
Site Reference	47	**ASC Name**	Basic Arenic Red-Orthic Tenosol (BEKKW)	
Average Slope	6%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Mid Slope	**Permeability**	Highly permeable	X: 764561
Surface Condition	Hard Set	**Drainage**	Imperfectly drained	Y: 6412454



Plate 1 – Soil Profile (47)



Plate 2 – Surface (47)



Plate 3 – Landscape (47)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Brown (Munsell 7.5YR 4/2) Loamy Sand, with weak pedality. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and well drained. Clear boundary.
A2	0.10 – 0.40	Brown (Munsell 7.5YR 5/2) Loamy Sand, apedal structure. Slightly acidic pH, non-saline. Non-sodic. <10% coarse fragments. Few fine roots and well drained. Gradual boundary.
B2	0.40+	Reddish-Brown to Reddish-Yellow (Munsell 5YR 5/4 to 5YR 6/6) Loamy Sand, with weak pedality. Neutral trending to mildly alkaline pH, non-saline. Non-sodic. 80% coarse fragments <20mm. No roots. Moderately drained.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.4	Non-saline	5.7	Moderately Acidic	0.4	Non sodic
0.20-0.30	0.2	Non-saline	6.3	Slightly Acidic	0.8	Non sodic
0.40-0.50	0.2	Non-saline	7.0	Neutral	1.6	Non sodic
0.65-0.75	0.3	Non-saline	7.3	Mildly Alkaline	1.6	Non sodic

Site Description – Site 48 (lab #K7399/159 – 162)				
Site Reference	48	**ASC Name**	Basic Arenic Red-Orthic Tenosol (BEKKW)	
Average Slope	6%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Mid Slope	**Permeability**	Highly permeable	X: 764759
Surface Condition	Loose	**Drainage**	Well drained	Y: 6412025



Plate 1 – Soil Profile (48)



Plate 2 – Surface (48)



Plate 3 – Landscape (48)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Black (Munsell 7.5YR 2.5/1) Loamy Sand, with weak pedality. Neutral pH, non-saline. Non-sodic. No coarse fragments. Many roots and well drained. Gradual boundary.
A2	0.10 – 0.35	Very Dark Brown (Munsell 10YR 2/2) Sandy Loam, apedal structure. Neutral pH, non-saline. Non-sodic. 20% coarse fragments <20mm. Few fine roots and well drained. Gradual boundary.
B2	0.35 – 0.80	Reddish-Brown to Reddish-Yellow (Munsell 5YR 4/3 to 5YR 6/8) apedal Loamy Sand. Moderately alkaline trending to strongly alkaline pH, non-saline. Non-sodic. 40% coarse fragments <20mm. No roots. Well drained.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.7	Non-saline	6.5	Neutral	0.2	Non sodic
0.20-0.30	0.3	Non-saline	7.2	Neutral	0.2	Non sodic
0.40-0.50	1.4	Non-saline	8.4	Moderately Alkaline	0.3	Non sodic
0.65-0.75	1.5	Non-saline	8.7	Strongly Alkaline	0.2	Non sodic

Site Description – Site 49 (lab #K7399/163 – 166)				
Site Reference	49	**ASC Name**	Mottled Eutrophic Yellow Chromosol (BELOW)	
Average Slope	3%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Mid Slope	**Permeability**	Moderately permeable	X: 765152
Surface Condition	Hard Set	**Drainage**	Poorly drained	Y: 6412064



Plate 1 – Soil Profile (49)



Plate 2 – Surface (49)



Plate 3 – Landscape (49)

Horizon	Depth (m)	Description
A1	0.00 – 0.15	Dark Greyish-Brown (Munsell 10YR 4/2) Loam, with weak pedality. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and poorly drained. Abrupt boundary.
A2	0.15 – 0.35	Light Brown (Munsell 7.5YR 6/3) apedal Loam. Neutral pH, non-saline. Non-sodic. 30% coarse fragments 5 - 20mm. No roots and poorly drained. Clear boundary.
B21	0.35 – 0.60	Brownish-Yellow (Munsell 10YR 6/6) Light Clay, with strong pedality. Mildly alkaline pH, non-saline. Non-sodic. 30% coarse fragments <20mm. No roots. Poorly drained. Gradual boundary. 20 – 50% distinct grey weathered mottles.
B22	0.60 – 0.80	Olive Yellow (Munsell 2.5Y 6/8) Heavy Clay, with strong pedality. Moderately alkaline pH, non-saline. Non-sodic. 30% coarse fragments <20mm. No roots. Poorly drained. 20 – 50% distinct grey weathered mottles.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.3	Non-saline	5.9	Moderately Acidic	1.0	Non sodic
0.20-0.30	0.1	Non-saline	6.8	Neutral	0.6	Non sodic
0.40-0.50	0.4	Non-saline	7.6	Mildly Alkaline	1.8	Non sodic
0.65-0.75	0.5	Non-saline	8.2	Moderately Alkaline	3.4	Non sodic

Site Description – Site 50 (lab #K7399/167 – 170)				
Site Reference	50	**ASC Name**	Basic Arenic Grey-Orthic Tenosol (BEKKW)	
Average Slope	3%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Lower Ridge	**Permeability**	Highly permeable	X: 765198
Surface Condition	Soft	**Drainage**	Well drained	Y: 6412391



Plate 1 – Soil Profile (50)



Plate 2 – Surface (50)



Plate 3 – Landscape (50)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Black (Munsell 10YR 2/1) apedal Loamy Sand. Strongly acidic pH, non-saline, sodic. No coarse fragments. Many roots and well drained. Clear boundary.
B2	0.10 – 0.80	Pinkish Grey to Light Grey (Munsell 7.5YR 6/2 to 2.5Y 7/2) apedal Loamy Sand. Moderately acidic pH, non-saline. Sodic. No coarse fragments. Very few roots and well drained.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.9	Non-saline	5.5	Strongly Acidic	6.9	Sodic
0.20-0.30	0.7	Non-saline	5.8	Moderately Acidic	11.0	Sodic
0.40-0.50	0.3	Non-saline	5.9	Moderately Acidic	25.1	Sodic
0.65-0.75	0.2	Non-saline	6.0	Moderately Acidic	14.4	Sodic

Site Description – Site 51 (lab #K7399/171 – 174)				
Site Reference	51	**ASC Name**	Basic Arenic Yellow-Orthic Tenosol (CEKLW)	
Average Slope	0%	**Land Use**	Cropping	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Flat	**Permeability**	Highly permeable	X: 764905
Surface Condition	Loose	**Drainage**	Well drained	Y: 6412678



Plate 1 – Soil Profile (51)



Plate 2 – Surface (51)



Plate 3 – Landscape (51)

Horizon	Depth (m)	Description
A1	0.00 – 0.30	Black to Very Dark Brown (Munsell 10YR 2/1 to 10YR 2/2) Loam, with weak pedality. Neutral pH, non-saline. Non-sodic. No coarse fragments. Many roots and well drained. Gradual boundary.
B2	0.30 – 0.80	Pale Olive to Olive Yellow (Munsell 5Y 6/4 to 2.5Y 6/6) apedal Loamy Sand. Neutral pH, non-saline. Non-sodic. 10% coarse fragments trending to 80% from 0.60m depth. No roots. Well drained.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.4	Non-saline	6.6	Neutral	0.2	Non sodic
0.20-0.30	0.1	Non-saline	6.5	Neutral	0.3	Non sodic
0.40-0.50	0.2	Non-saline	6.9	Neutral	0.8	Non sodic
0.65-0.75	0.3	Non-saline	7.0	Neutral	1.7	Non sodic

Site Description – Site 52 (lab #K7399/175 – 178)				
Site Reference	52	**ASC Name**	Basic Arenic Brown-Orthic Tenosol (BEKKW)	
Average Slope	0%	**Land Use**	Cropping	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Flat	**Permeability**	Highly permeable	X: 764913
Surface Condition	Loose	**Drainage**	Well drained	Y: 6413051



Plate 1 – Soil Profile (52)



Plate 2 – Surface (52)



Plate 3 – Landscape (52)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Very Dark Brown (Munsell 10YR 2/2) Loamy Sand, with weak pedality. Neutral trending to slightly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and well drained. Gradual boundary.
B2	0.20 – 0.80	Yellowish-Brown to Light Yellowish-Brown to Olive Yellow (Munsell 10YR 5/4 to 10YR 6/4 to 5Y 6/6) apedal Loamy Sand. Slightly acidic trending to neutral pH, non-saline. Non-sodic. 10% coarse fragments trending to 80% from 0.60m depth. No roots. Well drained.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	1.1	Non-saline	6.9	Neutral	0.3	Non sodic
0.20-0.30	0.2	Non-saline	6.3	Slightly Acidic	1.7	Non sodic
0.40-0.50	0.2	Non-saline	6.4	Slightly Acidic	1.2	Non sodic
0.65-0.75	0.2	Non-saline	6.7	Neutral	2.1	Non sodic

Site Description – Site 53 (lab #K7399/179 – 182)				
Site Reference	53	**ASC Name**	Basic Arenic Brown-Orthic Tenosol (BEKKW)	
Average Slope	0%	**Land Use**	Cropping	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Flat	**Permeability**	Highly permeable	X: 764648
Surface Condition	Loose	**Drainage**	Well drained	Y: 6413487



Plate 1 – Soil Profile (53)



Plate 2 – Surface (53)



Plate 3 – Landscape (53)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Dark Brown (Munsell 7.5YR 3/3) Loamy Sand, with weak pedality. Strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and well drained. Gradual boundary.
B2	0.20 – 0.80	Brown to Light Olive Brown to Light Brownish-Grey (Munsell 7.5YR 4/3 to 2.5Y 5/3 to 2.5Y 6/2) apedal Loamy Sand. Slightly acidic trending to neutral pH, non-saline. Non-sodic. 10% coarse fragments trending to 80% from 0.60m depth. No roots. Well drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.4	Non-saline	5.3	Strongly Acidic	0.6	Non sodic
0.20-0.30	0.1	Non-saline	6.2	Slightly Acidic	1.8	Non sodic
0.40-0.50	0.1	Non-saline	6.5	Neutral	1.1	Non sodic
0.65-0.75	0.2	Non-saline	7.0	Neutral	2.7	Non sodic

Site Description – Site 54 (lab #K7399/183 – 186)				
Site Reference	54	**ASC Name**	Eutrophic Mottled-Subnatric Grey Sodosol (BEKMW)	
Average Slope	0%	**Land Use**	Cropping	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Lower Slope	**Permeability**	Highly permeable	X: 764333
Surface Condition	Loose	**Drainage**	Well drained	Y: 6413753



Plate 1 – Soil Profile (54)



Plate 2 – Surface (54)



Plate 3 – Landscape (54)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Dark Greyish-Brown (Munsell 10YR 4/2) apedal Loamy Sand. Strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and poorly drained. Gradual boundary.
A2	0.10 – 0.40	Brown (Munsell 10YR 5/3) apedal Loamy Sand. Strongly acidic pH, non-saline. Sodic. <5% coarse fragments. Few to no roots and poorly drained. Clear boundary.
B21	0.40 – 0.60	Grey (Munsell 2.5Y 6/1) Sandy Clay with moderate pedality. Slightly acidic trending to slightly acidic pH, non-saline. Sodic. No coarse fragments. No roots. Well drained. Gradual boundary. 20 – 50% distinct grey weathered mottles.
B22	0.60+	Grey (Munsell 2.5Y 6/1) Clay Loam with moderate pedality. Slightly acidic trending to slightly acidic pH, non-saline. Sodic. No coarse fragments. No roots. Well drained. 20 – 50% distinct grey weathered mottles.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.7	Non-saline	5.1	Strongly Acidic	3.5	Non sodic
0.20-0.30	0.2	Non-saline	5.4	Strongly Acidic	6.1	Sodic
0.40-0.50	0.6	Non-saline	6.3	Slightly Acidic	13.7	Sodic
0.65-0.75	1.5	Non-saline	6.1	Slightly Acidic	20.7	Sodic

Site Description – Site 55 (lab #K7399/187 – 190)				
Site Reference	55	**ASC Name**	Basic Arenic Brown-Orthic Tenosol (BEKKW)	
Average Slope	0%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Lower Slope	**Permeability**	Highly permeable	X: 764273
Surface Condition	Hard Set	**Drainage**	Well drained	Y: 6414236



Plate 1 – Soil Profile (55)



Plate 2 – Surface (55)



Plate 3 – Landscape (55)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Brown (Munsell 7.5YR 4/2) apedal Loamy Sand. Strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and well drained. Gradual boundary.
B2	0.20 – 0.80	Olive Brown to Brown to Reddish-Brown (Munsell 2.5Y 4/3 to 10YR 4/3 to 5YR 5/4) apedal Loamy Sand. Strongly acidic trending to neutral pH, non-saline. Non-sodic. No coarse fragments. Some roots presence and well drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.5	Non-saline	5.1	Strongly Acidic	1.7	Non sodic
0.20-0.30	0.2	Non-saline	5.4	Strongly Acidic	0.7	Non sodic
0.40-0.50	0.2	Non-saline	6.4	Slightly Acidic	1.3	Non sodic
0.65-0.75	0.2	Non-saline	6.7	Neutral	2.8	Non sodic

Site Description – Site 56 (lab #K7399/191 – 194)				
Site Reference	56	**ASC Name**	Acidic Arenic Red-Orthic Tenosol (BEKLW)	
Average Slope	0%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Mid Slope	**Permeability**	Highly permeable	X: 764266
Surface Condition	Hard Set	**Drainage**	Imperfectly drained	Y: 6414700



Plate 1 – Soil Profile (56)



Plate 2 – Surface (56)



Plate 3 – Landscape (56)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Brown (Munsell 10YR 4/3) apedal Loamy Sand. Very strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Clear boundary.
B21	0.20 – 0.50	Reddish-Brown (Munsell 2.5YR 4/4) apedal Loamy Sand. Very strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Few fine roots and moderately drained. Clear boundary.
B22	0.50 – 0.90	Reddish-Brown (Munsell 5YR 4/3) Sandy Loam, apedal structure. Very strongly acidic trending to neutral pH, non-saline. Non-sodic. No coarse fragments. No roots. Moderately drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	1.0	Non-saline	4.7	Very Strongly Acidic	0.5	Non sodic
0.20-0.30	0.8	Non-saline	4.9	Very Strongly Acidic	0.5	Non sodic
0.40-0.50	0.6	Non-saline	5.5	Strongly Acidic	1.0	Non sodic
0.65-0.75	0.3	Non-saline	6.7	Neutral	1.0	Non sodic

Site Description – Site 57 (lab #K7399/195 – 198)				
Site Reference	57	**ASC Name**	Mottled Eutrophic Grey Chromosol (BEKMW)	
Average Slope	4%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Lower Slope	**Permeability**	Moderately permeable	X: 764790
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6414902



Plate 1 – Soil Profile (57)



Plate 2 – Surface (57)



Plate 3 – Landscape (57)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Very Dark Grey (Munsell 5Y 3/1) Loamy Sand, with weak pedality. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Clear boundary.
A2	0.10 – 0.30	Grey (Munsell 2.5Y 6/1) apedal Loamy Sand. Neutral pH, non-saline. Non-sodic. No coarse fragments. No roots and poorly drained. Clear boundary.
B2	0.30+	Light Yellowish-Brown (Munsell 2.5Y 6/3) Sandy Clay Loam to Clay Loam, with strong pedality. Mildly alkaline pH, non-saline. Non-sodic. No coarse fragments. No roots. Poorly drained. 20 – 50% distinct grey weathered mottles.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	1.3	Non-saline	5.6	Moderately Acidic	0.7	Non sodic
0.20-0.30	0.3	Non-saline	6.7	Neutral	0.6	Non sodic
0.40-0.50	0.2	Non-saline	7.4	Mildly Alkaline	0.9	Non sodic
0.65-0.75	0.3	Non-saline	7.7	Mildly Alkaline	1.5	Non sodic

Site Description – Site 58 (lab #K7399/199 – 202)				
Site Reference	58	**ASC Name**	Bleached-Mottled Eutrophic Grey Chromosol (BEKMW)	
Average Slope	3%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Lower Slope	**Permeability**	Highly permeable	X: 764384
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6415193



Plate 1 – Soil Profile (58)



Plate 2 – Surface (58)



Plate 3 – Landscape (58)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Brown (Munsell 7.5YR 4/2) Loamy Sand, with weak pedality. Strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Clear boundary.
A21	0.10 – 0.35	Yellowish-Brown (Munsell 10YR 5/4) apedal Sand. Strongly acidic pH, non-saline. Non-sodic. <2% coarse fragments. No roots and poorly drained. Gradual boundary.
A22	0.35 – 0.60	Pale Yellow (Munsell 5Y 8/3) apedal Loamy Sand. Neutral pH, non-saline. Non-sodic. <2% coarse fragments. No roots and poorly drained. Clear boundary.
B2	0.60+	Light Grey (Munsell 2.5Y 7/1) Sandy Clay Loam, with moderate pedality. Neutral pH, non-saline. Non-sodic. <2% coarse fragments. No roots. Poorly drained. 20 – 50% distinct grey weathered mottles.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.5	Non-saline	5.3	Strongly Acidic	0.7	Non sodic
0.20-0.30	0.2	Non-saline	6.0	Slightly Acidic	1.6	Non sodic
0.40-0.50	0.2	Non-saline	6.7	Neutral	3.2	Non sodic
0.65-0.75	0.3	Non-saline	7.1	Neutral	5.9	Non sodic

Site Description – Site 59 (lab #K7399/203 – 206)				
Site Reference	59	**ASC Name**	Basic Arenic Grey-Orthic Tenosol (BEKKW)	
Average Slope	4%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Mid Slope	**Permeability**	Highly permeable	X: 764746
Surface Condition	Soft	**Drainage**	Imperfectly drained	Y: 6414370



Plate 1 – Soil Profile (59)



Plate 2 – Surface (59)



Plate 3 – Landscape (59)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Very Dark Brown (Munsell 10YR 2/2) Loamy Sand, with weak pedality. Very strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Clear boundary.
A2	0.10 – 0.70	Greyish-Brown (Munsell 10YR 5/2 to 2.5Y 5/2) apedal Loamy Sand. Slightly acidic pH, non-saline. Non-sodic. No coarse fragments. No roots and moderately drained. Gradual boundary.
B2	0.70+	Light Yellowish-Brown (Munsell 10YR 6/4) Loamy Sand, with moderate pedality and moderate consistency. Slightly acidic pH, non-saline. Non-sodic. No coarse fragments. No roots. Moderately drained. 20 – 50% distinct grey weathered mottles.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	1.5	Non-saline	4.9	Very Strongly Acidic	1.9	Non sodic
0.20-0.30	0.3	Non-saline	6.3	Slightly Acidic	3.1	Non sodic
0.40-0.50	0.2	Non-saline	6.4	Slightly Acidic	3.9	Non sodic
0.65-0.75	0.3	Non-saline	6.4	Slightly Acidic	4.5	Non sodic

Site Description – Site 60 (lab #K7399/207 – 210)				
Site Reference	60	**ASC Name**	Eutrophic Mottled-Subnatric Grey Sodosol (BEKOW)	
Average Slope	4%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Mid Slope	**Permeability**	Moderately permeable	X: 764894
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6413737

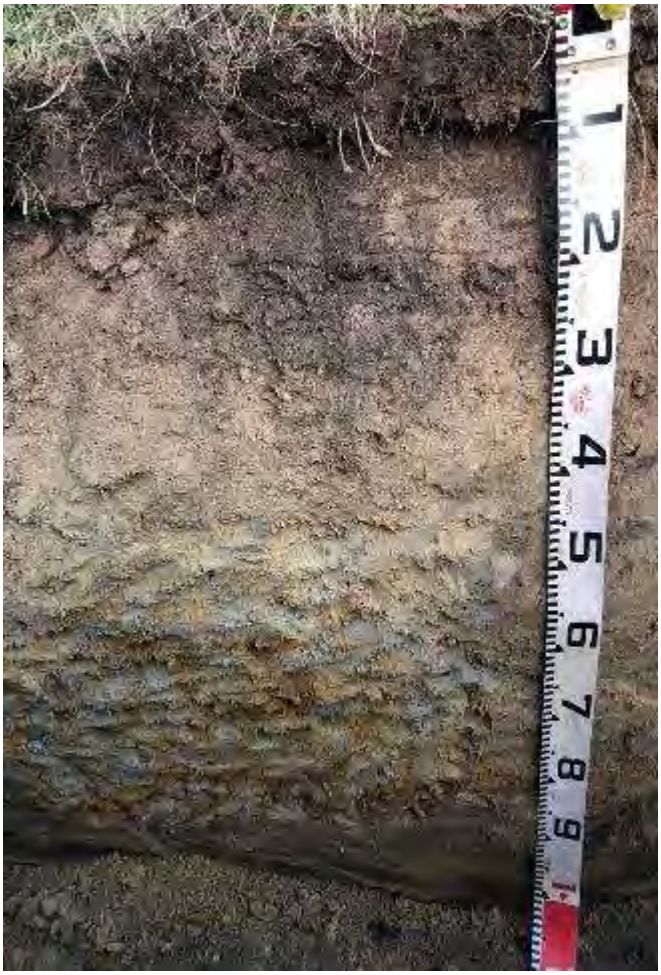


Plate 1 – Soil Profile (60)



Plate 2 – Surface (60)



Plate 3 – Landscape (60)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Very Dark Brown (Munsell 10YR 2/2) Loamy Sand, with weak pedality. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Clear boundary.
A2	0.10 – 0.50	Grey (Munsell 5Y 5/1 to 10YR 5/1) apedal Loamy Sand. Slightly acidic trending to neutral pH, non-saline. Non-sodic. <2% coarse fragments. Very few roots and poorly drained. Clear boundary.
B2	0.50+	Light Brownish Grey (Munsell 2.5Y 6/2) Light Medium Clay, with moderate pedality. Mildly alkaline trending to moderately alkaline pH, non-saline. Sodic. No coarse fragments. No roots. Poorly drained. 20 – 50% distinct grey weathered mottles.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.5	Non-saline	5.8	Moderately Acidic	0.7	Non sodic
0.20-0.30	0.2	Non-saline	6.4	Slightly Acidic	0.6	Non sodic
0.40-0.50	0.2	Non-saline	6.7	Neutral	4.1	Non sodic
0.65-0.75	0.9	Non-saline	6.0	Moderately Acidic	13.6	Sodic

Site Description – Site 61 (lab #K7399/211 – 214)				
Site Reference	61	**ASC Name**	Bleached Eutrophic Red Kandosol (BEKLW)	
Average Slope	4%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderate	MGA 55
Landform Element	Mid Slope	**Permeability**	Moderately permeable	X: 765133
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6413461



Plate 1 – Soil Profile (61)



Plate 2 – Surface (61)



Plate 3 – Landscape (61)

Horizon	Depth (m)	Description
A1	0.00 – 0.15	Dark Brown (Munsell 7.5YR 3/2) Loam, with weak pedality. Slightly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Clear boundary.
A2	0.15 – 0.35	Dark Brown (Munsell 7.5YR 3/3) Loam, with weak pedality. Slightly acidic pH, non-saline. Non-sodic. 20% coarse fragments <5mm. Some roots and poorly drained. Gradual boundary.
B2	0.35+	Reddish-Brown to Red (Munsell 5YR 4/4 to 10R 5/8) Loam, with weak pedality. Neutral pH, non-saline. Non-sodic. 20% coarse fragments 5 - 20mm. No roots. Poorly drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.4	Non-saline	6.1	Slightly Acidic	0.8	Non sodic
0.20-0.30	0.2	Non-saline	6.1	Slightly Acidic	0.6	Non sodic
0.40-0.50	0.2	Non-saline	6.7	Neutral	0.8	Non sodic
0.65-0.75	0.1	Non-saline	6.9	Neutral	0.6	Non sodic

Site Description – Site 62 (lab #K7399/215 – 218)				
Site Reference	62	**ASC Name**	Basic Arenic Brown-Orthic Tenosol (BFKKW)	
Average Slope	6%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Mid Slope	**Permeability**	Moderately permeable	X: 765771
Surface Condition	Soft	**Drainage**	Imperfectly drained	Y: 6412809



Plate 1 – Soil Profile (62)



Plate 2 – Surface (62)



Plate 3 – Landscape (62)

Horizon	Depth (m)	Description
A1	0.00 – 0.15	Very Dark Brown (Munsell 10YR 2/2) Loamy Sand, with moderately pedality. Slightly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Gradual boundary.
B2	0.15 – 0.80	Brown to Reddish-Brown (Munsell 7.5YR 4/3 to 5YR 4/4 to 2.5YR 5/3) Loamy Sand, with weak pedality. Neutral pH, non-saline. Non-sodic. 20% coarse fragments 10 - 20mm. No roots. Moderately drained.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.5	Non-saline	6.3	Slightly Acidic	0.2	Non sodic
0.20-0.30	0.3	Non-saline	6.3	Slightly Acidic	0.4	Non sodic
0.40-0.50	0.2	Non-saline	6.5	Slightly Acidic	0.7	Non sodic
0.65-0.75	0.3	Non-saline	6.9	Neutral	0.9	Non sodic

Site Description – Site 63 (lab #K7399/219 – 222)				
Site Reference	63	**ASC Name**	Bleached-Mottled Mesotrophic Red Chromosol (BEKOW)	
Average Slope	3%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Lower Slope	**Permeability**	Moderately permeable	X: 765726
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6412409



Plate 1 – Soil Profile (63)



Plate 2 – Surface (63)



Plate 3 – Landscape (63)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Dark Brown (Munsell 7.5YR 3/2) Loamy Sand, with moderate pedality. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Clear boundary.
A2	0.20 – 0.50	Pale Brown to Light Yellowish-Brown (Munsell 10YR 6/3 to 10YR 6/4) apedal Loamy Sand. Slightly acidic to neutral pH, non-saline. Non-sodic. 30% coarse fragments <50mm. No roots and poorly drained. Clear boundary.
B2	0.50+	Red (Munsell 2.5YR 5/8) Heavy Clay, with moderate pedality. Mildly alkaline pH, non-saline. Non-sodic. No roots. Poorly drained. 20 – 50% distinct grey weathered mottles.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.5	Non-saline	5.6	Moderately Acidic	0.9	Non sodic
0.20-0.30	0.2	Non-saline	6.4	Slightly Acidic	2.8	Non sodic
0.40-0.50	0.2	Non-saline	6.9	Neutral	0.2	Non sodic
0.65-0.75	0.3	Non-saline	7.3	Mildly Alkaline	0.5	Non sodic

Site Description – Site 64 (no lab #)				
Site Reference	64	**ASC Name**	Shallow Brown Dermosol	
Average Slope	4%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Low	MGA 55
Landform Element	Mid Slope	**Permeability**	Highly permeable	X: 766152
Surface Condition	Soft	**Drainage**	Well drained	Y: 6412361



Plate 1 – Soil Profile (64)



Plate 2 – Surface (64)



Plate 3 – Landscape (64)

Horizon	Depth (m)	Description
A1	0.00 – 0.15	Shallow, skeletal soil with high coarse fragment content. No samples collected for laboratory analysis.

Site Description – Site 65 (lab #K7399/223 – 226)				
Site Reference	65	**ASC Name**	Basic Arenic Brown-Orthic Tenosol (BELLW)	
Average Slope	8%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Mid Slope	**Permeability**	Highly permeable	X: 765534
Surface Condition	Soft	**Drainage**	Well drained	Y: 6412090



Plate 1 – Soil Profile (65)



Plate 2 – Surface (65)



Plate 3 – Landscape (65)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Dark Brown (Munsell 10YR 3/3) Sandy Loam, with moderate pedality. Strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and well drained. Gradual boundary.
B21	0.20 – 0.50	Brown to Red (Munsell 10YR 4/3 to 2.5YR 5/6) Loamy Sand to Loam, with weak pedality. Neutral pH, non-saline. Non-sodic. 20% coarse fragments 5mm. No roots and well drained. Gradual boundary.
B22	0.50+	Reddish-Yellow (Munsell 5YR 6/8) Sandy Loam, with weak pedality. Neutral pH, non-saline. Non-sodic. 20% coarse fragments 20 - 50mm. No roots. Well drained.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.4	Non-saline	5.5	Strongly Acidic	1.1	Non sodic
0.20-0.30	0.2	Non-saline	6.6	Neutral	3.3	Non sodic
0.40-0.50	0.1	Non-saline	6.9	Neutral	2.4	Non sodic
0.65-0.75	0.2	Non-saline	7.2	Neutral	4.5	Non sodic

Site Description – Site 66 (lab #K7399/227 – 230)				
Site Reference	66	**ASC Name**	Basic Arenic Grey-Orthic Tenosol (BEKKW)	
Average Slope	0%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Plain	**Permeability**	Highly permeable	X: 765295
Surface Condition	Loose	**Drainage**	Well drained	Y: 6412804



Plate 1 – Soil Profile (66)



Plate 2 – Surface (66)



Plate 3 – Landscape (66)

Horizon	Depth (m)	Description
A1	0.00 – 0.15	Dark Greyish-Brown (Munsell 10YR 4/2) apedal Sand. Moderately acidic pH, non-saline. Sodic. No coarse fragments. Many roots and well drained. Gradual boundary.
B21	0.15 – 0.60	Pinkish-Grey to Light Grey (Munsell 7.5YR 6/2 to 2.5Y 7/2) apedal Sand. Moderately acidic pH, non-saline. Non-sodic. Increasing gravel presence with depth. No roots and well drained. Gradual boundary.
B22	0.60 – 0.90	Light-Brownish Grey (Munsell 2.5Y 6/2) apedal Loamy Sand. Slightly acidic pH, non-saline. Non-sodic. Increasing gravel presence with depth. No roots and well drained.

Sample Depth	ECe		$pH_{(1:5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.2	Non-saline	5.9	Moderately Acidic	10.1	Sodic
0.20-0.30	0.2	Non-saline	5.7	Moderately Acidic	1.2	Non sodic
0.40-0.50	0.1	Non-saline	5.9	Moderately Acidic	1.1	Non sodic
0.65-0.75	0.2	Non-saline	6.3	Slightly Acidic	1.9	Non sodic

Site Description – Site 67 (lab #M1016/1 – 4)				
Site Reference	67	**ASC Name**	Mottled Eutrophic Red Dermosol (BFKMW)	
Average Slope	2%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Lower Slope	**Permeability**	Highly permeable	X: 764203
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6413250



Plate 1 – Soil Profile (67)



Plate 2 – Surface (67)



Plate 3 – Landscape (67)

Horizon	Depth (m)	Description
A1	0.00 – 0.15	Reddish-Brown (Munsell 5YR 4/4) Loamy Sand with weak structure. Slightly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Gradual boundary.
B21	0.15 – 0.60	Yellowish-Red to Red (Munsell 5YR 5/8 to 2.5YR 5/8) Loam to Clay Loam with moderate structure. Neutral pH, non-saline. Non-sodic. No coarse fragments. Few roots and poorly drained. Gradual boundary.
B22	>0.60	Pale Olive (Munsell 5Y 6/4) Silty Clay Loam with moderate structure. Neutral pH, non-saline. Non-sodic. No coarse fragments. No roots and poorly drained. Distinct grey weathered mottles (20-50%).

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.45	Non-saline	6.2	Slightly Acidic	0.5	Non sodic
0.20-0.30	0.08	Non-saline	6.5	Neutral	1.5	Non sodic
0.40-0.50	0.14	Non-saline	6.5	Neutral	1.4	Non sodic
0.65-0.75	0.19	Non-saline	6.9	Neutral	2.1	Non sodic

Site Description – Site 68 (lab # M1016/5 – 8)				
Site Reference	68	**ASC Name**	Mottled Eutrophic Brown Chromosol (BFLOW)	
Average Slope	2%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Lower Slope	**Permeability**	Moderately permeable	X: 764189
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6413082



Plate 1 – Soil Profile (68)



Plate 2 – Surface (68)



Plate 3 – Landscape (68)

Horizon	Depth (m)	Description
A1	0.00 – 0.15	Very Dark Greyish-Brown (Munsell 10YR 3/2) Loamy Sand with weak structure. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Gradual boundary.
A2	0.15 – 0.30	Yellowish Brown (Munsell 10YR 5/6) Loam with weak structure. Neutral pH, non-saline. Non-sodic. No coarse fragments. Few roots and poorly drained. Clear boundary.
B2	>0.30	Olive Yellow (Munsell 2.5Y 6/6) Medium Clay to Light Clay with moderate structure. Neutral pH, non-saline. Non-sodic. No coarse fragments. No roots and poorly drained. 20 – 50% distinct grey weathered mottles.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.53	Non-saline	5.9	Moderately Acidic	0.5	Non sodic
0.20-0.30	0.10	Non-saline	6.6	Neutral	0.4	Non sodic
0.40-0.50	0.13	Non-saline	6.9	Neutral	0.8	Non sodic
0.65-0.75	0.20	Non-saline	6.9	Neutral	1.3	Non sodic

Site Description – Site 69 (lab # M1016/9 – 12)				
Site Reference	69	**ASC Name**	Haplic Eutrophic Red Dermosol (BFLMW)	
Average Slope	3%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Lower Slope	**Permeability**	Highly permeable	X: 764431
Surface Condition	Soft	**Drainage**	Imperfectly drained	Y: 6413158



Plate 1 – Soil Profile (69)



Plate 2 – Surface (69)



Plate 3 – Landscape (69)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Dark Brown (Munsell 7.5YR 3/3) Loam with moderate structure. Slightly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Gradual boundary.
B21	0.20 – 0.40	Dark Red (Munsell 2.5YR 3/6) Loam with moderate structure. Neutral pH, non-saline. Non-sodic. No coarse fragments. Few roots and moderately drained. Gradual boundary.
B22	0.40 – 0.80	Red (Munsell 10R 4/6) Clay Loam with moderate structure. Mildly alkaline to moderately alkaline pH, non-saline. 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
0-0.10	0.24	Non-saline	6.5	Slightly Acidic	0.5	Non sodic
0.20-0.30	0.13	Non-saline	7.1	Neutral	0.5	Non sodic
0.40-0.50	0.17	Non-saline	7.8	Mildly Alkaline	0.3	Non sodic
0.65-0.75	0.61	Non-saline	8.4	Moderately Alkaline	1.1	Non sodic

Site Description – Site 70 (lab # M1016/13 – 16)				
Site Reference	70	**ASC Name**	Bleached-Mottled Eutrophic Red Chromosol (BGKOW)	
Average Slope	2%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Lower Slope	**Permeability**	Moderately permeable	X: 764553
Surface Condition	Soft	**Drainage**	Imperfectly drained	Y: 6413046



Plate 1 – Soil Profile (70)



Plate 2 – Surface (70)



Plate 3 – Landscape (70)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Dark Brown (Munsell 7.5YR 3/3) Loamy Sand with moderate structure. Slightly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Clear boundary.
A2	0.10 – 0.30	Light Yellowish Brown (Munsell 10YR 6/4) Loamy Sand with weak structure. Neutral pH, non-saline. Non-sodic. No coarse fragments. Common roots and moderately drained. Clear boundary.
B21	0.30 – 0.60	Reddish Yellow (Munsell 5YR 6/6) Clay Loam with strong structure. Neutral pH, non-saline. Non-sodic. No coarse fragments. Few roots and moderately drained. Gradual boundary. Distinct grey weathered mottles (10-20%).
B22	>0.60	Olive Yellow (Munsell 5Y 6/6) Light Medium Clay with strong structure. Mildly alkaline pH, non-saline. Non-sodic. No coarse fragments. No roots and imperfectly drained. Distinct grey weathered mottles (10-20%).

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.56	Non-saline	6.1	Slightly Acidic	1.0	Non sodic
0.20-0.30	0.32	Non-saline	6.7	Neutral	0.9	Non sodic
0.40-0.50	0.20	Non-saline	6.9	Neutral	0.9	Non sodic
0.65-0.75	0.37	Non-saline	7.6	Mildly Alkaline	1.9	Non sodic

Site Description – Site 71 (lab # M1016/17 – 20)				
Site Reference	71	**ASC Name**	Bleached-Sodic Eutrophic Grey Dermosol (BFLMW)	
Average Slope	1%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Drainage Line	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Lower Slope	**Permeability**	Moderately permeable	X: 764695
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6413148



Plate 1 – Soil Profile (71)



Plate 2 – Surface (71)



Plate 3 – Landscape (71)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Very Dark Brown (Munsell 7.5YR 2.5/2) Silty Loam with weak structure. Neutral pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Clear boundary.
A2	0.20 – 0.30	Brown (Munsell 7.5YR 4/2) Silty Loam with weak structure. Strongly alkaline pH, non-saline. Sodic. No coarse fragments. Few roots and poorly drained. Gradual boundary.
B2	0.30 – 0.80	Light-Brownish Grey to Light Grey (Munsell 2.5Y 6/2 to 2.5Y 7/1) Silty Clay Loam with strong structure. Very strongly alkaline pH, non-saline. Sodic. No coarse fragments. Few roots and poorly drained. 20 – 50% distinct grey weathered mottles.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.18	Non-saline	6.6	Neutral	2.6	Non sodic
0.20-0.30	0.28	Non-saline	8.5	Strongly Alkaline	13.1	Sodic
0.40-0.50	0.72	Non-saline	9.2	Very Strongly Alkaline	25.7	Sodic
0.65-0.75	1.75	Non-saline	9.5	Very Strongly Alkaline	36.5	Sodic

Site Description – Site 72 (lab # M1016/21 – 24)				
Site Reference	72	**ASC Name**	Mottled Sodic Eutrophic Grey Chromosol (BFKOW)	
Average Slope	7%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Lower Slope	**Permeability**	Moderately permeable	X: 762953
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6415092



Plate 1 – Soil Profile (72)



Plate 2 – Surface (72)



Plate 3 – Landscape (72)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Very Dark Brown (Munsell 7.5YR 2.5/2) Loamy Sand with weak structure. Strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Gradual boundary.
A2	0.10 – 0.30	Pale Brown (Munsell 10YR 6/3) apedal Loamy Sand. Slightly acidic pH, non-saline. Non-sodic. No coarse fragments. Very few roots and poorly drained. Clear boundary.
B2	0.30 – 0.75	Light-Brownish Grey to Grey (Munsell 2.5Y 6/2 to 2.5Y 6/1) Clay Loam with moderate structure. Moderately acidic to strongly acidic pH, non-saline. Non-sodic trending to sodic at depth. No coarse fragments. Very few roots and poorly drained. 20 – 50% distinct grey weathered mottles.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.64	Non-saline	5.2	Strongly Acidic	2.8	Non sodic
0.20-0.30	0.23	Non-saline	6.1	Slightly Acidic	3.3	Non sodic
0.40-0.50	0.21	Non-saline	5.9	Moderately Acidic	5.5	Non sodic
0.65-0.75	0.47	Non-saline	5.4	Strongly Acidic	8.2	Sodic

Site Description – Site 73 (no lab #)				
Site Reference	73	**ASC Name**	Lithic Leptic Tenosol	
Average Slope	4%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Low	MGA 55
Landform Element	Mid Slope	**Permeability**	Highly permeable	X: 762760
Surface Condition	Soft	**Drainage**	Well drained	Y: 6414883



Plate 1 – Soil Profile (73)



Plate 2 – Surface (73)



Plate 3 – Landscape (73)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Shallow, skeletal soil with high coarse fragment content. No samples collected for laboratory analysis.
B2	0.10 – 0.30	
C	>0.30	

Site Description – Site 74 (lab # M1016/25 – 28)				
Site Reference	74	**ASC Name**	Mottled-Sodic Eutrophic Grey Dermosol (BFKMW)	
Average Slope	6%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Mid Slope	**Permeability**	Moderately permeable	X: 762698
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6414712



Plate 1 – Soil Profile (74)



Plate 2 – Surface (74)



Plate 3 – Landscape (74)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Dark Reddish-Brown (Munsell 5YR 2.5/2) Loamy Sand with moderate structure. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Gradual boundary.
A2	0.10 – 0.30	Brown (Munsell 7.5YR 5/3) apedal Loamy Sand. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Few roots and moderately drained. Gradual boundary.
B2	0.30 – 0.80	Light-Brownish Grey to Olive Grey (Munsell 2.5Y 6/2 to 5Y 6/2) Loam with moderate structure. Slightly acidic pH, non-saline. Sodic. No coarse fragments. Very few roots and poorly drained. 20 – 50% distinct orange weathered mottles.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.66	Non-saline	5.6	Moderately Acidic	2.7	Non sodic
0.20-0.30	0.27	Non-saline	6.0	Slightly Acidic	4.5	Non sodic
0.40-0.50	0.38	Non-saline	7.3	Mildly Alkaline	14.1	Sodic
0.65-0.75	0.74	Non-saline	8.0	Moderately Alkaline	21.0	Sodic

Site Description – Site 75 (lab # M1016/29 – 32)				
Site Reference	75	**ASC Name**	Eutrophic Mottled-Mesonatric Grey Sodosol (BGKOW)	
Average Slope	6%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Mid Slope	**Permeability**	Moderately permeable	X: 762870
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6414676



Plate 1 – Soil Profile (75)



Plate 2 – Surface (75)



Plate 3 – Landscape (75)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Very Dark Brown (Munsell 7.5YR 2.5/2) Loamy Sand with moderate structure. Strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and well drained. Gradual boundary.
A2	0.10 – 0.30	Brown (Munsell 10YR 5/3) apedal Loam. Slightly acidic pH, non-saline. Sodic. No coarse fragments. No roots and well drained. Clear boundary.
B2	0.30 – 0.80	Grey to Light Grey (Munsell 5Y 6/1 to 5Y 7/1) Light Clay to Silty Clay with moderate structure. Strongly alkaline pH, non-saline. Sodic. No coarse fragments. Very few roots and poorly drained. 20 – 50% distinct orange weathered mottles.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.61	Non-saline	5.5	Strongly Acidic	2.6	Non sodic
0.20-0.30	0.13	Non-saline	6.5	Slightly Acidic	6.3	Sodic
0.40-0.50	2.33	Non-saline	8.6	Strongly Alkaline	20.1	Sodic
0.65-0.75	5.50	Moderately saline	8.7	Strongly Alkaline	26.4	Sodic

Site Description – Site 76 (lab # M1016/33 – 36)				
Site Reference	76	**ASC Name**	Bleached-Mottled Eutrophic Red Chromosol (BFKOW)	
Average Slope	4%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Mid Slope	**Permeability**	Moderately permeable	X: 762953
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6414915



Plate 1 – Soil Profile (76)



Plate 2 – Surface (76)



Plate 3 – Landscape (76)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Very Dark Brown (Munsell 7.5YR 2.5/2) Loam with moderate structure. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Gradual boundary.
A2	0.10 – 0.30	Light Brown (Munsell 7.5YR 6/4) Loam with weak structure. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Few roots and poorly drained. Clear boundary.
B2	0.30 – 0.80	Red to Pale Olive (Munsell 2.5YR 4/6 to 5Y 6/3) Light Medium Clay with strong structure. Slightly acidic pH, non-saline. Non-sodic. No coarse fragments. Very few roots and poorly drained. 20 – 50% distinct grey weathered mottles.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.41	Non-saline	5.6	Moderately Acidic	1.2	Non sodic
0.20-0.30	0.13	Non-saline	6.9	Neutral	1.6	Non sodic
0.40-0.50	0.22	Non-saline	7.3	Neutral	1.9	Non sodic
0.65-0.75	0.34	Non-saline	7.3	Mildly Alkaline	3.8	Non sodic

Site Description – Site 77 (no lab #)				
Site Reference	77	**ASC Name**	Brown Chromosol	
Average Slope	9%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Mid Slope	**Permeability**	Highly permeable	X: 762829
Surface Condition	Soft	**Drainage**	Imperfectly drained	Y: 6414562



Plate 1 – Soil Profile (77)



Plate 2 – Surface (77)



Plate 3 – Landscape (77)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Brown Sandy Loam (field assessment) with moderate structure. No coarse fragments. Many roots and moderately drained. Clear boundary.
B21	0.10 – 0.30	Light Brown Loamy Sand (field assessment) with weak structure. 10% coarse fragments. Few roots and moderately drained. Gradual boundary.
B22	0.30 – 0.50	Orange Clay (field assessment) with strong structure. No coarse fragments. Few roots and moderately drained. Gradual boundary.
BC	0.50 – 0.80	Weathered parent material/rock. (Clay content, strong structure, contains 20-50% distinct grey mottles. Poorly drained.)

No samples collected for laboratory analysis due to soil depth limitation.

Site Description – Site 78 (lab # M1016/37 – 40)				
Site Reference	78	**ASC Name**	Bleached-Mottled Eutrophic Yellow Chromosol (BFKOW)	
Average Slope	7%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Mid Slope	**Permeability**	Moderately permeable	X: 762922
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6414335



Plate 1 – Soil Profile (78)



Plate 2 – Surface (78)



Plate 3 – Landscape (78)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Very Dark Brown (Munsell 10YR 2/2) Loam with moderate structure. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Clear boundary.
A2	0.10 – 0.30	Pale Brown (Munsell 10YR 6/3) Loam with weak structure. Slightly acidic pH, non-saline. Non-sodic. No coarse fragments. Few roots and poorly drained. Clear boundary.
B2	0.30 – 0.80	Light Yellowish-Brown to Light-Brownish Grey (Munsell 10YR 6/4 to 2.5Y 6/2) Heavy Clay to Medium Clay with strong structure. Neutral to moderately alkaline pH, non-saline. Non-sodic. No coarse fragments. No roots and poorly drained. 20 – 50% distinct grey weathered mottles.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.27	Non-saline	5.6	Moderately Acidic	0.9	Non sodic
0.20-0.30	0.13	Non-saline	6.3	Slightly Acidic	1.1	Non sodic
0.40-0.50	0.17	Non-saline	7.2	Neutral	1.2	Non sodic
0.65-0.75	0.62	Non-saline	8.2	Moderately Alkaline	1.0	Non sodic

Site Description – Site 79 (lab # M1016/41 – 44)				
Site Reference	79	**ASC Name**	Eutrophic Mottled-Subnatric Grey Sodosol (BFLMW)	
Average Slope	2%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Drainage Line	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Lower Slope	**Permeability**	Highly permeable	X: 763154
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6414722



Plate 1 – Soil Profile (79)



Plate 2 – Surface (79)



Plate 3 – Landscape (79)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Very Dark Brown (Munsell 7.5YR 2.5/2) Loam with moderate structure. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and well drained. Gradual boundary.
A2	0.20 – 0.60	Dark Greyish Brown to Pale Brown (Munsell 10YR 4/2 to 10YR 6/3) apedal Loamy Sand. Neutral to mildly alkaline pH, non-saline. Non-sodic. No coarse fragments. Few roots and moderately drained. Clear boundary.
B2	0.60 – 0.75	Light-Brownish Grey (Munsell 2.5Y 6/2) Clay Loam with moderate structure. Strongly alkaline pH, non-saline. Sodic. No coarse fragments. No roots and poorly drained. 20 – 50% distinct grey weathered mottles.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.28	Non-saline	6.0	Moderately Acidic	0.5	Non sodic
0.20-0.30	0.25	Non-saline	6.8	Neutral	1.7	Non sodic
0.40-0.50	0.22	Non-saline	7.5	Mildly Alkaline	2.7	Non sodic
0.65-0.75	0.67	Non-saline	8.8	Strongly Alkaline	12.9	Sodic

Site Description – Site 80 (lab # M1016/45 – 48)				
Site Reference	80	**ASC Name**	Bleached-Mottled Eutrophic Yellow Chromosol (BGLOW)	
Average Slope	3%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Mid Slope	**Permeability**	Moderately permeable	X: 763337
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6414563



Plate 1 – Soil Profile (80)



Plate 2 – Surface (80)



Plate 3 – Landscape (80)

Horizon	Depth (m)	Description
A1	0.00 – 0.15	Dark Brown (Munsell 7.5YR 3/2) Silty Loam with moderate structure. Strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Gradual boundary.
A2	0.15 – 0.30	Light Brownish-Grey (Munsell 2.5Y 6/2) apedal Silty Loam. Slightly acidic pH, non-saline. Non-sodic. No coarse fragments. Few roots and poorly drained. Clear boundary.
B2	0.30 – 0.80	Reddish-Yellow to Olive Grey (Munsell 7.5YR 6/8 to 5Y 5/2) Heavy Clay with strong pedality. Moderately acidic to slightly acidic pH, non-saline. Non-sodic. No coarse fragments. Few roots and very poorly drained. 20 – 50% distinct grey weathered mottles.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.28	Non-saline	5.4	Strongly Acidic	0.8	Non sodic
0.20-0.30	0.11	Non-saline	6.5	Slightly Acidic	1.8	Non sodic
0.40-0.50	0.16	Non-saline	5.9	Moderately Acidic	2.8	Non sodic
0.65-0.75	0.13	Non-saline	6.5	Slightly Acidic	4.2	Non sodic

Site Description – Site 81 (no lab #)				
Site Reference	81	**ASC Name**	Brown Dermosol	
Average Slope	6%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillcrest	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Crest/upper slope	**Permeability**	Highly permeable	X: 762601
Surface Condition	Soft	**Drainage**	Well drained	Y: 6412913



Plate 1 – Soil Profile (81)



Plate 2 – Surface (81)



Plate 3 – Landscape (81)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Brown Clay Loam (field assessment) with moderate structure. 80% coarse fragments 50 – 100mm. Many roots and moderately drained. Gradual boundary.
BC	0.10 +	Weathered parent material/rock. (Transition horizon, 70% coarse fragments 50 – 200mm.)

Due to the rock and depth limitations of this site, no samples were submitted for laboratory analysis.

Site Description – Site 82 (lab #M6945/1 - 4)				
Site Reference	82	**ASC Name**	Haplic Eutrophic Red Dermosol (BFLOW)	
Average Slope	7%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillcrest	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Upper Slope	**Permeability**	Highly permeable	X: 763027
Surface Condition	Soft	**Drainage**	Imperfectly drained	Y: 6412502



Plate 1 – Soil Profile (82)



Plate 2 – Surface (82)



Plate 3 – Landscape (82)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Dark reddish-brown (Munsell 5YR 2.5/2) Loam with moderate structure. Slightly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Clear boundary.
A2	0.10 – 0.30	Yellowish-Red (Munsell 5YR 4/6) Loam with moderate structure. Slightly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Gradual boundary.
-	0.30 – 0.50	Sandstone layer. 50 – 80% distinct yellow and grey mottling. 90% coarse fragment material to 200mm.
B2	0.50 – 0.80+	Red to Very Pale Brown (Munsell 2.5YR 4/8 to 10YR 7/3) Heavy Clay with moderate pedality. Neutral to mildly alkaline pH, non-saline. Non-sodic. No coarse fragments. No roots and moderately drained.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.7	Non-saline	6.0	Slightly Acidic	0.1	Non sodic
0.20-0.30	0.1	Non-saline	6.4	Slightly Acidic	0.3	Non sodic
0.50-0.60	0.1	Non-saline	7.3	Neutral	0.5	Non sodic
0.65-0.75	0.2	Non-saline	7.5	Mildly Alkaline	1.0	Non sodic

Site Description – Site 83 (lab #M6945/5 - 8)				
Site Reference	83	**ASC Name**	Haplic Eutrophic Red Dermosol (BGMOV)	
Average Slope	1%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillcrest	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Crest	**Permeability**	Highly permeable	X: 762569
Surface Condition	Soft	**Drainage**	Imperfectly drained	Y: 6412489



Plate 1 – Soil Profile (83)



Plate 2 – Surface (83)



Plate 3 – Landscape (83)

Horizon	Depth (m)	Description
A1	0.00 – 0.15	Dark Reddish-Brown (Munsell 5YR 3/4) Silty Loam with strong structure. Moderately acidic pH, non-saline. Non-sodic. 80% coarse fragments 60 – 200mm. Common roots and moderately drained. Gradual boundary.
B2	0.15 – 0.75	Dark Reddish-Brown to Dark Red (Munsell 2.5YR 2.5/4 to 2.5YR 3/6) Heavy Clay with strong structure. Neutral trending to mildly alkaline pH, non-saline. Non-sodic. 50% coarse fragments 60mm+. Few roots and moderately drained. Gradual boundary.
BC	0.75+	Weathered parent material/rock.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.8	Non-saline	5.9	Moderately Acidic	0.2	Non sodic
0.20-0.30	0.1	Non-saline	6.8	Neutral	0.7	Non sodic
0.40-0.50	0.1	Non-saline	6.8	Neutral	0.3	Non sodic
0.65-0.75	0.5	Non-saline	7.4	Mildly Alkaline	0.1	Non sodic

Site Description – Site 84 (lab #M6945/9 - 12)				
Site Reference	84	**ASC Name**	Haplic Eutrophic Red Dermosol (BFNOW)	
Average Slope	3%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillcrest	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Crest	**Permeability**	Highly permeable	X: 762206
Surface Condition	Soft	**Drainage**	Imperfectly drained	Y: 6412353



Plate 1 – Soil Profile (84)



Plate 2 – Surface (84)



Plate 3 – Landscape (84)

Horizon	Depth (m)	Description
A1	0.00 – 0.15	Very Dark Brown (Munsell 7.5YR 2.5/2) Silty Loam with strong structure. Mildly alkaline pH, non-saline. Non-sodic. 90% coarse fragments to 200mm. Common roots and moderately drained. Gradual boundary.
B2	0.15 – 0.75+	Dark Reddish-Brown (Munsell 2.5YR 2.5/4) Silty Clay to Heavy Clay with strong structure. Mildly alkaline trending to neutral pH, non-saline. Non-sodic. 50% coarse fragments 60 – 200mm. Very few roots and moderately drained.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.8	Non-saline	7.4	Mildly Alkaline	0.1	Non sodic
0.20-0.30	0.5	Non-saline	7.5	Mildly Alkaline	0.2	Non sodic
0.40-0.50	0.4	Non-saline	7.1	Neutral	0.4	Non sodic
0.65-0.75	0.2	Non-saline	7.2	Neutral	0.9	Non sodic

Site Description – Site 85 (lab #220849/1 - 4)				
Site Reference	85	**ASC Name**	Mottled Eutrophic Yellow Kandosol (BELMW)	
Average Slope	5%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderate	MGA 55
Landform Element	Mid Slope	**Permeability**	Highly permeable	X: 762816
Surface Condition	Soft/ Loose	**Drainage**	Imperfectly drained	Y: 6414122



Plate 1 – Soil Profile (85)



Plate 2 – Surface (85)



Plate 3 – Landscape (85)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Dark Yellowish Brown (Munsell 10YR 3/6) Loamy Sand with moderate structure. Strongly acidic pH, non-saline and non-sodic. No coarse fragments. Many roots and moderately drained. Gradual boundary.
A2	0.10 – 0.50	Brownish-Yellow (Munsell 10YR 6/6) Loamy Sand to Sandy Loam with weak structure. Strongly to slightly acidic pH, non-saline and non-sodic. 10% coarse fragments 10mm. Few roots and moderately drained. Gradual boundary.
B2	0.50 – 0.85	Light Yellowish-Brown (Munsell 10YR 6/4) Sandy Loam with weak pedality. Neutral pH, non-saline and non-sodic. No coarse fragments. No roots and moderately drained. 50% distinct grey mottling.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.9	Non-saline	5.3	Strongly Acidic	2.7	Non sodic
0.20-0.30	0.2	Non-saline	5.0	Strongly Acidic	2.0	Non sodic
0.40-0.50	0.1	Non-saline	6.2	Slightly Acidic	1.7	Non sodic
0.65-0.75	0.3	Non-saline	6.7	Neutral	3.0	Non sodic

Site Description – Site 86 (no lab #)				
Site Reference	86	**ASC Name**	Brown Kandosol	
Average Slope	5%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	-	MGA 55
Landform Element	Low Slope	**Permeability**	Highly permeable	X: 762895
Surface Condition	Loose	**Drainage**	Well drained	Y: 6414002



Plate 1 – Soil Profile (86)



Plate 2 – Surface (86)



Plate 3 – Landscape (86)

Horizon	Depth (m)	Description
A1	0.00 – 0.25	Grey Loam (field assessment) with moderate pedality. Strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Common roots and well drained. Gradual boundary.
-	0.25 – 0.35	Rock layer consisting of 95% coarse fragment ~100mm.
B2	0.35 – 0.80+	Grey-Brown Clay Loam (field assessment) with weak pedality. 30% coarse fragments <10mm with occasional sandstone floater 200mm+. Very few roots and well drained.

Site Description – Site 87 (no lab #)				
Site Reference	87	**ASC Name**	Red Duplex	
Average Slope	2%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Drainage Plain	**Soil Fertility**	-	MGA 55
Landform Element	Lower Slope	**Permeability**	Highly permeable	X: 763044
Surface Condition	Loose	**Drainage**	Poorly drained	Y: 6414099



Plate 1 – Soil Profile (87)



Plate 2 – Surface (87)



Plate 3 – Landscape (87)

Horizon	Depth (m)	Description
A1	0.00 – 0.15	Grey Loamy Sand (field assessment) with moderate structure. No coarse fragments. Many roots and moderately drained. Gradual boundary.
A2	0.15 – 0.30	Bleached Sand. Apedal. 30% coarse fragments <10mm. Very few roots and poorly drained (bleached horizon). Clear boundary.
B2	0.30 – 0.80	Reddish Brown Medium Clay (field assessment) with strong pedality. No coarse fragments. Very few roots and poorly drained.

Site Description – Site 88 (no lab #)				
Site Reference	88	**ASC Name**	Yellow Duplex	
Average Slope	3%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	-	MGA 55
Landform Element	Lower to Mid Slope	**Permeability**	Moderately permeable	X: 763277
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6414268



Plate 1 – Soil Profile (88)



Plate 2 – Surface (88)



Plate 3 – Landscape (88)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Grey Loamy Sand (field assessment) with moderate structure. No coarse fragments. Many roots and moderately drained. Gradual boundary.
A2	0.10 – 0.40	Bleached Sand (field assessment). Apedal. 20% coarse fragments 10mm. Very few roots and poorly drained (bleached horizon). Clear boundary.
B2	0.40 – 0.80+	Yellow Medium Clay (field assessment) with strong pedality. No coarse fragments. No roots and very poorly drained. 40% distinct grey mottling.

Site Description – Site 89 (lab #220849/5 - 8)				
Site Reference	89	**ASC Name**	Haplic Eutrophic Red Dermosol (BFLOW)	
Average Slope	5%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Lower Slope	**Permeability**	Highly permeable	X: 762803
Surface Condition	Soft	**Drainage**	Imperfectly drained	Y: 6413439



Plate 1 – Soil Profile (89)



Plate 2 – Surface (89)



Plate 3 – Landscape (89)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Yellowish-Red (Munsell 5YR 4/6) Sandy Loam with moderate structure. Very strongly acidic pH, non-sodic and non-saline. No coarse fragments. Many roots and moderately drained. Gradual boundary.
A2	0.10 – 0.60	Yellowish-Red (Munsell 5YR 4/6 to 5YR 5/8) Loam with weak structure. Slightly acidic pH, non-saline and non-sodic. No coarse fragments. Few roots and poorly drained. Gradual boundary.
B2	0.60 +	Reddish-Yellow (Munsell 5YR 6/6) Light Medium Clay with moderate pedality. No coarse fragments. Few roots and moderately drained. 10% faint grey mottling.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.4	Non-saline	4.96	Very Strongly Acidic	2.9	Non sodic
0.20-0.30	0.2	Non-saline	6.0	Slightly Acidic	3.4	Non sodic
0.40-0.50	0.1	Non-saline	6.5	Slightly Acidic	3.4	Non sodic
0.65-0.75	0.3	Non-saline	6.8	Neutral	2.8	Non sodic

Site Description – Site 90 (no lab #)				
Site Reference	90	**ASC Name**	Red Duplex	
Average Slope	1%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	-	MGA 55
Landform Element	Lower Slope	**Permeability**	Moderately permeable	X: 763221
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6414404



Plate 1 – Soil Profile (90)



Plate 2 – Surface (90)



Plate 3 – Landscape (90)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Greyish Brown Loamy Sand (field assessment) with weak structure. No coarse fragments. Many roots and moderately drained. Gradual boundary.
A2	0.20 – 0.50	Grey Loamy Sand (field assessment) with weak structure. 20% coarse fragments <10mm. Few roots and poorly drained (bleached horizon). Clear boundary.
B2	0.50 – 0.80 +	Yellowish red medium Clay (field assessment) with moderate pedality. 20% coarse fragments 10mm. Few roots and moderately drained. 20% faint grey mottling.

Site Description – Site 91 (no lab #)				
Site Reference	91	**ASC Name**	Yellow Duplex	
Average Slope	1%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	-	MGA 55
Landform Element	Lower Slope	**Permeability**	Moderately permeable	X: 763020
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6414532



Plate 1 – Soil Profile (91)



Plate 2 – Surface (91)



Plate 3 – Landscape (91)

Horizon	Depth (m)	Description
A1	0.00 – 0.20	Greyish Brown Loamy Sand (field assessment) with weak structure. No coarse fragments. Many roots and moderately drained. Gradual boundary.
A2	0.20 – 0.55	Bleached Loamy Sand (field assessment) with weak structure. 20% coarse fragments <10mm. Few roots and poorly drained (bleached horizon). Clear boundary.
B2	0.55 – 0.80 +	Yellow Heavy Clay (field assessment) with moderate pedality. 20% coarse fragments 10mm. Few roots and poorly drained. 30% distinct grey mottling.

Site Description – Site 92 (no lab #)				
Site Reference	92	**ASC Name**	Red Duplex	
Average Slope	6%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	-	MGA 55
Landform Element	Mid Slope	**Permeability**	Highly permeable	X: 763883
Surface Condition	Loose	**Drainage**	Poorly drained	Y: 6414221



Plate 1 – Soil Profile (92)



Plate 2 – Surface (92)



Plate 3 – Landscape (92)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Light Brown Loamy Sand (field assessment) with weak structure. No coarse fragments. Many roots and moderately drained. Gradual boundary.
A2	0.10 – 0.60	Bleached Sand (field assessment). Apedal. <5% coarse fragments <10mm. Few roots and poorly drained (bleached horizon). Clear boundary.
B2	0.60 +	Reddish Brown Medium Clay (field assessment) with moderate pedality. No coarse fragments. No roots and poorly drained. 40% distinct grey mottling.

Site Description – Site 93 (no lab #)				
Site Reference	93	**ASC Name**	Yellow Duplex	
Average Slope	6%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	-	MGA 55
Landform Element	Lower to Mid Slope	**Permeability**	Highly permeable	X: 763939
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6413813



Plate 1 – Soil Profile (93)



Plate 2 – Surface (93)



Plate 3 – Landscape (93)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Light Brown Sandy Loam (field assessment) with moderate structure. No coarse fragments. Many roots and moderately drained. Gradual boundary.
A2	0.10 – 0.65	Grey Sand (field assessment) with weak pedality. 5% coarse fragments 10mm. Few roots and poorly drained (bleached horizon). Clear boundary.
B2	0.65 – 0.90+	Yellow Sandy Clay (field assessment) with moderate pedality. No coarse fragments. Few roots and poorly drained. 30% grey distinct mottling.

Site Description – Site 94 (no lab #)				
Site Reference	94	**ASC Name**	Red Duplex	
Average Slope	8%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	-	MGA 55
Landform Element	Mid Slope	**Permeability**	Moderately permeable	X: 763770
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6413602



Plate 1 – Soil Profile (94)



Plate 2 – Surface (94)



Plate 3 – Landscape (94)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Pale Brown Sandy Loam (field assessment) with weak structure. No coarse fragments. Many roots and moderately drained. Gradual boundary.
A2	0.10 – 0.55	Grey Sandy Loam with weak structure. 30% coarse fragments 10 – 50mm. Few roots and poorly drained (bleached horizon). Clear boundary.
B2	0.55 – 0.80	Reddish Brown Sandy Clay (field assessment) with moderate pedality. 40% coarse fragments 20mm. Few roots and poorly drained. 50% distinct grey mottling.

Site Description – Site 95 (no lab #)				
Site Reference	95	**ASC Name**	Red Duplex	
Average Slope	9%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	-	MGA 55
Landform Element	Lower to Mid Slope	**Permeability**	Moderately permeable	X: 763738
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6413423



Plate 1 – Soil Profile (95)



Plate 2 – Surface (95)



Plate 3 – Landscape (95)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Brown Sandy Loam (field assessment) with moderate structure. No coarse fragments. Many roots and moderately drained. Clear boundary.
A2	0.10 – 0.40	White Loamy Sand (field assessment) with weak pedality. 40% coarse fragments 5 – 20mm. Few roots and poorly drained. Clear boundary.
B2	0.40 – 0.70	Yellowish Red Sandy Clay (field assessment) with moderate pedality. 20% coarse fragments 10 – 20mm. Very few roots and poorly drained. 90% distinct grey and orange mottling. Gradual boundary.
C	0.70+	Parent material.

Site Description – Site 96 (lab #M6945/13 - 17)				
Site Reference	96	**ASC Name**	Magnesic Mesonatric Grey Sodosol (BFMOW)	
Average Slope	1%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Plain	**Permeability**	Moderately permeable	X: 764165
Surface Condition	Hard set	**Drainage**	Poorly drained	Y: 6413331



Plate 1 – Soil Profile (96)



Plate 2 – Surface (96)



Plate 3 – Landscape (96)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Dark Brown (Munsell 7.5YR 3/4) Loam Sand with moderate structure. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Abrupt boundary.
A2	0.10 – 0.20	White (Munsell 7.5YR 8/1) Loamy Sand with very weak pedality. Neutral pH, non-saline. Sodic. 20% coarse fragments <10mm. Few roots and poorly drained (bleached horizon). Clear boundary.
B21	0.20 – 0.60	Pale Brown to Brown (Munsell 10YR 6/3 to 7.5YR 5/2) Clay Loam to Light-Medium Clay with moderate pedality. Moderately to strongly alkaline pH, non-saline. Sodic. No coarse fragments. Few roots and very poorly drained. 50% distinct grey mottling. Gradual boundary.
B22	0.60 – 0.80	Light Yellowish Brown (Munsell 10YR 6/4) Clay Loam with moderate pedality. Slightly alkaline pH, non-saline. Sodic. No coarse fragments. Few roots and very poorly drained. 40% distinct grey mottling.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	1.5	Non-saline	5.7	Moderately Acidic	2.9	Non sodic
0.10-0.20	0.4	Non-saline	6.7	Neutral	7.4	Sodic
0.25-0.35	0.9	Non-saline	8.0	Moderately Alkaline	17.8	Sodic
0.40-0.50	1.9	Non-saline	8.5	Strongly Alkaline	23.0	Sodic
0.65-0.75	2.1	Non-saline	8.8	Strongly Alkaline	25.9	Sodic

Site Description – Site 97 (lab #M6945/18 - 21)				
Site Reference	97	**ASC Name**	Bleached-Mottled Eutrophic Red Chromosol (BEMOW)	
Average Slope	4%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Mid Slope	**Permeability**	Moderately permeable	X: 764220
Surface Condition	Loose	**Drainage**	Poorly drained	Y: 6412924



Plate 1 – Soil Profile (97)



Plate 2 – Surface (97)



Plate 3 – Landscape (97)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Brown (Munsell 7.5YR 4/3) Loam with moderate structure. Slightly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Clear boundary.
A2	0.10 – 0.30	Reddish-Brown (Munsell 5YR 5/4) Loam with weak structure. Neutral pH, non-saline. Non-sodic. 40% coarse fragments 10 -50mm. Few roots and poorly drained (bleached horizon). Clear boundary.
B21	0.30 – 0.50	Red (Munsell 2.5YR 4/8) Heavy Clay with strong pedality. Mildly alkaline pH, non-saline. Non-sodic. No coarse fragments. Few roots and poorly drained. 10% distinct grey mottling. Gradual boundary.
B22	0.50 – 0.80	Greyish-Brown (Munsell 10YR 5/2) Medium Clay with moderate pedality. Moderately alkaline pH, non-saline. Non-sodic. No coarse fragments. No roots and poorly drained. 40% distinct grey mottling.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.3	Non-saline	6.3	Slightly Acidic	0.6	Non sodic
0.15-0.25	0.1	Non-saline	6.7	Neutral	0.4	Non sodic
0.30-0.40	0.2	Non-saline	7.6	Mildly Alkaline	1.4	Non sodic
0.65-0.75	0.6	Non-saline	8.1	Moderately Alkaline	2.5	Non sodic

Site Description – Site 98 (lab #M6945/22 - 25)				
Site Reference	98	**ASC Name**	Bleached-Mottled Eutrophic Grey Chromosol (BFKOW)	
Average Slope	7%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Mid Slope	**Permeability**	Highly permeable	X: 764513
Surface Condition	Hard Set	**Drainage**	Poorly drained	Y: 6412827



Plate 1 – Soil Profile (98)



Plate 2 – Surface (98)



Plate 3 – Landscape (98)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Brown (Munsell 7.5YR 4/2) Loamy Sand with moderate structure. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Clear boundary.
A2	0.10 – 0.40	Pale Brown (Munsell 10YR 6/3) Silty Loamy Sand with weak structure. Neutral pH, non-saline. Non-sodic. 30% coarse fragments 5 – 20mm. Few roots and poorly drained (bleached horizon). Clear boundary.
B2	0.40 – 0.80 +	Light Grey (Munsell 10YR 7/1) Medium Clay to Heavy Clay with moderate pedality. Mildly to moderately alkaline pH, non-saline. Non-sodic. No coarse fragments. Very few roots and poorly drained. 30% distinct grey mottling.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.5	Non-saline	6.0	Moderately Acidic	0.2	Non sodic
0.20-0.30	0.2	Non-saline	6.6	Neutral	0.2	Non sodic
0.50-0.60	0.2	Non-saline	7.7	Mildly Alkaline	1.8	Non sodic
0.65-0.75	0.3	Non-saline	7.9	Moderately Alkaline	3.2	Non sodic

Site Description – Site 99 (lab #M6945/26 - 29)				
Site Reference	99	**ASC Name**	Bleached-Mottled Eutrophic Grey Chromosol (BGKOW)	
Average Slope	3%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Lower Slope	**Permeability**	Highly permeable	X: 764655
Surface Condition	Hard Set	**Drainage**	Poorly drained	Y: 6413016



Plate 1 – Soil Profile (99)



Plate 2 – Surface (99)



Plate 3 – Landscape (99)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Brown (Munsell 10YR 4/3) Loamy Sand with moderate structure. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Clear boundary.
A2	0.10 – 0.50	Light Grey (Munsell 10YR 7/2) Loamy Sand with weak structure. Neutral trending to moderately alkaline pH, non-saline. Non-sodic. 30% coarse fragments 10mm. Few roots, poorly drained (bleached horizon). Clear boundary.
B21	0.50 – 0.60	Light Grey (Munsell 2.5Y 7/2) Light Clay with moderate pedality. Moderately alkaline pH, non-saline. Non-sodic. No coarse fragments. No roots and poorly drained. 30% distinct grey mottling. Gradual boundary.
B22	0.60 – 0.80 +	Red (Munsell 2.5YR 5/8) Light Clay with moderate pedality. Moderately alkaline pH, non-saline. Non-sodic. No coarse fragments. No roots and poorly drained. 30% distinct grey mottling.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.5	Non-saline	6.0	Moderately Acidic	0.2	Non sodic
0.20-0.30	0.2	Non-saline	6.8	Neutral	0.6	Non sodic
0.50-0.60	0.2	Non-saline	7.8	Moderately Alkaline	0.3	Non sodic
0.65-0.75	0.2	Non-saline	7.8	Moderately Alkaline	0.4	Non sodic

Site Description – Site 100 (lab #M6945/30 - 33)				
Site Reference	100	**ASC Name**	Eutrophic Mottled-Subnatric Yellow-Grey Sodosol (BFKMW)	
Average Slope	1%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Mid Slope	**Permeability**	Moderately permeable	X: 764624
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6413308



Plate 1 – Soil Profile (100)



Plate 2 – Surface (100)



Plate 3 – Landscape (100)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Light Brownish Grey (Munsell 10YR 5/2) Loamy Sand with weak structure. Slightly acidic pH, non-saline. Non-sodic. No coarse fragments. Many roots and moderately drained. Clear boundary.
A2	0.10 – 0.60	Pale Brown (Munsell 10YR 6/3) Loamy Sand to Loam with weak structure. Neutral pH, non-saline. Non-sodic. 20% coarse fragments <10mm. Few roots and poorly drained (bleached horizon). Clear boundary.
B2	0.60 – 0.80	Light Grey (Munsell 5Y 7/1) Clay Loam with moderate structure. Moderately alkaline pH, non-saline. Sodic. No coarse fragments. Few roots and very poorly drained. 50% distinct grey mottling.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.6	Non-saline	6.1	Slightly Acidic	0.3	Non sodic
0.20-0.30	0.2	Non-saline	6.8	Neutral	0.3	Non sodic
0.40-0.50	0.1	Non-saline	7.1	Neutral	2.1	Non sodic
0.65-0.75	0.7	Non-saline	7.9	Moderately Alkaline	10.6	Sodic

Site Description – Site 101 (no lab #)				
Site Reference	101	**ASC Name**	Yellow-Grey Duplex	
Average Slope	4%	**Land Use**	Grazing, Scrub	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	-	MGA 55
Landform Element	Mid Slope	**Permeability**	Moderately permeable	X: 764399
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6413388



Plate 1 – Soil Profile (101)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Brown Loamy Sand (field assessment) with moderate structure. 10% coarse fragments 5 – 20mm. Many roots and moderately drained. Clear boundary.
A2	0.10 – 0.30	Bleached Loamy Sand (field assessment) with weak pedality. No coarse fragments. Few roots and poorly drained. Clear boundary.
B2	0.30+	Yellow Heavy Clay (field assessment) with moderate pedality. No coarse fragments. Few roots and poorly drained.

Site Description – Site 102 (no lab #)				
Site Reference	102	**ASC Name**	Yellow-Grey Duplex	
Average Slope	2%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	-	MGA 55
Landform Element	Mid Slope	**Permeability**	Moderately permeable	X: 764288
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6413405



Plate 1 – Soil Profile (102)



Plate 2 – Surface (102)



Plate 3 – Landscape (102)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Brown Loamy Sand (field assessment) with strong structure. No coarse fragments. Many roots and moderately drained. Clear boundary.
A2	0.10 – 0.30	Bleached Loamy Sand (field assessment) with weak pedality. No coarse fragments. Few roots and poorly drained. Clear boundary.
B2	0.30+	Yellow Heavy Clay (field assessment) with strong pedality. No coarse fragments. No roots and poorly drained.

Site Description – Site 103 (lab #221569-1 – 4)				
Site Reference	103	**ASC Name**	-*	
Average Slope	2%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Lower Slope	**Permeability**	Moderately permeable	X: 764074
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6413251



Plate 1 – Soil Profile (103)



Plate 2 – Surface (103)



Plate 3 – Landscape (103)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Very Dark Brown (Munsell 7.5YR 2.5/3) Loamy Sand, with moderate structure. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many fine roots and moderately drained.
-	0.10 – 0.30	Bleached Pale Brown (Field Munsell 10YR 7/4) Loamy Sand, with weak structure. Slightly acidic pH, slightly saline. Non-sodic. 40% coarse fragments 5 – 20mm. Very few roots and poorly drained.
-	0.30 – 0.60	Light Yellowish Brown (Munsell 10YR 6/4) Sand*. Slightly acidic pH, non-saline. Sodic. No coarse fragments. Very few roots and poorly drained. 30% distinct grey weathered mottles.
-	0.60+	Pale Brown (Munsell 2.5Y 7/4) Sandy Loam*. Slightly acidic pH, non-saline. Non-sodic. No coarse fragments. No roots. Poorly drained. 30% distinct grey weathered mottles.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.7	Non-saline	5.7	Moderately Acidic	4.8	Non sodic
0.20-0.30	0.2	Non-saline	6.1	Slightly Acidic	4.3	Non sodic
0.40-0.50	0.2	Non-saline	6.2	Slightly Acidic	16.4	Sodic
0.65-0.75	0.1	Non-saline	6.4	Slightly Acidic	3.4	Non sodic

*Due to soil saturation resulting in pit slumping, it was not safe to access pit for clear assessment of profile boundaries and field distinctions. All effort was made to obtain clean unmixed samples at estimated layer depths, however there may be some inaccuracies with this site so it is considered a lab tested check site.

Site Description – Site 104 (lab # lab #221569-5 – 8)				
Site Reference	104	**ASC Name**	Eutrophic Mottled-Subnatric Brown Sodosol (BFLOWNR)	
Average Slope	2%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Lower Slope	**Permeability**	Moderately permeable	X: 764212
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6413277



Plate 1 – Soil Profile (104)



Plate 2 – Surface (103)



Plate 3 – Pit (104)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Dark Brown (Munsell 7.5YR 3/4) Loam, with moderate structure. Slightly acidic pH, non-saline. Non-sodic. No coarse fragments. Many fine roots and moderately drained. Clear boundary.
A2	0.10 – 0.30	Bleached Pale Brown (Field Munsell 10YR 7/3) Loam, with weak structure. Neutral pH, slightly saline. Sodic. No coarse fragments 5 – 20mm. Very few roots and poorly drained. Clear boundary.
B21	0.30 – 0.60	Yellowish Brown (Munsell 10YR 5/4) Medium Clay, with strong structure. Mildly alkaline pH, non-saline. Sodic. No coarse fragments. Very few roots and poorly drained. 30% distinct grey weathered mottles. Gradual boundary.
B22	0.60+	Yellowish Red (Munsell 5YR 5/6) Sandy Clay Loam, with strong structure. Strongly alkaline pH, non-saline. Sodic. No coarse fragments. No roots. Poorly drained. 25% distinct grey weathered mottles.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.2	Non-saline	6.1	Slightly Acidic	2.3	Non sodic
0.20-0.30	0.1	Non-saline	6.7	Neutral	6.6	Sodic
0.40-0.50	0.4	Non-saline	7.6	Mildly Alkaline	11.3	Sodic
0.65-0.75	0.7	Non-saline	8.7	Strongly Alkaline	17.2	Sodic

Site Description – Site 105 (lab # lab #221569-9 – 12)				
Site Reference	105	**ASC Name**	Eutrophic Mottled-Mesonatric Brown Sodosol (BFMOWNR)	
Average Slope	2%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Lower Slope	**Permeability**	Moderately permeable	X: 764318
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6413267



Plate 1 – Soil Profile (105)



Plate 2 – Surface (105)



Plate 3 – Landscape (105)

Horizon	Depth (m)	Description
A1	0.00 – 0.15	Dark Reddish Brown (Munsell 5YR 3/4) Clay Loam, with moderate structure. Slightly acidic pH, non-saline. Non-sodic. No coarse fragments. Many fine roots and moderately drained. Clear boundary.
A2	0.15 – 0.30	Yellowish Red (Munsell 5YR 5/6) Clay Loam, with weak structure. Neutral pH, slightly saline. Sodic. No coarse fragments. Few roots and poorly drained. Clear boundary.
B21	0.30 – 0.65	Strong Brown (Munsell 7.5YR 5/6) Heavy Clay, with strong structure. Neutral pH, non-saline. Sodic. No coarse fragments. Very few roots and poorly drained. 10 - 20% distinct grey weathered mottles.
B22	0.65 – 0.75	Reddish Brown (Munsell 2.5YR 5/4) Clay Loam, with strong structure. Neutral pH, non-saline. Sodic. No coarse fragments. Very few roots and poorly drained. 10 - 20% distinct grey weathered mottles.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.3	Non-saline	6.2	Slightly Acidic	5.3	Non sodic
0.20-0.30	0.2	Non-saline	6.6	Neutral	10.6	Sodic
0.40-0.50	1.1	Non-saline	6.8	Neutral	24.4	Sodic
0.65-0.75	3.5	Non-saline	7.0	Neutral	34.2	Sodic

Site Description – Site 106 (lab # lab #221569-13 – 16)				
Site Reference	106	**ASC Name**	Eutrophic Mottled-Hypernatric Yellow Sodosol (BEMOWNR)	
Average Slope	0%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Plain	**Permeability**	Moderately permeable	X: 764353
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6413313



Plate 1 – Soil Profile (106)



Plate 2 – Surface (106)



Plate 3 – Landscape (106)

Horizon	Depth (m)	Description
A1	0.00 – 0.15	Dark Brown (Munsell 7.5YR 3/3) Loam, with moderate structure. Neutral pH, non-saline. Sodic. No coarse fragments. Many fine roots and moderately drained. Abrupt boundary.
A2	0.15 – 0.30	Bleached Light Gray (Field Munsell 7.5YR 7/1) Loam, with weak structure. Strongly alkaline pH, slightly saline. Sodic. No coarse fragments. Few roots and poorly drained. Abrupt boundary.
B21	0.30 – 0.65	Reddish Yellow (Munsell 7.5YR 6/6) Heavy Clay, with strong structure. Strongly alkaline pH, non-saline. Sodic. No coarse fragments. Very few roots and poorly drained. 15% distinct grey weathered mottles. Gradual boundary.
B22	0.65+	Reddish Yellow (Munsell 5YR 6/8) Clay Loam, with strong structure. Very strongly alkaline pH, non-saline. Sodic. No coarse fragments. No roots and poorly drained. 20% distinct grey weathered mottles.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.8	Non-saline	6.9	Neutral	24.9	Sodic
0.20-0.30	1.4	Non-saline	8.7	Strongly Alkaline	38.8	Sodic
0.40-0.50	2.6	Non-saline	8.8	Strongly Alkaline	51.7	Sodic
0.65-0.75	4.2	Non-saline	9.0	Very Strongly Alkaline	50.3	Sodic

Site Description – Site 107 (lab # lab #221569-17 – 20)				
Site Reference	107	**ASC Name**	Eutrophic Mottled-Subnatric Yellow Sodosol (CELOWNR)	
Average Slope	0%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Plain	**Permeability**	Moderately permeable	X: 764544
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6413157



Plate 1 – Soil Profile (107)



Plate 2 – Surface (107)



Plate 3 – Landscape Nearby (107)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Dark Brown (Munsell 7.5YR 3/4) Loam, with moderate structure. Strongly acidic pH, non-saline. Non-sodic. No coarse fragments. Many fine roots and moderately drained. Abrupt boundary.
A2	0.10 – 0.40	Bleached Very Pale Brown (Field Munsell 10YR 7/4) Clay Loam, with weak structure. Slightly acidic pH, slightly saline. Non-sodic. No coarse fragments. Few roots and poorly drained. Abrupt boundary.
B21	0.40 – 0.60	Reddish Yellow (Munsell 7.5YR 6/8) Light Medium Clay, with strong structure. Strongly alkaline pH, non-saline. Sodic. No coarse fragments. Very few roots and poorly drained. 20% distinct grey weathered mottles. Gradual boundary.
B22	0.60+	Light Reddish Brown (Munsell 5YR 6/4) Clay Loam, with strong structure. Strongly alkaline pH, non-saline. Sodic. No coarse fragments. No roots and poorly drained. 30% distinct grey weathered mottles.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.2	Non-saline	5.4	Strongly Acidic	3.9	Non sodic
0.20-0.30	0.2	Non-saline	6.3	Slightly Acidic	3.2	Non sodic
0.40-0.50	0.9	Non-saline	8.7	Strongly Alkaline	9.3	Sodic
0.65-0.75	1.9	Non-saline	8.9	Strongly Alkaline	17.7	Sodic

Site Description – Site 108 (lab # lab #221569-21 – 24)				
Site Reference	108	**ASC Name**	Bleached-Mottled Eutrophic Brown Chromosol (BFKMWNR)	
Average Slope	0%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Plain	**Permeability**	Moderately permeable	X: 764429
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6412958



Plate 1 – Soil Profile (108)



Plate 2 – Surface (108)



Plate 3 – Landscape (108)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Dark Brown (Munsell 7.5YR 3/4) Loamy Sand, with moderate structure. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many fine roots and moderately drained. Clear boundary.
A2	0.10 – 0.30	Bleached Very Pale Brown (Field Munsell 10YR 7/4) Loam, with weak structure. Slightly acidic pH, slightly saline. Non-sodic. Very few roots and poorly drained. Clear boundary.
B21	0.30 – 1.00	Yellowish Brown to Strong Brown (Munsell 10YR 5/4 to 7.5YR 5/8) Light Medium Clay to Light Clay, with strong structure. Neutral pH, non-saline. Non-sodic. 10% coarse fragments 5 – 20mm. Very few roots and poorly drained. 30% distinct grey weathered mottles.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.7	Non-saline	5.9	Moderately Acidic	1.5	Non sodic
0.20-0.30	0.1	Non-saline	6.4	Slightly Acidic	2.0	Non sodic
0.40-0.50	0.2	Non-saline	6.8	Neutral	2.9	Non sodic
0.65-0.75	0.3	Non-saline	7.1	Neutral	3.4	Non sodic

Site Description – Site 109				
Site Reference	109	**ASC Name**	Brown Chromosol	
Average Slope	2%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Lower Slope	**Permeability**	Moderately permeable	X: 764178
Surface Condition	Soft	**Drainage**	Imperfectly drained	Y: 6412996

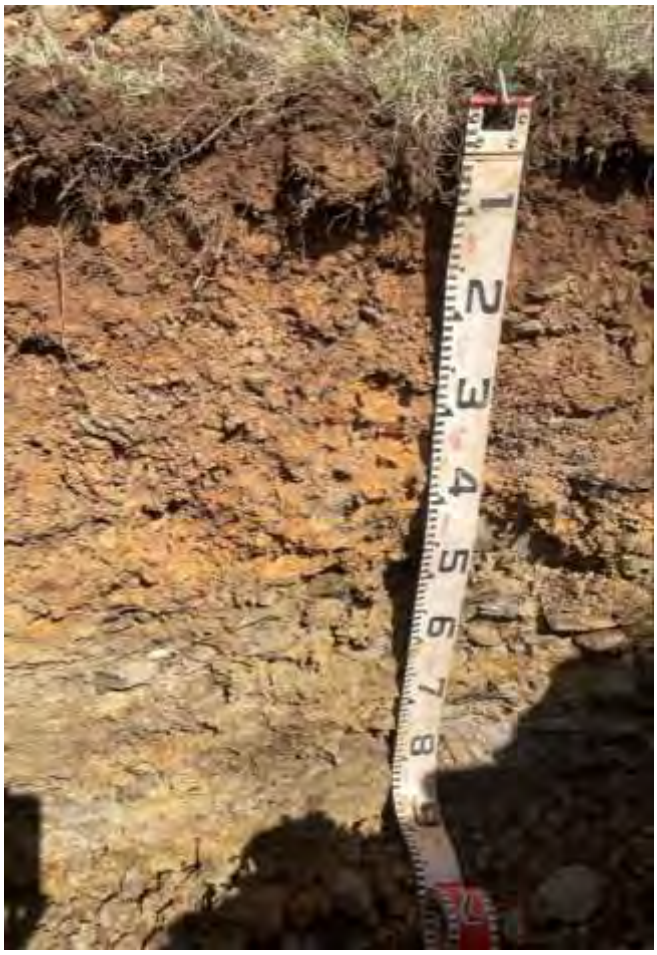


Plate 1 – Soil Profile (109)



Plate 2 – Surface (109)



Plate 3 – Landscape (109)

Horizon	Depth (m)	Description
A1	0.00 – 0.10	Dark Brown (Munsell 7.5YR 3/3) Loamy Sand (field assessment), with moderate structure. No coarse fragments. Many fine roots and moderately drained. Clear boundary.
A2	0.10 – 0.20	Reddish Brown (Munsell 2.5YR 5/4) Loamy Sand (field assessment), with weak structure. Common roots and moderately drained. 20% coarse fragments 5 – 20mm. Clear boundary.
B21	0.20 – 0.50	Yellowish Brown (Munsell 10YR 5/4) Light Clay (field assessment), with strong structure. Few roots and imperfectly drained. 20% coarse fragments 5 – 20mm.
C	0.50+	Parent material

Site Description – Site 110 (lab # lab #221569-25 – 28)				
Site Reference	110	**ASC Name**	Bleached-Mottled Eutrophic Brown Chromosol (CFLMWNR)	
Average Slope	3%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 55
Landform Element	Mid to lower slope	**Permeability**	Moderately permeable	X: 764108
Surface Condition	Soft	**Drainage**	Poorly drained	Y: 6413074



Plate 1 – Soil Profile (110)



Plate 2 – Surface (110)



Plate 3 – Landscape (110)

Horizon	Depth (m)	Description
A1	0.00 – 0.15	Dark Brown (Munsell 7.5YR 3/3) Sandy Loam, with moderate structure. Moderately acidic pH, non-saline. Non-sodic. No coarse fragments. Many fine roots and moderately drained. Abrupt boundary.
A2	0.15 – 0.50	Bleached Very Pale Brown (Field Munsell 10YR 7/4) Loam, with weak structure. Slightly acidic trending to neutral pH, slightly saline. Non-sodic. No coarse fragments. Few roots and poorly drained. Clear boundary.
B21	0.50 – 0.80	Yellowish Brown (Munsell 10YR 5/4) Light Clay with strong structure. Neutral pH, non-saline. Non-sodic. No coarse fragments. Very few roots and poorly drained. 20% distinct grey weathered mottles.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0-0.10	0.1	Non-saline	5.6	Moderately Acidic	1.2	Non sodic
0.20-0.30	0.1	Non-saline	6.4	Slightly Acidic	2.0	Non sodic
0.40-0.50	0.2	Non-saline	6.5	Neutral	1.4	Non sodic
0.65-0.75	0.3	Non-saline	7.2	Neutral	0.6	Non sodic

Site Description – Site 111(no lab#)				
Site Reference	111	**ASC Name**	Lithic, Leptic Rudosol	
Average Slope	14%	**Land Use**	Grazing	**Coordinates**
Landform Pattern	Hillcrest	**Soil Fertility**	-	MGA 55
Landform Element	Crest	**Permeability**	Highly permeable	X: 763574
Surface Condition	Soft	**Drainage**	Well drained	Y: 6414114



Plate 1 – Landscape (111)



Plate 2 – Landscape (111)



Plate 3 – Surface (111)



Plate 3 – Surface (111)

Description

Thin, skeletal soil over hard, unweathered bedrock. High coarse fragment content.

Appendix 2
Laboratory Certificates of Analysis

Environmental Analysis Laboratory

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AGRICULTURAL SOIL ANALYSIS REPORT

230 samples supplied by Minesoils Pty. Ltd. on 27/05/2021. Lab Job No.K7399
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

Parameter		Method reference	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
Sample ID:			1	2	3	4	5	6
Crop:			Soil	Soil	Soil	Soil	Soil	Soil
Client:			Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
			K7399/1	K7399/2	K7399/3	K7399/4	K7399/5	K7399/6
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.01	6.36	5.70	6.05	5.41	6.31
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.047	0.013	0.019	0.007	0.053	0.021
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	3.94	1.03	0.23	0.15	3.25	2.31
	(kg/ha)		1770	462	104	69	1461	1037
	(mg/kg)		790	206	46	31	652	463
Exchangeable Magnesium	(cmol$_+$/kg)		0.76	0.27	0.28	0.22	1.33	1.48
	(kg/ha)		208	74	77	61	362	403
	(mg/kg)		93	33	34	27	161	180
Exchangeable Potassium	(cmol$_+$/kg)		0.41	0.14	<0.12	<0.12	0.56	0.33
	(kg/ha)		357	126	<112	<112	492	285
	(mg/kg)		159	56	<50	<50	220	127
Exchangeable Sodium	(cmol$_+$/kg)		<0.065	<0.065	<0.065	<0.065	0.08	<0.065
	(kg/ha)		<33	<33	<33	<33	43	<33
	(mg/kg)		<15	<15	<15	<15	19	<15
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.02	0.03	0.08	0.05	0.04	0.01
	(kg/ha)		4	6	16	9	9	3
	(mg/kg)		2	3	7	4	4	1
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.28	0.13	0.18	0.12	0.12	0.19
	(kg/ha)		6	3	4	3	3	4
	(mg/kg)		3	1	2	1	1	2
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	5.44	1.62	0.92	0.66	5.39	4.38
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	72.5	63.4	25.2	23.1	60.4	52.7
Magnesium (%)			14.1	16.8	30.8	33.6	24.6	33.8
Potassium (%)			7.5	8.8	12.1	16.6	10.4	7.4
Sodium - ESP (%)			0.5	1.4	4.1	2.0	1.6	1.4
Aluminium (%)			0.4	1.7	8.4	7.0	0.8	0.3
Hydrogen (%)			5.1	7.9	19.3	17.6	2.2	4.3
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	5.2	3.8	0.8	0.7	2.4	1.6
Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	10Y 3/2 very dark greyish brown	7.5YR 5/3 brown	7.5YR 6/6 reddish yellow	7.5YR 6/4 light brown	10YR 3/2 very dark greyish brown	5YR 4/4 reddish brown
Mottles Munsell Colour			..	..	..	..	..	..
Degree of Mottling (%)			..	..	..	..	..	..

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AGRICULTURAL SOIL ANALYSIS REPORT

230 samples supplied by Minesoils Pty. Ltd. on 27/05/2021. Lab Job No.K7399
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
	Sample ID:	1	2	3	4	5	6
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/1	K7399/2	K7399/3	K7399/4	K7399/5	K7399/6

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
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17. This report was issued on 21/07/2021.

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

Quality Checked: Kris Saville
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AGRICULTURAL SOIL ANALYSIS REPORT

230 samples supplied by Minesoils Pty. Ltd. on 27/05/2021. Lab Job No.K7399
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

Parameter		Method reference	Sample 7	Sample 8	Sample 9	Sample 10	Sample 11	Sample 12
Sample ID:			7	8	9	10	11	12
Crop:			Soil	Soil	Soil	Soil	Soil	Soil
Client:			Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
			K7399/7	K7399/8	K7399/9	K7399/10	K7399/11	K7399/12
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.83	7.15	5.46	5.92	6.72	7.44
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.031	0.083	0.035	0.012	0.046	0.045
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	3.60	1.90	1.47	0.97	4.50	3.74
	(kg/ha)		1618	851	661	437	2018	1678
	(mg/kg)		722	380	295	195	901	749
Exchangeable Magnesium	(cmol$_+$/kg)		6.49	6.39	0.59	0.37	5.39	5.82
	(kg/ha)		1767	1740	160	99	1466	1583
	(mg/kg)		789	777	71	44	654	707
Exchangeable Potassium	(cmol$_+$/kg)		0.39	0.25	0.67	0.24	0.42	0.44
	(kg/ha)		338	218	584	213	372	387
	(mg/kg)		151	97	261	95	166	173
Exchangeable Sodium	(cmol$_+$/kg)		0.21	0.79	<0.065	<0.065	0.40	0.50
	(kg/ha)		106	406	<33	<33	206	260
	(mg/kg)		47	181	<15	<15	92	116
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.01	<0.01	0.08	0.02	<0.01	<0.01
	(kg/ha)		2	1	17	4	1	<1
	(mg/kg)		1	<1	8	2	<1	<1
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	0.94	0.26	<0.01	<0.01
	(kg/ha)		<1	<1	21	6	<1	<1
	(mg/kg)		<1	<1	9	3	<1	<1
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	10.70	9.33	3.80	1.92	10.71	10.50
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	33.7	20.3	38.7	50.8	42.0	35.6
Magnesium (%)			60.7	68.5	15.4	19.0	50.3	55.4
Potassium (%)			3.6	2.7	17.5	12.7	4.0	4.2
Sodium - ESP (%)			1.9	8.5	1.4	3.0	3.7	4.8
Aluminium (%)			0.1	0.1	2.2	1.2	0.1	0.0
Hydrogen (%)			0.0	0.0	24.7	13.4	0.0	0.0
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	0.6	0.3	2.5	2.7	0.8	0.6
Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	2.5YR 4/4 reddish brown	5Y 5/6 olive	5Y 3/2 dark olive grey	10YR 6/4 light yellowish brown	5Y 5/2 olive grey	5Y 4/2 olive grey
Mottles Munsell Colour			..	..	..	..	5YR 5/8 yellowish red	..
Degree of Mottling (%)			..	..	..	..	40	..

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230 samples supplied by Minesoils Pty. Ltd. on 27/05/2021. Lab Job No.K7399
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 7	Sample 8	Sample 9	Sample 10	Sample 11	Sample 12
	Sample ID:	7	8	9	10	11	12
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/7	K7399/8	K7399/9	K7399/10	K7399/11	K7399/12

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
10. Conversions for 1 $cmol_+/kg$ = 230 mg/kg Sodium, 390 mg/kg Potassium, 122 mg/kg Magnesium, 200 mg/kg Calcium
11. Conversions to kg/ha = mg/kg x 2.24
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			Sample 13	Sample 14	Sample 15	Sample 16	Sample 17	Sample 18
		Sample ID:	13	14	15	16	17	18
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	K7399/13	K7399/14	K7399/15	K7399/16	K7399/17	K7399/18
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.61	5.70	5.65	5.34	5.22	5.97
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.237	0.043	0.052	0.070	0.034	0.027
	Exchangeable Calcium (cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	2.93	0.71	0.55	0.20	1.50	1.74
	Exchangeable Calcium (kg/ha)		1316	318	245	91	672	782
	Exchangeable Calcium (mg/kg)		588	142	109	40	300	349
	Exchangeable Magnesium (cmol$_+$/kg)		1.84	0.96	1.44	4.73	0.59	0.70
	Exchangeable Magnesium (kg/ha)		501	261	391	1286	161	192
	Exchangeable Magnesium (mg/kg)		224	117	174	574	72	86
	Exchangeable Potassium (cmol$_+$/kg)		1.24	0.59	0.50	0.29	0.20	0.15
	Exchangeable Potassium (kg/ha)		1088	519	434	258	178	135
	Exchangeable Potassium (mg/kg)		486	232	194	115	79	60
	Exchangeable Sodium (cmol$_+$/kg)		0.12	0.07	0.18	0.50	0.14	0.12
	Exchangeable Sodium (kg/ha)		61	38	91	256	72	64
	Exchangeable Sodium (mg/kg)		27	17	41	114	32	29
	Exchangeable Aluminium (cmol$_+$/kg)	**Inhouse S37 (KCl)	0.02	0.03	0.01	0.11	0.21	0.05
	Exchangeable Aluminium (kg/ha)		4	7	2	23	43	10
	Exchangeable Aluminium (mg/kg)		2	3	1	10	19	5
	Exchangeable Hydrogen (cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.54	0.51	0.53	1.32	1.13	0.36
	Exchangeable Hydrogen (kg/ha)		12	12	12	30	25	8
	Exchangeable Hydrogen (mg/kg)		5	5	5	13	11	4
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	6.69	2.88	3.19	7.15	3.77	3.13
	Calcium (%)	**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	43.8	24.5	17.1	2.8	39.7	55.6
	Magnesium (%)		27.5	33.3	44.9	66.1	15.6	22.5
	Potassium (%)		18.6	20.5	15.5	4.1	5.4	4.9
	Sodium - ESP (%)		1.8	2.6	5.5	6.9	3.7	4.0
	Aluminium (%)		0.3	1.2	0.4	1.6	5.6	1.6
	Hydrogen (%)		8.0	17.8	16.6	18.5	30.0	11.4
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol$_+$/kg)	1.6	0.7	0.4	0.0	2.5	2.5
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	7.5YR 2.5/2 very dark brown	7.5YR 4/3 brown	2.5Y 5/4 light olive brown	5YR 6/6 reddish yellow	10YR 2/2 very dark brown	10YR 4/2 dark greyish brown
	Mottles Munsell Colour		..	..	7.5YR 6/6 reddish yellow	5Y 6/1 grey	..	..
	Degree of Mottling (%)		..	..	25	40	..	..

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230 samples supplied by Minesoils Pty. Ltd. on 27/05/2021. Lab Job No.K7399
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 13	Sample 14	Sample 15	Sample 16	Sample 17	Sample 18
	Sample ID:	13	14	15	16	17	18
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/13	K7399/14	K7399/15	K7399/16	K7399/17	K7399/18

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
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Parameter		Method reference	Sample 19	Sample 20	Sample 21	Sample 22	Sample 23	Sample 24
Sample ID:			19	20	21	22	23	24
Crop:			Soil	Soil	Soil	Soil	Soil	Soil
Client:			Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
			K7399/19	K7399/20	K7399/21	K7399/22	K7399/23	K7399/24
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.35	5.98	4.84	5.59	6.32	6.37
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.020	0.107	0.085	0.014	0.016	0.148
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	0.85	0.14	0.86	0.46	0.27	1.21
	(kg/ha)		379	65	386	207	120	544
	(mg/kg)		169	29	172	92	53	243
Exchangeable Magnesium	(cmol$_+$/kg)		0.61	4.65	0.42	0.16	0.36	5.38
	(kg/ha)		165	1265	113	43	97	1465
	(mg/kg)		74	565	50	19	44	654
Exchangeable Potassium	(cmol$_+$/kg)		0.12	0.16	0.39	0.14	<0.12	0.28
	(kg/ha)		<112	140	341	119	<112	244
	(mg/kg)		<50	62	152	53	<50	109
Exchangeable Sodium	(cmol$_+$/kg)		0.13	1.34	0.08	0.08	0.16	1.99
	(kg/ha)		66	688	40	39	82	1023
	(mg/kg)		29	307	18	17	37	457
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.03	0.04	0.15	0.07	0.01	0.01
	(kg/ha)		6	7	29	14	3	2
	(mg/kg)		3	3	13	6	1	<1
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.18	0.25	1.06	0.37	0.09	0.30
	(kg/ha)		4	6	24	8	2	7
	(mg/kg)		2	2	11	4	<1	3
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	1.91	6.57	2.95	1.27	0.99	9.17
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	44.2	2.2	29.2	36.2	26.8	13.2
Magnesium (%)			31.7	70.7	14.1	12.5	36.0	58.7
Potassium (%)			6.3	2.4	13.2	10.7	10.5	3.0
Sodium - ESP (%)			6.7	20.3	2.6	5.9	16.1	21.7
Aluminium (%)			1.6	0.6	5.0	5.3	1.4	0.1
Hydrogen (%)			9.6	3.8	35.9	29.4	9.4	3.3
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	1.4	0.0	2.1	2.9	0.7	0.2
Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	7.5YR 5/3 brown	10YR 6/8 brownish yellow	10YR 2/2 very dark brown	7.5YR 5/3 brown	5Y 6/4 pale olive	10YR 6/1 grey
Mottles Munsell Colour			..	..	..	..	..	7.5YR 6/6 reddish yellow
Degree of Mottling (%)			..	..	..	..	..	10

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PO BOX 11034 TAMWORTH NSW 2340

		Sample 19	Sample 20	Sample 21	Sample 22	Sample 23	Sample 24
	Sample ID:	19	20	21	22	23	24
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/19	K7399/20	K7399/21	K7399/22	K7399/23	K7399/24

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
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5. Guidelines for phosphorus have been reduced for Australian soils.
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7. Total Acid Extractable Nutrients indicate a store of nutrients.
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Parameter		Method reference	Sample 25	Sample 26	Sample 27	Sample 28	Sample 29	Sample 30
Sample ID:			25	26	27	28	29	30
Crop:			Soil	Soil	Soil	Soil	Soil	Soil
Client:			Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
			K7399/25	K7399/26	K7399/27	K7399/28	K7399/29	K7399/30
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	4.91	5.49	5.71	5.54	5.75	5.76
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.048	0.010	0.007	0.092	0.019	0.018
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	1.44	0.55	0.59	6.43	2.38	2.42
	(kg/ha)		645	246	267	2885	1068	1088
	(mg/kg)		288	110	119	1288	477	486
Exchangeable Magnesium	(cmol$_+$/kg)		0.40	0.17	0.10	2.57	0.72	0.72
	(kg/ha)		110	45	27	700	197	196
	(mg/kg)		49	20	12	312	88	87
Exchangeable Potassium	(cmol$_+$/kg)		0.22	<0.12	0.13	0.32	0.38	0.42
	(kg/ha)		191	<112	114	279	331	366
	(mg/kg)		85	<50	51	124	148	163
Exchangeable Sodium	(cmol$_+$/kg)		<0.065	<0.065	<0.065	<0.065	<0.065	0.18
	(kg/ha)		<33	<33	<33	<33	<33	95
	(mg/kg)		<15	<15	<15	<15	<15	43
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.08	0.06	0.04	0.03	0.08	0.10
	(kg/ha)		17	13	9	7	16	20
	(mg/kg)		7	6	4	3	7	9
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.90	0.32	0.20	0.50	0.53	0.67
	(kg/ha)		20	7	5	11	12	15
	(mg/kg)		9	3	2	5	5	7
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	3.08	1.24	1.10	9.91	4.16	4.51
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	46.7	44.2	54.1	64.9	57.2	53.7
Magnesium (%)			13.1	13.4	9.0	26.0	17.4	15.9
Potassium (%)			7.1	9.0	11.9	3.2	9.1	9.3
Sodium - ESP (%)			1.3	2.3	2.7	0.6	1.5	4.1
Aluminium (%)			2.7	5.2	4.0	0.3	1.9	2.2
Hydrogen (%)			29.2	25.9	18.4	5.0	12.8	14.8
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	3.6	3.3	6.0	2.5	3.3	3.4
Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	7.5YR 2.5/2 very dark brown	7.5YR 6/4 light brown	2.5Y 6/4 light yellowish brown	10YR 7/3 very pale brown	10YR 2/1 black	7.5YR 2.5/2 very dark brown
Mottles Munsell Colour			..	..	..	..	..	..
			..	..	..	..	..	..
Degree of Mottling (%)			..	..	..	..	..	..

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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 25	Sample 26	Sample 27	Sample 28	Sample 29	Sample 30
	Sample ID:	25	26	27	28	29	30
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/25	K7399/26	K7399/27	K7399/28	K7399/29	K7399/30

Notes:

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

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			Sample 31	Sample 32	Sample 33	Sample 34	Sample 35	Sample 36
		Sample ID:	31	32	33	34	35	36
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	K7399/31	K7399/32	K7399/33	K7399/34	K7399/35	K7399/36
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.52	5.67	5.54	6.07	6.16	6.03
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.017	0.009	0.141	0.037	0.040	0.079
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	1.51	0.93	3.77	1.53	0.58	0.39
	Exchangeable Calcium (kg/ha)		676	418	1691	686	258	174
	Exchangeable Calcium (mg/kg)		302	187	755	306	115	78
	Exchangeable Magnesium (cmol+/kg)		0.87	1.53	3.10	2.15	3.09	6.37
	Exchangeable Magnesium (kg/ha)		236	417	843	585	842	1735
	Exchangeable Magnesium (mg/kg)		105	186	377	261	376	774
	Exchangeable Potassium (cmol+/kg)		0.29	0.17	0.94	0.51	0.39	0.57
	Exchangeable Potassium (kg/ha)		253	151	822	443	346	498
	Exchangeable Potassium (mg/kg)		113	68	367	198	154	222
	Exchangeable Sodium (cmol+/kg)		0.07	<0.065	0.20	0.10	0.25	0.68
	Exchangeable Sodium (kg/ha)		34	<33	102	54	128	348
	Exchangeable Sodium (mg/kg)		15	<15	46	24	57	156
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.11	0.08	0.04	0.06	0.05	0.06
	Exchangeable Aluminium (kg/ha)		22	16	9	12	10	11
	Exchangeable Aluminium (mg/kg)		10	7	4	5	5	5
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.66	0.44	0.72	0.41	0.42	0.49
	Exchangeable Hydrogen (kg/ha)		15	10	16	9	9	11
	Exchangeable Hydrogen (mg/kg)		7	4	7	4	4	5
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	3.50	3.21	8.76	4.75	4.78	8.56
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	43.1	29.0	43.0	32.1	12.0	4.5
	Magnesium (%)		24.8	47.8	35.4	45.2	64.7	74.5
	Potassium (%)		8.2	5.4	10.7	10.6	8.3	6.6
	Sodium - ESP (%)		1.9	1.4	2.3	2.2	5.2	7.9
	Aluminium (%)		3.1	2.5	0.5	1.2	1.1	0.7
	Hydrogen (%)		18.9	13.9	8.2	8.6	8.7	5.8
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	1.7	0.6	1.2	0.7	0.2	0.1
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	2.5YR 4/3 reddish brown	2.5YR 4/3 reddish brown	7.5YR 2.5/3 very dark brown	10YR 4/2 dark greyish brown	5Y 5/1 grey	5Y 5/2 olive grey
	Mottles Munsell Colour		..	..	..	..	2.5YR 5/6	2.5YR 5/6
	Degree of Mottling (%)		..	..	..	..	red	red
			..	..	..	..	10	50

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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 31	Sample 32	Sample 33	Sample 34	Sample 35	Sample 36
	Sample ID:	31	32	33	34	35	36
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/31	K7399/32	K7399/33	K7399/34	K7399/35	K7399/36

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
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5. Guidelines for phosphorus have been reduced for Australian soils.
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Parameter		Method reference	Sample 37	Sample 38	Sample 39	Sample 40	Sample 41	Sample 42
Sample ID:			37	38	39	40	41	42
Crop:			Soil	Soil	Soil	Soil	Soil	Soil
Client:			Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
			K7399/37	K7399/38	K7399/39	K7399/40	K7399/41	K7399/42
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.27	5.68	5.86	6.15	4.98	5.59
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.038	0.017	0.016	0.017	0.072	0.014
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	3.49	4.85	2.68	2.61	1.52	0.85
	(kg/ha)		1567	2178	1203	1173	684	383
	(mg/kg)		699	973	537	524	306	171
Exchangeable Magnesium	(cmol$_+$/kg)		0.85	1.83	1.25	2.12	0.57	0.32
	(kg/ha)		233	499	341	576	155	86
	(mg/kg)		104	223	152	257	69	38
Exchangeable Potassium	(cmol$_+$/kg)		0.38	0.40	0.22	0.23	0.51	0.20
	(kg/ha)		335	353	194	205	448	179
	(mg/kg)		149	157	87	91	200	80
Exchangeable Sodium	(cmol$_+$/kg)		0.08	0.15	0.07	0.14	<0.065	<0.065
	(kg/ha)		43	80	38	70	<33	<33
	(mg/kg)		19	36	17	31	<15	<15
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.12	0.07	0.03	0.03	0.20	0.05
	(kg/ha)		24	14	7	7	40	9
	(mg/kg)		11	6	3	3	18	4
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	1.01	0.59	0.43	0.41	1.13	0.36
	(kg/ha)		23	13	10	9	25	8
	(mg/kg)		10	6	4	4	11	4
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	5.94	7.90	4.69	5.54	4.00	1.85
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	58.7	61.4	57.2	47.2	38.2	46.2
Magnesium (%)			14.4	23.2	26.7	38.2	14.2	17.1
Potassium (%)			6.4	5.1	4.7	4.2	12.8	11.1
Sodium - ESP (%)			1.4	2.0	1.6	2.4	1.6	3.4
Aluminium (%)			2.0	0.9	0.7	0.6	5.0	2.5
Hydrogen (%)			17.0	7.4	9.1	7.4	28.2	19.7
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	4.1	2.6	2.1	1.2	2.7	2.7
Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	7.5YR 2.5/1 black	5Y 2.5/1 black	5Y 2.5/1 black	7.5YR 2.5/1 black	7.5YR 2.5/3 very dark brown	7.5YR 6/6 reddish yellow
Mottles Munsell Colour			..	..	..	..	..	..
Degree of Mottling (%)			..	..	..	..	..	..

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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 37	Sample 38	Sample 39	Sample 40	Sample 41	Sample 42
	Sample ID:	37	38	39	40	41	42
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/37	K7399/38	K7399/39	K7399/40	K7399/41	K7399/42

Notes:

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			Sample 43	Sample 44	Sample 45	Sample 46	Sample 47	Sample 48
		Sample ID:	43	44	45	46	47	48
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	K7399/43	K7399/44	K7399/45	K7399/46	K7399/47	K7399/48
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.58	6.89	5.30	5.99	6.74	6.79
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.055	0.093	0.130	0.028	0.025	0.027
	Exchangeable Calcium (cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	2.99	1.39	3.17	2.73	1.76	1.79
	Exchangeable Calcium (kg/ha)		1344	624	1422	1228	792	803
	Exchangeable Calcium (mg/kg)		600	279	635	548	353	358
	Exchangeable Magnesium (cmol$_+$/kg)		8.42	5.77	1.14	0.84	0.75	1.24
	Exchangeable Magnesium (kg/ha)		2291	1570	310	228	205	336
	Exchangeable Magnesium (mg/kg)		1023	701	138	102	92	150
	Exchangeable Potassium (cmol$_+$/kg)		0.42	0.27	1.10	0.43	0.40	0.22
	Exchangeable Potassium (kg/ha)		367	240	962	373	353	195
	Exchangeable Potassium (mg/kg)		164	107	430	167	157	87
	Exchangeable Sodium (cmol$_+$/kg)		0.54	0.64	<0.065	0.07	0.12	0.11
	Exchangeable Sodium (kg/ha)		276	330	<33	34	61	55
	Exchangeable Sodium (mg/kg)		123	147	<15	15	27	25
	Exchangeable Aluminium (cmol$_+$/kg)	**Inhouse S37 (KCl)	0.02	0.01	0.07	0.03	0.01	<0.01
	Exchangeable Aluminium (kg/ha)		5	3	14	6	3	2
	Exchangeable Aluminium (mg/kg)		2	1	6	3	1	<1
	Exchangeable Hydrogen (cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	0.76	0.29	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		<1	<1	17	7	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	<1	8	3	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	12.39	8.09	6.28	4.38	3.05	3.36
	Calcium (%)	**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	24.2	17.2	50.5	62.4	57.8	53.2
	Magnesium (%)		67.9	71.3	18.1	19.1	24.7	36.7
	Potassium (%)		3.4	3.4	17.5	9.7	13.2	6.6
	Sodium - ESP (%)		4.3	7.9	0.7	1.5	3.9	3.2
	Aluminium (%)		0.2	0.2	1.1	0.7	0.4	0.3
	Hydrogen (%)		0.0	0.0	12.1	6.6	0.0	0.0
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol$_+$/kg)	0.4	0.2	2.8	3.3	2.3	1.4
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	10YR 6/8 brownish yellow	2.5Y 7/1 light grey	7.5YR 2.5/2 very dark brown	7.5YR 3/3 dark brown	5YR 5/6 yellowish red	5YR 5/6 yellowish red
	Mottles Munsell Colour		..	5YR 3/2 dark reddish brown	..	..	..	..
	Degree of Mottling (%)		..	5	..	..	..	..

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		Sample 43	Sample 44	Sample 45	Sample 46	Sample 47	Sample 48
	Sample ID:	43	44	45	46	47	48
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/43	K7399/44	K7399/45	K7399/46	K7399/47	K7399/48

Notes:

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Parameter		Method reference	Sample 49	Sample 50	Sample 51	Sample 52	Sample 53	Sample 54
Sample ID:			49	50	51	52	53	54
Crop:			Soil	Soil	Soil	Soil	Soil	Soil
Client:			Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
			K7399/49	K7399/50	K7399/51	K7399/52	K7399/53	K7399/54
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	4.76	5.62	5.49	5.80	5.23	5.97
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.130	0.025	0.028	0.026	0.059	0.010
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	2.49	0.85	0.47	0.11	1.74	0.72
	(kg/ha)		1116	380	210	47	783	323
	(mg/kg)		498	169	94	21	350	144
Exchangeable Magnesium	(cmol$_+$/kg)		0.81	0.47	1.76	2.60	0.64	0.34
	(kg/ha)		220	129	480	707	175	92
	(mg/kg)		98	58	214	316	78	41
Exchangeable Potassium	(cmol$_+$/kg)		0.37	0.44	0.43	0.21	0.37	0.19
	(kg/ha)		324	389	378	185	326	163
	(mg/kg)		145	174	169	83	145	73
Exchangeable Sodium	(cmol$_+$/kg)		0.16	0.09	0.14	0.20	<0.065	<0.065
	(kg/ha)		82	47	71	102	<33	<33
	(mg/kg)		37	21	32	46	<15	<15
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.30	0.06	0.16	0.03	0.07	0.03
	(kg/ha)		60	13	32	6	14	5
	(mg/kg)		27	6	14	3	6	2
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	1.32	0.59	0.94	0.54	0.76	0.21
	(kg/ha)		30	13	21	12	17	5
	(mg/kg)		13	6	9	5	8	2
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	5.44	2.51	3.90	3.68	3.64	1.53
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	45.7	33.7	12.0	2.9	47.9	47.0
Magnesium (%)			14.8	18.9	45.2	70.6	17.7	22.1
Potassium (%)			6.8	17.7	11.1	5.7	10.2	12.1
Sodium - ESP (%)			2.9	3.6	3.5	5.4	1.2	3.3
Aluminium (%)			5.5	2.5	4.1	0.8	1.9	1.7
Hydrogen (%)			24.3	23.6	24.1	14.6	21.0	13.9
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	3.1	1.8	0.3	0.0	2.7	2.1
Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	7.5YR 2.5/2 very dark brown	10YR 5/2 greyish brown	7.5YR 6/8 reddish yellow	2.5Y 6/6 olive yellow	7.5YR 3/3 dark brown	7.5YR 5/4 brown
Mottles Munsell Colour			..	..	7.5YR 6/1 grey	2.5YR 4/6 red	..	..
Degree of Mottling (%)			..	..	50	20	..	..

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AGRICULTURAL SOIL ANALYSIS REPORT

230 samples supplied by Minesoils Pty. Ltd. on 27/05/2021. Lab Job No.K7399
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 49	Sample 50	Sample 51	Sample 52	Sample 53	Sample 54
	Sample ID:	49	50	51	52	53	54
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/49	K7399/50	K7399/51	K7399/52	K7399/53	K7399/54

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil re
10. Conversions for 1 $cmol_+/kg$ = 230 mg/kg Sodium, 390 mg/kg Potassium, 122 mg/kg Magnesium, 200 mg/kg Calcium
11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimat
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230 samples supplied by Minesoils Pty. Ltd. on 27/05/2021. Lab Job No.K7399
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

			Sample 55	Sample 56	Sample 57	Sample 58	Sample 59	Sample 60
		Sample ID:	55	56	57	58	59	60
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	K7399/55	K7399/56	K7399/57	K7399/58	K7399/59	K7399/60
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.90	5.07	6.39	7.28	7.89	8.17
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.033	0.057	0.089	0.049	0.032	0.021
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	1.44	0.30	6.50	5.68	3.94	3.10
	Exchangeable Calcium (kg/ha)		645	132	2920	2551	1769	1390
	Exchangeable Calcium (mg/kg)		288	59	1303	1139	790	621
	Exchangeable Magnesium (cmol+/kg)		3.49	3.02	1.02	0.46	0.67	1.14
	Exchangeable Magnesium (kg/ha)		951	821	276	125	182	311
	Exchangeable Magnesium (mg/kg)		425	366	123	56	81	139
	Exchangeable Potassium (cmol+/kg)		0.36	0.20	1.05	0.41	0.21	0.18
	Exchangeable Potassium (kg/ha)		317	172	920	355	184	158
	Exchangeable Potassium (mg/kg)		141	77	411	159	82	71
	Exchangeable Sodium (cmol+/kg)		0.15	0.39	<0.065	<0.065	<0.065	<0.065
	Exchangeable Sodium (kg/ha)		77	200	<33	<33	<33	<33
	Exchangeable Sodium (mg/kg)		34	89	<15	<15	<15	<15
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.01	1.27	0.04	<0.01	<0.01	<0.01
	Exchangeable Aluminium (kg/ha)		3	257	7	2	2	2
	Exchangeable Aluminium (mg/kg)		1	115	3	<1	<1	<1
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.43	2.16	0.05	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		10	48	1	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		4	22	<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	5.88	7.33	8.69	6.57	4.85	4.46
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	24.4	4.0	74.9	86.4	81.2	69.5
	Magnesium (%)		59.4	41.1	11.7	7.0	13.8	25.6
	Potassium (%)		6.1	2.7	12.1	6.2	4.3	4.1
	Sodium - ESP (%)		2.5	5.3	0.3	0.3	0.5	0.6
	Aluminium (%)		0.2	17.4	0.4	0.2	0.2	0.2
	Hydrogen (%)		7.3	29.5	0.6	0.0	0.0	0.0
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	0.4	0.1	6.4	12.4	5.9	2.7
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	10YR 6/6 brownish yellow	5y 6/1 grey	7.5YR 2.5/2 very dark brown	10YR 3/3 dark brown	2.5YR 4/6 red	10R 5/8 red
	Mottles Munsell Colour		..	2.5YR 5/8 red	7.5YR 7/6 reddish yellow	..	..	..
	Degree of Mottling (%)		..	10	1	..	..	..

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AGRICULTURAL SOIL ANALYSIS REPORT

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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 55	Sample 56	Sample 57	Sample 58	Sample 59	Sample 60
	Sample ID:	55	56	57	58	59	60
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/55	K7399/56	K7399/57	K7399/58	K7399/59	K7399/60

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
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5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
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11. Conversions to kg/ha = mg/kg x 2.24
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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
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			Sample 61	Sample 62	Sample 63	Sample 64	Sample 65	Sample 66
		Sample ID:	61	62	63	64	65	66
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	K7399/61	K7399/62	K7399/63	K7399/64	K7399/65	K7399/66
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.81	6.57	6.63	6.69	6.55	8.46
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.048	0.018	0.014	0.011	0.061	0.053
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	6.99	2.66	2.09	1.71	8.91	2.71
	Exchangeable Calcium (kg/ha)		3136	1196	937	767	3999	1216
	Exchangeable Calcium (mg/kg)		1400	534	418	342	1785	543
	Exchangeable Magnesium (cmol+/kg)		1.60	0.70	0.75	0.72	3.62	1.98
	Exchangeable Magnesium (kg/ha)		435	191	205	195	984	540
	Exchangeable Magnesium (mg/kg)		194	85	91	87	439	241
	Exchangeable Potassium (cmol+/kg)		0.45	0.19	0.16	0.16	0.42	0.15
	Exchangeable Potassium (kg/ha)		398	163	140	141	369	127
	Exchangeable Potassium (mg/kg)		178	73	63	63	165	57
	Exchangeable Sodium (cmol+/kg)		0.11	0.08	0.08	<0.065	0.41	0.42
	Exchangeable Sodium (kg/ha)		57	42	40	<33	210	217
	Exchangeable Sodium (mg/kg)		25	19	18	<15	94	97
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.02	0.01	0.01	<0.01	0.02	<0.01
	Exchangeable Aluminium (kg/ha)		5	3	2	2	3	2
	Exchangeable Aluminium (mg/kg)		2	1	1	<1	1	<1
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.49	<0.01	<0.01	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		11	<1	<1	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		5	<1	<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	9.67	3.65	3.09	2.65	13.37	5.27
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	72.3	73.0	67.6	64.4	66.6	51.4
	Magnesium (%)		16.5	19.2	24.4	27.0	27.0	37.7
	Potassium (%)		4.7	5.1	5.2	6.1	3.1	2.8
	Sodium - ESP (%)		1.1	2.2	2.5	2.2	3.0	8.0
	Aluminium (%)		0.3	0.4	0.4	0.3	0.1	0.2
	Hydrogen (%)		5.1	0.0	0.0	0.0	0.0	0.0
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	4.4	3.8	2.8	2.4	2.5	1.4
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	7.5YR 2.5/1 black	10YR 4/2 dark greyish brown	10YR 5/3 brown	10YR 5/1 grey	10YR 2/2 very dark brown	2.5Y 6/1 grey
	Mottles Munsell Colour		..	..	..	..	..	..
	Degree of Mottling (%)		..	..	..	..	..	..

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AGRICULTURAL SOIL ANALYSIS REPORT

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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 61	Sample 62	Sample 63	Sample 64	Sample 65	Sample 66
	Sample ID:	61	62	63	64	65	66
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/61	K7399/62	K7399/63	K7399/64	K7399/65	K7399/66

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
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9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
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11. Conversions to kg/ha = mg/kg x 2.24
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Parameter		Method reference	Sample 67	Sample 68	Sample 69	Sample 70	Sample 71	Sample 72
Sample ID:			67	68	69	70	71	72
Crop:			Soil	Soil	Soil	Soil	Soil	Soil
Client:			Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
			K7399/67	K7399/68	K7399/69	K7399/70	K7399/71	K7399/72
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.27	8.09	6.28	8.06	7.53	7.77
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.241	0.193	0.071	0.116	0.029	0.026
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	8.74	5.60	8.37	7.20	2.89	1.30
	(kg/ha)		3924	2515	3757	3233	1297	583
	(mg/kg)		1752	1123	1677	1443	579	260
Exchangeable Magnesium	(cmol$_+$/kg)		11.29	7.35	1.80	8.35	1.32	0.84
	(kg/ha)		3075	2000	489	2273	359	229
	(mg/kg)		1373	893	219	1015	160	102
Exchangeable Potassium	(cmol$_+$/kg)		0.51	0.39	0.85	0.85	0.20	0.17
	(kg/ha)		444	338	742	746	174	152
	(mg/kg)		198	151	331	333	78	68
Exchangeable Sodium	(cmol$_+$/kg)		2.60	1.54	0.12	1.33	0.10	<0.065
	(kg/ha)		1340	792	62	684	52	<33
	(mg/kg)		598	353	28	305	23	<15
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	<0.01	<0.01	0.02	<0.01	<0.01	<0.01
	(kg/ha)		2	2	4	1	2	1
	(mg/kg)		<1	<1	2	<1	<1	<1
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	0.25	<0.01	<0.01	<0.01
	(kg/ha)		<1	<1	6	<1	<1	<1
	(mg/kg)		<1	<1	3	<1	<1	<1
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	23.15	14.88	11.41	17.74	4.52	2.37
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	37.8	37.6	73.4	40.6	64.0	54.8
Magnesium (%)			48.8	49.4	15.8	47.1	29.2	35.5
Potassium (%)			2.2	2.6	7.4	4.8	4.4	7.3
Sodium - ESP (%)			11.2	10.3	1.1	7.5	2.2	2.1
Aluminium (%)			0.0	0.1	0.2	0.0	0.2	0.3
Hydrogen (%)			0.0	0.0	2.2	0.0	0.0	0.0
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	0.8	0.8	4.7	0.9	2.2	1.5
Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	2.5Y 5/1 grey	5Y 5/1 grey	10YR 2/2 very dark brown	2.5Y 4/1 dark grey	2.5Y 5/1 grey	2.5Y 5/2 greyish brown
Mottles Munsell Colour			2.5Y 7/8 yellow	5YR 7/8 reddish yellow	.. ..	.. ..	5YR 7/8 reddish yellow	.. ..
Degree of Mottling (%)			25	5	..	..	20	..

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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 67	Sample 68	Sample 69	Sample 70	Sample 71	Sample 72
	Sample ID:	67	68	69	70	71	72
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/67	K7399/68	K7399/69	K7399/70	K7399/71	K7399/72

Notes:

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2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
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Parameter		Method reference	Sample 73	Sample 74	Sample 75	Sample 76	Sample 77	Sample 78
Sample ID:			73	74	75	76	77	78
Crop:			Soil	Soil	Soil	Soil	Soil	Soil
Client:			Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
			K7399/73	K7399/74	K7399/75	K7399/76	K7399/77	K7399/78
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.45	6.69	7.46	7.67	5.88	6.93
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.057	0.024	0.086	0.289	0.043	0.019
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	5.85	3.85	3.84	2.94	6.42	5.42
	(kg/ha)		2626	1728	1724	1322	2882	2433
	(mg/kg)		1172	771	770	590	1287	1086
Exchangeable Magnesium	(cmol$_+$/kg)		1.76	3.05	8.30	9.92	1.38	0.47
	(kg/ha)		479	830	2261	2701	375	127
	(mg/kg)		214	371	1009	1206	167	57
Exchangeable Potassium	(cmol$_+$/kg)		0.35	0.18	0.27	0.29	0.72	0.26
	(kg/ha)		307	157	240	257	628	224
	(mg/kg)		137	70	107	115	281	100
Exchangeable Sodium	(cmol$_+$/kg)		0.12	0.20	0.97	2.06	<0.065	<0.065
	(kg/ha)		61	101	500	1063	<33	<33
	(mg/kg)		27	45	223	475	<15	<15
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.07	0.02	<0.01	<0.01	0.03	<0.01
	(kg/ha)		15	3	1	<1	7	2
	(mg/kg)		7	2	<1	<1	3	<1
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.97	<0.01	<0.01	<0.01	0.63	<0.01
	(kg/ha)		22	<1	<1	<1	14	<1
	(mg/kg)		10	<1	<1	<1	6	<1
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	9.12	7.29	13.40	15.23	9.23	6.19
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	64.1	52.8	28.7	19.3	69.5	87.6
Magnesium (%)			19.3	41.8	62.0	65.2	14.9	7.5
Potassium (%)			3.8	2.5	2.0	1.9	7.8	4.1
Sodium - ESP (%)			1.3	2.7	7.3	13.6	0.6	0.6
Aluminium (%)			0.8	0.2	0.0	0.0	0.4	0.1
Hydrogen (%)			10.6	0.0	0.0	0.0	6.8	0.0
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	3.3	1.3	0.5	0.3	4.7	11.6
Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	10YR 2/2	10YR 4/1	2.5YR 5/1	2.5Y 7/1	7.5YR 2.5/2	7.5YR 3/3
			very dark brown	dark grey	grey	light grey	very dark brown	dark brown
Mottles Munsell Colour			..	..	5YR 7/8	2.5Y 8/8	..	..
			..	..	reddish yellow	yellow	..	..
Degree of Mottling (%)			..	..	10	10	..	..

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AGRICULTURAL SOIL ANALYSIS REPORT

230 samples supplied by Minesoils Pty. Ltd. on 27/05/2021. Lab Job No.K7399
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 73	Sample 74	Sample 75	Sample 76	Sample 77	Sample 78
	Sample ID:	73	74	75	76	77	78
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/73	K7399/74	K7399/75	K7399/76	K7399/77	K7399/78

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
10. Conversions for 1 $cmol_+/kg$ = 230 mg/kg Sodium, 390 mg/kg Potassium, 122 mg/kg Magnesium, 200 mg/kg Calcium
11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimat
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Quality Checked: Kris Saville
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PO BOX 11034 TAMWORTH NSW 2340

Parameter		Method reference	Sample 79	Sample 80	Sample 81	Sample 82	Sample 83	Sample 84
Sample ID:			79	80	81	82	83	84
Crop:			Soil	Soil	Soil	Soil	Soil	Soil
Client:			Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
			K7399/79	K7399/80	K7399/81	K7399/82	K7399/83	K7399/84
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	7.29	7.30	5.66	6.75	7.37	7.53
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.015	0.014	0.061	0.017	0.040	0.060
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	3.05	1.70	5.23	2.76	5.60	4.64
	(kg/ha)		1367	764	2348	1238	2513	2085
	(mg/kg)		610	341	1048	553	1122	931
Exchangeable Magnesium	(cmol$_+$/kg)		0.38	1.42	0.80	0.35	3.27	3.95
	(kg/ha)		104	388	217	97	890	1075
	(mg/kg)		46	173	97	43	397	480
Exchangeable Potassium	(cmol$_+$/kg)		0.15	0.13	0.63	0.37	0.72	0.78
	(kg/ha)		133	<112	556	321	633	681
	(mg/kg)		59	<50	248	143	282	304
Exchangeable Sodium	(cmol$_+$/kg)		<0.065	<0.065	<0.065	<0.065	0.10	0.18
	(kg/ha)		<33	<33	<33	<33	54	93
	(mg/kg)		<15	<15	<15	<15	24	41
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	<0.01	<0.01	0.03	0.01	<0.01	<0.01
	(kg/ha)		2	2	6	2	2	2
	(mg/kg)		<1	<1	3	1	<1	<1
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	0.68	<0.01	<0.01	<0.01
	(kg/ha)		<1	<1	15	<1	<1	<1
	(mg/kg)		<1	<1	7	<1	<1	<1
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	3.63	3.30	7.40	3.53	9.70	9.56
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	84.0	51.6	70.7	78.1	57.7	48.6
Magnesium (%)			10.5	43.2	10.8	10.0	33.7	41.3
Potassium (%)			4.2	3.8	8.6	10.4	7.4	8.1
Sodium - ESP (%)			1.0	1.2	0.3	1.1	1.1	1.9
Aluminium (%)			0.2	0.3	0.4	0.3	0.1	0.1
Hydrogen (%)			0.0	0.0	9.2	0.0	0.0	0.0
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	8.0	1.2	6.5	7.8	1.7	1.2
Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	5YR 4/4 reddish brown	7.5YR 5/4 brown	7.5YR 3/2 dark brown	5YR 5/8 yellowish red	2.5YR 5/6 red	10R 5/8 red
Mottles Munsell Colour			..	..	..	..	..	5Y 6/3 pale olive
Degree of Mottling (%)			..	..	..	..	..	30

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230 samples supplied by Minesoils Pty. Ltd. on 27/05/2021. Lab Job No.K7399
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 79	Sample 80	Sample 81	Sample 82	Sample 83	Sample 84
	Sample ID:	79	80	81	82	83	84
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/79	K7399/80	K7399/81	K7399/82	K7399/83	K7399/84

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
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5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
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11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimat
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			Sample 85	Sample 86	Sample 87	Sample 88	Sample 89	Sample 90
		Sample ID:	85	86	87	88	89	90
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	K7399/85	K7399/86	K7399/87	K7399/88	K7399/89	K7399/90
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.46	6.82	7.11	7.36	5.86	6.94
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.076	0.016	0.020	0.025	0.035	0.020
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	4.87	3.96	3.31	4.30	5.17	5.95
	Exchangeable Calcium (kg/ha)		2185	1778	1486	1931	2323	2670
	Exchangeable Calcium (mg/kg)		975	794	664	862	1037	1192
	Exchangeable Magnesium (cmol+/kg)		0.56	0.40	0.40	0.66	0.97	1.04
	Exchangeable Magnesium (kg/ha)		153	108	109	180	265	284
	Exchangeable Magnesium (mg/kg)		68	48	49	80	118	127
	Exchangeable Potassium (cmol+/kg)		0.38	0.17	0.16	0.21	0.89	0.57
	Exchangeable Potassium (kg/ha)		333	149	139	185	782	500
	Exchangeable Potassium (mg/kg)		149	66	62	83	349	223
	Exchangeable Sodium (cmol+/kg)		<0.065	<0.065	<0.065	<0.065	<0.065	<0.065
	Exchangeable Sodium (kg/ha)		<33	<33	<33	<33	<33	<33
	Exchangeable Sodium (mg/kg)		<15	<15	<15	<15	<15	<15
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.04	0.01	<0.01	<0.01	0.04	0.01
	Exchangeable Aluminium (kg/ha)		7	2	2	2	7	2
	Exchangeable Aluminium (mg/kg)		3	1	<1	<1	3	<1
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.66	<0.01	<0.01	<0.01	0.62	<0.01
	Exchangeable Hydrogen (kg/ha)		15	<1	<1	<1	14	<1
	Exchangeable Hydrogen (mg/kg)		7	<1	<1	<1	6	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	6.53	4.57	3.91	5.22	7.72	7.60
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	74.5	86.6	84.6	82.4	67.0	78.2
	Magnesium (%)		8.6	8.7	10.2	12.6	12.6	13.7
	Potassium (%)		5.8	3.7	4.1	4.1	11.6	7.5
	Sodium - ESP (%)		0.4	0.8	0.9	0.8	0.3	0.4
	Aluminium (%)		0.6	0.2	0.2	0.2	0.5	0.1
	Hydrogen (%)		10.1	0.0	0.0	0.0	8.0	0.0
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	8.7	10.0	8.3	6.5	5.3	5.7
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	10YR 2/2 very dark brown	7.5YR 4/3 brown	10YR 5/3 brown	2.5Y 7/8 yellow	5Y 3/1 very dark grey	7.5YR 3/2 dark brown
	Mottles Munsell Colour		..	..	..	..	..	..
	Degree of Mottling (%)		..	..	..	..	..	..

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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 85	Sample 86	Sample 87	Sample 88	Sample 89	Sample 90
	Sample ID:	85	86	87	88	89	90
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/85	K7399/86	K7399/87	K7399/88	K7399/89	K7399/90

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
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5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
10. Conversions for 1 $cmol_+/kg$ = 230 mg/kg Sodium, 390 mg/kg Potassium, 122 mg/kg Magnesium, 200 mg/kg Calcium
11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimat
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			Sample 91	Sample 92	Sample 93	Sample 94	Sample 95	Sample 96
		Sample ID:	91	92	93	94	95	96
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	K7399/91	K7399/92	K7399/93	K7399/94	K7399/95	K7399/96
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	7.28	6.14	6.66	7.26	8.22	6.68
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.023	0.059	0.036	0.072	0.110	0.207
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	6.54	14.16	24.19	30.78	30.06	22.94
	Exchangeable Calcium (kg/ha)		2936	6358	10858	13817	13494	10298
	Exchangeable Calcium (mg/kg)		1311	2839	4847	6168	6024	4597
	Exchangeable Magnesium (cmol+/kg)		0.70	2.50	5.38	5.59	4.10	4.03
	Exchangeable Magnesium (kg/ha)		192	681	1465	1521	1116	1097
	Exchangeable Magnesium (mg/kg)		86	304	654	679	498	490
	Exchangeable Potassium (cmol+/kg)		0.42	1.52	1.03	0.90	0.56	5.48
	Exchangeable Potassium (kg/ha)		367	1330	901	791	492	4798
	Exchangeable Potassium (mg/kg)		164	594	402	353	220	2142
	Exchangeable Sodium (cmol+/kg)		<0.065	<0.065	0.09	0.09	0.08	<0.065
	Exchangeable Sodium (kg/ha)		<33	<33	44	47	40	<33
	Exchangeable Sodium (mg/kg)		<15	<15	20	21	18	<15
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	<0.01	0.01	0.01	<0.01	<0.01	0.01
	Exchangeable Aluminium (kg/ha)		2	3	3	2	2	3
	Exchangeable Aluminium (mg/kg)		<1	1	1	<1	<1	1
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	0.34	<0.01	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		<1	8	<1	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	3	<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	7.71	18.57	30.70	37.37	34.81	32.51
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	84.8	76.3	78.8	82.4	86.4	70.6
	Magnesium (%)		9.1	13.5	17.5	15.0	11.8	12.4
	Potassium (%)		5.4	8.2	3.4	2.4	1.6	16.9
	Sodium - ESP (%)		0.5	0.1	0.3	0.2	0.2	0.1
	Aluminium (%)		0.1	0.1	0.0	0.0	0.0	0.0
	Hydrogen (%)		0.0	1.8	0.0	0.0	0.0	0.0
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	9.3	5.7	4.5	5.5	7.3	5.7
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	5YR 3/4 dark reddish brown	7.5YR 2.5/3 very dark brown	2.5YR 5/8 red	5YR 6/8 reddish yellow	5Y 6/1 grey	7.5YR 2.5/2 very dark brown
	Mottles Munsell Colour		..	..	..	..	5YR 6/8 reddish yellow	..
	Degree of Mottling (%)		..	..	..	..	10	..

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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 91	Sample 92	Sample 93	Sample 94	Sample 95	Sample 96
	Sample ID:	91	92	93	94	95	96
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/91	K7399/92	K7399/93	K7399/94	K7399/95	K7399/96

Notes:

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3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
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ABN: 41 995 651 524

AGRICULTURAL SOIL ANALYSIS REPORT

230 samples supplied by Minesoils Pty. Ltd. on 27/05/2021. Lab Job No.K7399
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

			Sample 97	Sample 98	Sample 99	Sample 100	Sample 101	Sample 102
		Sample ID:	97	98	99	100	101	102
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	K7399/97	K7399/98	K7399/99	K7399/100	K7399/101	K7399/102
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	7.28	7.67	7.84	6.31	6.32	7.01
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.074	0.075	0.073	0.037	0.026	0.025
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	27.24	21.26	27.47	5.12	3.81	4.66
	Exchangeable Calcium (kg/ha)		12229	9543	12330	2298	1713	2091
	Exchangeable Calcium (mg/kg)		5459	4260	5505	1026	765	934
	Exchangeable Magnesium (cmol+/kg)		3.28	3.32	5.74	0.89	0.74	1.68
	Exchangeable Magnesium (kg/ha)		894	904	1561	242	201	458
	Exchangeable Magnesium (mg/kg)		399	404	697	108	90	205
	Exchangeable Potassium (cmol+/kg)		2.03	1.31	0.91	0.95	0.43	0.23
	Exchangeable Potassium (kg/ha)		1774	1147	798	833	375	197
	Exchangeable Potassium (mg/kg)		792	512	356	372	167	88
	Exchangeable Sodium (cmol+/kg)		0.07	0.07	0.09	<0.065	<0.065	0.08
	Exchangeable Sodium (kg/ha)		34	38	47	<33	<33	41
	Exchangeable Sodium (mg/kg)		15	17	21	<15	<15	18
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.01	0.01	<0.01	0.02	0.02	0.01
	Exchangeable Aluminium (kg/ha)		2	3	2	4	3	2
	Exchangeable Aluminium (mg/kg)		1	1	<1	2	1	1
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	0.37	0.21	<0.01
	Exchangeable Hydrogen (kg/ha)		<1	<1	<1	8	5	<1
	Exchangeable Hydrogen (mg/kg)		<1	<1	<1	4	2	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	32.63	25.98	34.21	7.40	5.26	6.66
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	83.5	81.8	80.3	69.2	72.5	70.0
	Magnesium (%)		10.1	12.8	16.8	12.0	14.0	25.3
	Potassium (%)		6.2	5.0	2.7	12.9	8.1	3.4
	Sodium - ESP (%)		0.2	0.3	0.3	0.6	1.0	1.2
	Aluminium (%)		0.0	0.0	0.0	0.3	0.3	0.2
	Hydrogen (%)		0.0	0.0	0.0	5.0	4.1	0.0
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	8.3	6.4	4.8	5.8	5.2	2.8
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	2.5YR 2.5/3 dark reddish brown	10R 3/6 dark red	2.5YR 4/6 red	7.5YR 3/3 dark brown	7.5YR 4/4 brown	5YR 6/8 reddish yellow
	Mottles Munsell Colour		..	..	..	..	..	..
	Degree of Mottling (%)		..	..	..	..	..	..

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		Sample 97	Sample 98	Sample 99	Sample 100	Sample 101	Sample 102
	Sample ID:	97	98	99	100	101	102
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/97	K7399/98	K7399/99	K7399/100	K7399/101	K7399/102

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
10. Conversions for 1 $cmol_+/kg$ = 230 mg/kg Sodium, 390 mg/kg Potassium, 122 mg/kg Magnesium, 200 mg/kg Calcium
11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimat
13. ** NATA accreditation does not cover the performance of this service.
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Quality Checked: Kris Saville
Agricultural Co-Ordinator KS

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Parameter		Method reference	Sample 103	Sample 104	Sample 105	Sample 106	Sample 107	Sample 108
Sample ID:			103	104	105	106	107	108
Crop:			Soil	Soil	Soil	Soil	Soil	Soil
Client:			Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
			K7399/103	K7399/104	K7399/105	K7399/106	K7399/107	K7399/108
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	7.06	6.62	6.59	6.69	6.77	6.02
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.027	0.056	0.038	0.030	0.035	0.042
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	5.15	6.55	4.72	2.97	1.40	3.68
	(kg/ha)		2313	2941	2118	1332	627	1653
	(mg/kg)		1032	1313	945	595	280	738
Exchangeable Magnesium	(cmol$_+$/kg)		5.08	1.93	1.63	2.42	5.17	1.14
	(kg/ha)		1383	524	444	658	1406	311
	(mg/kg)		617	234	198	294	628	139
Exchangeable Potassium	(cmol$_+$/kg)		0.35	2.83	2.05	1.55	1.59	1.04
	(kg/ha)		305	2481	1795	1358	1396	911
	(mg/kg)		136	1108	801	606	623	407
Exchangeable Sodium	(cmol$_+$/kg)		<0.065	<0.065	<0.065	<0.065	0.10	<0.065
	(kg/ha)		<33	<33	<33	<33	50	<33
	(mg/kg)		<15	<15	<15	<15	22	<15
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.01	0.02	0.03	0.03	0.02	0.04
	(kg/ha)		2	4	6	6	5	8
	(mg/kg)		<1	2	3	2	2	3
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	<0.01	0.54
	(kg/ha)		<1	<1	<1	<1	<1	12
	(mg/kg)		<1	<1	<1	<1	<1	5
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	10.65	11.35	8.46	7.01	8.28	6.48
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	48.4	57.7	55.8	42.3	16.9	56.9
Magnesium (%)			47.7	17.0	19.3	34.4	62.4	17.7
Potassium (%)			3.3	24.9	24.2	22.1	19.3	16.1
Sodium - ESP (%)			0.6	0.2	0.3	0.8	1.2	0.4
Aluminium (%)			0.1	0.2	0.4	0.4	0.3	0.6
Hydrogen (%)			0.0	0.0	0.0	0.0	0.0	8.4
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	1.0	3.4	2.9	1.2	0.3	3.2
Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	2.5YR 6/8	10YR 2/2	10YR 2/2	10YR 2/2	10YR 2/2	7.5YR 3/3
			light red	very dark brown	very dark brown	very dark brown	very dark brown	dark brown
Mottles Munsell Colour			5Y 7/6	..	..	..	..	..
			yellow	..	..	..	..	..
Degree of Mottling (%)			40	..	..	..	..	..

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PO BOX 11034 TAMWORTH NSW 2340

		Sample 103	Sample 104	Sample 105	Sample 106	Sample 107	Sample 108
	Sample ID:	103	104	105	106	107	108
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/103	K7399/104	K7399/105	K7399/106	K7399/107	K7399/108

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
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11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimat
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			Sample 109	Sample 110	Sample 111	Sample 112	Sample 113	Sample 114
		Sample ID:	109	110	111	112	113	114
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	K7399/109	K7399/110	K7399/111	K7399/112	K7399/113	K7399/114
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.71	7.13	8.06	5.55	7.32	7.92
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.019	0.016	0.031	0.094	0.055	0.103
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	4.62	4.25	3.13	5.51	3.48	4.53
	Exchangeable Calcium (kg/ha)		2074	1907	1405	2473	1563	2033
	Exchangeable Calcium (mg/kg)		926	851	627	1104	698	907
	Exchangeable Magnesium (cmol+/kg)		1.02	1.41	2.89	1.49	1.26	4.20
	Exchangeable Magnesium (kg/ha)		277	383	787	405	344	1144
	Exchangeable Magnesium (mg/kg)		124	171	351	181	154	511
	Exchangeable Potassium (cmol+/kg)		0.49	0.34	0.37	1.44	1.18	2.39
	Exchangeable Potassium (kg/ha)		433	299	325	1264	1036	2092
	Exchangeable Potassium (mg/kg)		193	133	145	564	462	934
	Exchangeable Sodium (cmol+/kg)		<0.065	<0.065	0.20	<0.065	<0.065	0.14
	Exchangeable Sodium (kg/ha)		<33	<33	101	<33	<33	70
	Exchangeable Sodium (mg/kg)		<15	<15	45	<15	<15	31
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.02	0.01	0.01	0.06	0.02	<0.01
	Exchangeable Aluminium (kg/ha)		3	2	3	12	3	1
	Exchangeable Aluminium (mg/kg)		1	1	1	5	1	<1
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	0.71	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		<1	<1	<1	16	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	<1	<1	7	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	6.18	6.07	6.60	9.23	5.98	11.26
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	74.8	70.0	47.4	59.7	58.3	40.2
	Magnesium (%)		16.5	23.2	43.8	16.1	21.1	37.3
	Potassium (%)		8.0	5.6	5.6	15.6	19.8	21.2
	Sodium - ESP (%)		0.5	1.0	3.0	0.2	0.6	1.2
	Aluminium (%)		0.3	0.2	0.2	0.7	0.3	0.1
	Hydrogen (%)		0.0	0.0	0.0	7.7	0.0	0.0
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	4.5	3.0	1.1	3.7	2.8	1.1
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	5YR 3/3 dark reddish brown	2.5YR 4/4 reddish brown	10R 5/6 red	7.5YR 4/2 brown	7.5YR 5/4 brown	2.5YR 5/6 red
	Mottles Munsell Colour		..	..	..	..	..	5Y 8/6
	Degree of Mottling (%)		..	..	..	..	..	yellow
			..	..	..	..	..	5

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PO BOX 11034 TAMWORTH NSW 2340

		Sample 109	Sample 110	Sample 111	Sample 112	Sample 113	Sample 114
	Sample ID:	109	110	111	112	113	114
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/109	K7399/110	K7399/111	K7399/112	K7399/113	K7399/114

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
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9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
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Parameter		Method reference	Sample 115	Sample 116	Sample 117	Sample 118	Sample 119	Sample 120
Sample ID:			115	116	117	118	119	120
Crop:			Soil	Soil	Soil	Soil	Soil	Soil
Client:			Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
			K7399/115	K7399/116	K7399/117	K7399/118	K7399/119	K7399/120
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.32	5.30	5.90	6.08	5.61	6.33
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.165	0.055	0.022	0.091	0.048	0.018
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	2.95	2.40	1.39	1.13	2.39	2.13
	(kg/ha)		1324	1078	624	507	1073	955
	(mg/kg)		591	481	278	226	479	427
Exchangeable Magnesium	(cmol$_+$/kg)		5.45	1.29	2.45	7.41	0.96	0.84
	(kg/ha)		1484	351	666	2017	262	230
	(mg/kg)		663	157	297	900	117	102
Exchangeable Potassium	(cmol$_+$/kg)		1.69	0.84	0.20	0.25	0.60	0.39
	(kg/ha)		1477	732	177	216	524	342
	(mg/kg)		659	327	79	96	234	153
Exchangeable Sodium	(cmol$_+$/kg)		0.35	0.12	0.19	1.02	<0.065	<0.065
	(kg/ha)		179	61	100	524	<33	<33
	(mg/kg)		80	27	45	234	<15	<15
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	<0.01	0.13	0.04	0.02	0.05	0.02
	(kg/ha)		1	25	7	3	10	3
	(mg/kg)		<1	11	3	1	4	2
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	0.93	0.60	0.47	0.71	0.22
	(kg/ha)		<1	21	14	10	16	5
	(mg/kg)		<1	9	6	5	7	2
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	10.44	5.70	4.87	10.28	4.77	3.64
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	28.2	42.1	28.5	11.0	50.1	58.5
Magnesium (%)			52.2	22.6	50.2	72.0	20.2	23.2
Potassium (%)			16.1	14.7	4.1	2.4	12.6	10.7
Sodium - ESP (%)			3.3	2.1	4.0	9.9	1.1	1.1
Aluminium (%)			0.1	2.2	0.7	0.2	1.0	0.5
Hydrogen (%)			0.0	16.3	12.4	4.6	15.0	6.1
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	0.5	1.9	0.6	0.2	2.5	2.5
Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	2.5YR 4/4 reddish brown	7.5YR 4/3 brown	10YR 6/6 brownish yellow	2.5Y 6/6 olive yellow	7.5YR 3/3 dark brown	2.5YR 4/4 reddish brown
Mottles Munsell Colour			2.5Y 6/6 olive yellow	.. ..	.. ..	.. ..	.. ..	.. ..
Degree of Mottling (%)			10	..	..	..	..	..

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		Sample 115	Sample 116	Sample 117	Sample 118	Sample 119	Sample 120
	Sample ID:	115	116	117	118	119	120
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/115	K7399/116	K7399/117	K7399/118	K7399/119	K7399/120

Notes:

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

230 samples supplied by Minesoils Pty. Ltd. on 27/05/2021. Lab Job No.K7399
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

			Sample 121	Sample 122	Sample 123	Sample 124	Sample 125	Sample 126
		Sample ID:	121	122	123	124	125	126
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	K7399/121	K7399/122	K7399/123	K7399/124	K7399/125	K7399/126
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.63	7.21	5.23	6.81	7.34	7.49
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.014	0.025	0.092	0.026	0.027	0.068
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	2.52	2.72	2.49	2.28	2.52	3.41
	Exchangeable Calcium (kg/ha)		1130	1221	1117	1024	1131	1529
	Exchangeable Calcium (mg/kg)		504	545	499	457	505	683
	Exchangeable Magnesium (cmol+/kg)		1.72	4.10	0.72	0.80	0.86	2.29
	Exchangeable Magnesium (kg/ha)		467	1115	197	217	234	624
	Exchangeable Magnesium (mg/kg)		209	498	88	97	104	278
	Exchangeable Potassium (cmol+/kg)		0.27	0.24	1.03	0.46	0.30	0.30
	Exchangeable Potassium (kg/ha)		239	214	902	400	262	261
	Exchangeable Potassium (mg/kg)		107	95	403	179	117	117
	Exchangeable Sodium (cmol+/kg)		<0.065	0.26	<0.065	<0.065	0.07	0.23
	Exchangeable Sodium (kg/ha)		<33	135	<33	<33	37	118
	Exchangeable Sodium (mg/kg)		<15	60	<15	<15	17	53
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.02	0.01	0.07	<0.01	<0.01	<0.01
	Exchangeable Aluminium (kg/ha)		3	2	13	2	1	1
	Exchangeable Aluminium (mg/kg)		2	<1	6	<1	<1	<1
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	0.83	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		<1	<1	19	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	<1	8	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	4.58	7.33	5.18	3.59	3.76	6.23
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	55.0	37.1	48.1	63.6	67.1	54.7
	Magnesium (%)		37.5	55.8	14.0	22.2	22.9	36.8
	Potassium (%)		6.0	3.3	19.9	12.7	8.0	4.8
	Sodium - ESP (%)		1.2	3.6	0.7	1.3	1.9	3.7
	Aluminium (%)		0.4	0.1	1.3	0.2	0.1	0.1
	Hydrogen (%)		0.0	0.0	16.1	0.0	0.0	0.0
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	1.5	0.7	3.4	2.9	2.9	1.5
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	5YR 6/8 reddish yellow	5Y 6/6 olive yellow	7.5YR 3/3 dark brown	5YR 5/6 yellowish red	5YR 5/8 yellowish red	10R 5/8 red
	Mottles Munsell Colour		..	2.5YR 5/8 yellowish red	..	..	..	..
	Degree of Mottling (%)		..	15	..	..	..	..

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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 121	Sample 122	Sample 123	Sample 124	Sample 125	Sample 126
	Sample ID:	121	122	123	124	125	126
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/121	K7399/122	K7399/123	K7399/124	K7399/125	K7399/126

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
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Parameter		Method reference	Sample 127	Sample 128	Sample 129	Sample 130	Sample 131	Sample 132
Sample ID:			127	128	129	130	131	132
Crop:			Soil	Soil	Soil	Soil	Soil	Soil
Client:			Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
			K7399/127	K7399/128	K7399/129	K7399/130	K7399/131	K7399/132
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.78	6.53	6.59	7.38	5.36	6.24
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.047	0.011	0.034	0.028	0.031	0.013
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	1.98	1.98	1.60	3.84	2.39	3.05
	(kg/ha)		888	888	718	1725	1074	1368
	(mg/kg)		396	396	320	770	480	611
Exchangeable Magnesium	(cmol$_+$/kg)		0.55	0.46	0.49	3.89	0.56	0.46
	(kg/ha)		149	125	135	1060	151	127
	(mg/kg)		66	56	60	473	68	56
Exchangeable Potassium	(cmol$_+$/kg)		0.33	0.14	<0.12	0.20	0.43	0.23
	(kg/ha)		290	119	<112	178	380	198
	(mg/kg)		130	53	<50	79	170	88
Exchangeable Sodium	(cmol$_+$/kg)		0.09	<0.065	0.07	0.26	0.09	<0.065
	(kg/ha)		47	<33	38	134	46	<33
	(mg/kg)		21	<15	17	60	21	<15
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.05	0.01	<0.01	<0.01	0.09	0.01
	(kg/ha)		11	2	2	2	18	2
	(mg/kg)		5	1	<1	<1	8	1
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.59	<0.01	<0.01	<0.01	0.89	0.19
	(kg/ha)		13	<1	<1	<1	20	4
	(mg/kg)		6	<1	<1	<1	9	2
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	3.59	2.64	2.28	8.21	4.45	3.99
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	55.0	75.1	70.0	46.8	53.8	76.5
Magnesium (%)			15.2	17.4	21.7	47.4	12.5	11.7
Potassium (%)			9.2	5.2	4.8	2.5	9.8	5.7
Sodium - ESP (%)			2.6	1.9	3.2	3.2	2.0	1.0
Aluminium (%)			1.5	0.4	0.3	0.1	2.0	0.3
Hydrogen (%)			16.6	0.0	0.0	0.0	19.9	4.8
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	3.6	4.3	3.2	1.0	4.3	6.6
Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	7.5YR 2.5/2 very dark brown	7.5YR 4/4 brown	10YR 5/4 yellowish brown	10YR 6/1 grey	7.5YR 3/3 dark brown	5YR 5/6 yellowish red
Mottles Munsell Colour			..	..	..	10R 4/8 red	..	..
Degree of Mottling (%)			..	..	..	30	..	..

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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 127	Sample 128	Sample 129	Sample 130	Sample 131	Sample 132
	Sample ID:	127	128	129	130	131	132
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/127	K7399/128	K7399/129	K7399/130	K7399/131	K7399/132

Notes:

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2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
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Parameter		Method reference	Sample 133	Sample 134	Sample 135	Sample 136	Sample 137	Sample 138
Sample ID:			133	134	135	136	137	138
Crop:			Soil	Soil	Soil	Soil	Soil	Soil
Client:			Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
			K7399/133	K7399/134	K7399/135	K7399/136	K7399/137	K7399/138
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.87	7.32	5.22	5.84	6.02	5.99
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.010	0.016	0.151	0.013	0.012	0.010
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	3.53	4.86	5.24	2.30	2.65	1.28
	(kg/ha)		1585	2182	2354	1032	1188	575
	(mg/kg)		708	974	1051	461	531	257
Exchangeable Magnesium	(cmol$_+$/kg)		0.84	2.45	1.57	1.02	1.55	1.21
	(kg/ha)		230	668	426	277	423	330
	(mg/kg)		102	298	190	124	189	147
Exchangeable Potassium	(cmol$_+$/kg)		0.16	0.28	0.52	<0.12	0.14	<0.12
	(kg/ha)		139	244	455	<112	125	<112
	(mg/kg)		62	109	203	<50	56	<50
Exchangeable Sodium	(cmol$_+$/kg)		<0.065	<0.065	0.16	0.07	0.11	<0.065
	(kg/ha)		<33	<33	85	38	57	<33
	(mg/kg)		<15	<15	38	17	26	<15
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	<0.01	<0.01	0.08	0.05	0.04	0.03
	(kg/ha)		2	1	17	11	8	6
	(mg/kg)		<1	<1	7	5	3	3
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	0.83	0.57	0.45	0.34
	(kg/ha)		<1	<1	19	13	10	8
	(mg/kg)		<1	<1	8	6	4	3
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	4.58	7.64	8.40	4.11	4.94	3.01
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	77.1	63.6	62.4	55.9	53.6	42.6
Magnesium (%)			18.4	32.1	18.6	24.8	31.5	40.3
Potassium (%)			3.5	3.7	6.2	2.3	2.9	3.1
Sodium - ESP (%)			0.8	0.5	2.0	1.8	2.3	1.7
Aluminium (%)			0.2	0.1	1.0	1.3	0.8	1.0
Hydrogen (%)			0.0	0.0	9.8	13.8	9.0	11.3
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	4.2	2.0	3.3	2.3	1.7	1.1
Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	5YR 6/8 reddish yellow	5YR 5/6 yellowish red	10YR 2/1 black	10YR 2/1 black	2.5Y 2.5/1 black	2.5Y 4/1 dark grey
Mottles Munsell Colour			..	..	..	..	..	..
Degree of Mottling (%)			..	..	..	..	..	..

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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 133	Sample 134	Sample 135	Sample 136	Sample 137	Sample 138
	Sample ID:	133	134	135	136	137	138
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/133	K7399/134	K7399/135	K7399/136	K7399/137	K7399/138

Notes:

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Parameter		Method reference	Sample 139	Sample 140	Sample 141	Sample 142	Sample 143	Sample 144
Sample ID:			139	140	141	142	143	144
Crop:			Soil	Soil	Soil	Soil	Soil	Soil
Client:			Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
			K7399/139	K7399/140	K7399/141	K7399/142	K7399/143	K7399/144
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	4.49	5.59	6.75	7.44	4.90	5.37
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.077	0.014	0.013	0.023	0.039	0.011
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	1.24	1.35	1.92	4.91	0.52	0.23
	(kg/ha)		555	608	861	2205	232	103
	(mg/kg)		248	272	384	984	104	46
Exchangeable Magnesium	(cmol$_+$/kg)		0.25	0.32	0.53	4.01	0.16	0.09
	(kg/ha)		69	88	143	1091	43	25
	(mg/kg)		31	39	64	487	19	11
Exchangeable Potassium	(cmol$_+$/kg)		0.40	0.17	0.19	0.28	0.24	0.18
	(kg/ha)		352	152	164	249	210	158
	(mg/kg)		157	68	73	111	94	71
Exchangeable Sodium	(cmol$_+$/kg)		<0.065	<0.065	0.08	0.17	<0.065	<0.065
	(kg/ha)		<33	<33	41	90	<33	<33
	(mg/kg)		<15	<15	18	40	<15	<15
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.26	0.05	0.01	<0.01	0.09	0.14
	(kg/ha)		52	10	2	2	19	28
	(mg/kg)		23	4	<1	<1	8	12
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	1.53	0.33	<0.01	<0.01	0.74	0.64
	(kg/ha)		34	7	<1	<1	17	14
	(mg/kg)		15	3	<1	<1	7	6
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	3.71	2.26	2.72	9.39	1.76	1.29
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	33.3	59.9	70.5	52.3	29.4	17.7
Magnesium (%)			6.8	14.3	19.3	42.7	8.9	7.0
Potassium (%)			10.8	7.7	6.9	3.0	13.6	14.0
Sodium - ESP (%)			0.9	1.4	2.9	1.9	0.7	1.2
Aluminium (%)			7.0	2.1	0.4	0.1	5.3	10.7
Hydrogen (%)			41.1	14.5	0.0	0.0	42.2	49.4
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	4.9	4.2	3.6	1.2	3.3	2.5
Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	7.5YR 2.5/3	10YR 6/8	2.5Y 6/8	10R 5/8	7.5YR 3/3	7.5YR 4/3
			very dark brown	brownish yellow	olive yellow	red	dark brown	brown
Mottles Munsell Colour			..	..	..	2.5Y 6/6	..	..
			..	..	..	olive yellow	..	..
Degree of Mottling (%)			..	..	..	30	..	..

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AGRICULTURAL SOIL ANALYSIS REPORT

230 samples supplied by Minesoils Pty. Ltd. on 27/05/2021. Lab Job No.K7399
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 139	Sample 140	Sample 141	Sample 142	Sample 143	Sample 144
	Sample ID:	139	140	141	142	143	144
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/139	K7399/140	K7399/141	K7399/142	K7399/143	K7399/144

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
10. Conversions for 1 $cmol_+/kg$ = 230 mg/kg Sodium, 390 mg/kg Potassium, 122 mg/kg Magnesium, 200 mg/kg Calcium
11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimat
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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
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			Sample 145	Sample 146	Sample 147	Sample 148	Sample 149	Sample 150
		Sample ID:	145	146	147	148	149	150
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	K7399/145	K7399/146	K7399/147	K7399/148	K7399/149	K7399/150
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.95	6.36	6.50	7.25	7.64	7.89
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.012	0.016	0.030	0.024	0.022	0.031
	Exchangeable Calcium (cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	0.70	1.43	5.12	4.59	5.08	6.12
	Exchangeable Calcium (kg/ha)		314	641	2298	2060	2282	2746
	Exchangeable Calcium (mg/kg)		140	286	1026	919	1019	1226
	Exchangeable Magnesium (cmol$_+$/kg)		0.18	0.33	0.85	0.77	1.13	2.72
	Exchangeable Magnesium (kg/ha)		49	91	230	210	309	742
	Exchangeable Magnesium (mg/kg)		22	41	103	94	138	331
	Exchangeable Potassium (cmol$_+$/kg)		0.30	0.27	0.69	0.42	0.45	0.54
	Exchangeable Potassium (kg/ha)		266	239	607	370	394	470
	Exchangeable Potassium (mg/kg)		119	107	271	165	176	210
	Exchangeable Sodium (cmol$_+$/kg)		<0.065	<0.065	<0.065	<0.065	<0.065	<0.065
	Exchangeable Sodium (kg/ha)		<33	<33	<33	<33	<33	<33
	Exchangeable Sodium (mg/kg)		<15	<15	<15	<15	<15	<15
	Exchangeable Aluminium (cmol$_+$/kg)	**Inhouse S37 (KCl)	0.03	0.02	0.01	0.01	0.01	0.01
	Exchangeable Aluminium (kg/ha)		5	4	2	2	2	3
	Exchangeable Aluminium (mg/kg)		2	2	1	<1	<1	1
	Exchangeable Hydrogen (cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.18	0.10	0.13	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		4	2	3	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		2	<1	1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	1.44	2.17	6.82	5.81	6.73	9.44
	Calcium (%)	**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	48.6	65.8	75.1	78.9	75.5	64.8
	Magnesium (%)		12.5	15.4	12.4	13.3	16.9	28.8
	Potassium (%)		21.1	12.6	10.2	7.3	6.7	5.7
	Sodium - ESP (%)		3.6	0.9	0.3	0.4	0.8	0.6
	Aluminium (%)		1.7	0.8	0.2	0.2	0.2	0.2
	Hydrogen (%)		12.5	4.5	1.9	0.0	0.0	0.0
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol$_+$/kg)	3.9	4.3	6.0	6.0	4.5	2.2
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	5YR 5/8 yellowish red	10R 4/8 red	5YR 3/4 dark reddish brown	2.5YR 5/8 red	2.5YR 4/8 red	5YR 5/8 yellowish red
	Mottles Munsell Colour		..	..	..	..	..	..
	Degree of Mottling (%)		..	..	..	..	..	..

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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 145	Sample 146	Sample 147	Sample 148	Sample 149	Sample 150
	Sample ID:	145	146	147	148	149	150
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/145	K7399/146	K7399/147	K7399/148	K7399/149	K7399/150

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
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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.
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11. Conversions to kg/ha = mg/kg x 2.24
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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

			Sample 151	Sample 152	Sample 153	Sample 154	Sample 155	Sample 156
		Sample ID:	151	152	153	154	155	156
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	K7399/151	K7399/152	K7399/153	K7399/154	K7399/155	K7399/156
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.97	6.53	6.76	7.30	5.74	6.28
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.020	0.008	0.008	0.013	0.016	0.007
	Exchangeable Calcium (cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	2.39	1.46	0.87	0.89	2.34	1.51
	Exchangeable Calcium (kg/ha)		1075	657	389	398	1051	677
	Exchangeable Calcium (mg/kg)		480	293	174	177	469	302
	Exchangeable Magnesium (cmol$_+$/kg)		0.75	0.91	0.98	1.82	0.69	0.48
	Exchangeable Magnesium (kg/ha)		205	249	267	496	187	132
	Exchangeable Magnesium (mg/kg)		91	111	119	221	83	59
	Exchangeable Potassium (cmol$_+$/kg)		0.34	0.20	0.19	0.17	0.30	0.20
	Exchangeable Potassium (kg/ha)		295	179	167	151	260	172
	Exchangeable Potassium (mg/kg)		132	80	74	67	116	77
	Exchangeable Sodium (cmol$_+$/kg)		<0.065	<0.065	<0.065	<0.065	<0.065	<0.065
	Exchangeable Sodium (kg/ha)		<33	<33	<33	<33	<33	<33
	Exchangeable Sodium (mg/kg)		<15	<15	<15	<15	<15	<15
	Exchangeable Aluminium (cmol$_+$/kg)	**Inhouse S37 (KCl)	0.02	0.02	0.01	0.01	0.05	0.02
	Exchangeable Aluminium (kg/ha)		5	3	3	2	10	4
	Exchangeable Aluminium (mg/kg)		2	1	1	<1	5	2
	Exchangeable Hydrogen (cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.33	<0.01	<0.01	<0.01	0.60	0.18
	Exchangeable Hydrogen (kg/ha)		7	<1	<1	<1	13	4
	Exchangeable Hydrogen (mg/kg)		3	<1	<1	<1	6	2
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	3.85	2.61	2.07	2.94	3.99	2.41
	Calcium (%)	**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	62.1	56.1	41.9	30.1	58.7	62.7
	Magnesium (%)		19.5	35.1	47.5	62.0	17.2	20.1
	Potassium (%)		8.7	7.9	9.2	5.9	7.4	8.2
	Sodium - ESP (%)		0.5	0.4	0.8	1.7	0.4	0.8
	Aluminium (%)		0.6	0.6	0.6	0.3	1.3	0.8
	Hydrogen (%)		8.5	0.0	0.0	0.0	15.0	7.3
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol$_+$/kg)	3.2	1.6	0.9	0.5	3.4	3.1
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	7.5YR 2.5/2 very dark brown	5Y 5/3 olive	10YR 5/3 brown	5Y 6/8 olive yelllow	7.5YR 4/2 brown	7.5YR 5/2 brown
	Mottles Munsell Colour		..	..	..	..	..	..
	Degree of Mottling (%)		..	..	..	..	..	..

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AGRICULTURAL SOIL ANALYSIS REPORT

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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 151	Sample 152	Sample 153	Sample 154	Sample 155	Sample 156
	Sample ID:	151	152	153	154	155	156
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/151	K7399/152	K7399/153	K7399/154	K7399/155	K7399/156

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
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Parameter		Method reference	Sample 157	Sample 158	Sample 159	Sample 160	Sample 161	Sample 162
		Sample ID:	157	158	159	160	161	162
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
			K7399/157	K7399/158	K7399/159	K7399/160	K7399/161	K7399/162
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.98	7.34	6.51	7.24	8.39	8.65
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.010	0.013	0.029	0.020	0.062	0.064
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	1.59	1.80	9.16	8.58	6.03	7.78
	(kg/ha)		712	808	4110	3854	2706	3494
	(mg/kg)		318	361	1835	1720	1208	1560
Exchangeable Magnesium	(cmol$_+$/kg)		0.55	0.57	0.97	0.63	0.26	0.16
	(kg/ha)		148	155	263	171	70	45
	(mg/kg)		66	69	117	76	31	20
Exchangeable Potassium	(cmol$_+$/kg)		0.20	0.19	0.58	0.43	0.23	0.21
	(kg/ha)		175	170	505	379	198	188
	(mg/kg)		78	76	225	169	88	84
Exchangeable Sodium	(cmol$_+$/kg)		<0.065	<0.065	<0.065	<0.065	<0.065	<0.065
	(kg/ha)		<33	<33	<33	<33	<33	<33
	(mg/kg)		<15	<15	<15	<15	<15	<15
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.01	<0.01	0.02	<0.01	0.01	0.01
	(kg/ha)		2	2	3	2	2	3
	(mg/kg)		<1	<1	1	<1	1	1
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	(kg/ha)		<1	<1	<1	<1	<1	<1
	(mg/kg)		<1	<1	<1	<1	<1	<1
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	2.38	2.61	10.73	9.68	6.54	8.19
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	66.6	68.9	85.3	88.7	92.1	95.0
Magnesium (%)			22.9	21.8	9.0	6.5	3.9	2.0
Potassium (%)			8.4	7.4	5.4	4.5	3.4	2.6
Sodium - ESP (%)			1.6	1.6	0.2	0.2	0.3	0.2
Aluminium (%)			0.5	0.3	0.1	0.1	0.2	0.2
Hydrogen (%)			0.0	0.0	0.0	0.0	0.0	0.0
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	2.9	3.2	9.5	13.7	23.3	47.5
Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	5YR 5/4 reddish brown	5YR 6/6 reddish yellow	7.5YR 2.5/1 black	10YR 2/2 very dark brown	5YR 4/3 reddish brown	5YR 6/8 reddish yellow
Mottles Munsell Colour			..	..	..	..	..	5Y 7/8
Degree of Mottling (%)			..	..	..	..	..	yellow
			..	..	..	..	..	20

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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 157	Sample 158	Sample 159	Sample 160	Sample 161	Sample 162
	Sample ID:	157	158	159	160	161	162
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/157	K7399/158	K7399/159	K7399/160	K7399/161	K7399/162

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
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			Sample 163	Sample 164	Sample 165	Sample 166	Sample 167	Sample 168
		Sample ID:	163	164	165	166	167	168
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	K7399/163	K7399/164	K7399/165	K7399/166	K7399/167	K7399/168
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.94	6.76	7.60	8.18	5.46	5.76
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.032	0.012	0.044	0.079	0.041	0.032
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	3.55	2.21	5.95	6.59	0.85	0.31
	Exchangeable Calcium (kg/ha)		1596	994	2670	2960	380	141
	Exchangeable Calcium (mg/kg)		712	444	1192	1321	170	63
	Exchangeable Magnesium (cmol+/kg)		0.63	0.44	3.35	5.08	0.25	0.09
	Exchangeable Magnesium (kg/ha)		172	119	912	1383	67	26
	Exchangeable Magnesium (mg/kg)		77	53	407	618	30	12
	Exchangeable Potassium (cmol+/kg)		0.66	0.34	0.94	1.29	0.12	<0.12
	Exchangeable Potassium (kg/ha)		576	294	822	1127	<112	<112
	Exchangeable Potassium (mg/kg)		257	131	367	503	<50	<50
	Exchangeable Sodium (cmol+/kg)		<0.065	<0.065	0.18	0.46	0.17	0.08
	Exchangeable Sodium (kg/ha)		<33	<33	94	237	90	39
	Exchangeable Sodium (mg/kg)		<15	<15	42	106	40	18
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.03	0.01	<0.01	0.01	0.13	0.03
	Exchangeable Aluminium (kg/ha)		6	2	2	2	26	7
	Exchangeable Aluminium (mg/kg)		3	<1	<1	1	11	3
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.47	<0.01	<0.01	<0.01	1.01	0.12
	Exchangeable Hydrogen (kg/ha)		11	<1	<1	<1	23	3
	Exchangeable Hydrogen (mg/kg)		5	<1	<1	<1	10	1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	5.40	3.01	10.43	13.43	2.53	0.69
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	65.9	73.4	57.0	49.1	33.5	45.1
	Magnesium (%)		11.7	14.5	32.1	37.8	9.7	13.7
	Potassium (%)		12.2	11.1	9.0	9.6	4.8	9.0
	Sodium - ESP (%)		1.0	0.6	1.8	3.4	6.9	11.0
	Aluminium (%)		0.6	0.4	0.1	0.1	5.0	4.6
	Hydrogen (%)		8.7	0.0	0.0	0.0	40.0	16.6
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	5.6	5.1	1.8	1.3	3.4	3.3
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	10YR 4/2 dark greyish brown	7.5YR 6/3 light brown	10YR 6/6 brownish yellow	2.5Y 6/8 olive yellow	10YR 2/1 black	7.5YR 6/2 pinkish grey
	Mottles Munsell Colour		..	..	2.5YR 5/8 red	..	..	..
	Degree of Mottling (%)		..	..	30	..	..	..

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AGRICULTURAL SOIL ANALYSIS REPORT

230 samples supplied by Minesoils Pty. Ltd. on 27/05/2021. Lab Job No.K7399
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 163	Sample 164	Sample 165	Sample 166	Sample 167	Sample 168
	Sample ID:	163	164	165	166	167	168
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/163	K7399/164	K7399/165	K7399/166	K7399/167	K7399/168

Notes:

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

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			Sample 169	Sample 170	Sample 171	Sample 172	Sample 173	Sample 174
		Sample ID:	169	170	171	172	173	174
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	K7399/169	K7399/170	K7399/171	K7399/172	K7399/173	K7399/174
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.93	5.99	6.60	6.51	6.88	7.02
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.012	0.011	0.040	0.013	0.010	0.011
	Exchangeable Calcium (cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	0.18	0.13	8.30	4.71	1.56	1.14
	Exchangeable Calcium (kg/ha)		80	60	3724	2113	702	512
	Exchangeable Calcium (mg/kg)		36	27	1663	943	313	228
	Exchangeable Magnesium (cmol$_+$/kg)		0.07	0.13	1.08	0.84	0.51	0.51
	Exchangeable Magnesium (kg/ha)		20	36	294	228	140	138
	Exchangeable Magnesium (mg/kg)		9	16	131	102	62	62
	Exchangeable Potassium (cmol$_+$/kg)		0.18	<0.12	0.48	0.34	0.16	0.17
	Exchangeable Potassium (kg/ha)		160	<112	417	301	142	148
	Exchangeable Potassium (mg/kg)		72	<50	186	135	63	66
	Exchangeable Sodium (cmol$_+$/kg)		0.18	0.09	<0.065	<0.065	<0.065	<0.065
	Exchangeable Sodium (kg/ha)		94	45	<33	<33	<33	<33
	Exchangeable Sodium (mg/kg)		42	20	<15	<15	<15	<15
	Exchangeable Aluminium (cmol$_+$/kg)	**Inhouse S37 (KCl)	0.03	0.05	0.01	0.01	0.01	0.01
	Exchangeable Aluminium (kg/ha)		6	10	2	2	3	2
	Exchangeable Aluminium (mg/kg)		3	5	1	1	1	<1
	Exchangeable Hydrogen (cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.08	0.12	<0.01	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		2	3	<1	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	1	<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	0.72	0.61	9.88	5.92	2.27	1.86
	Calcium (%)	**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	24.6	22.1	84.0	79.5	68.8	61.4
	Magnesium (%)		10.3	22.0	10.9	14.2	22.6	27.3
	Potassium (%)		25.3	13.2	4.8	5.8	7.1	9.1
	Sodium - ESP (%)		25.1	14.4	0.2	0.3	0.8	1.7
	Aluminium (%)		3.9	8.4	0.1	0.2	0.6	0.6
	Hydrogen (%)		10.8	19.9	0.0	0.0	0.0	0.0
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol$_+$/kg)	2.4	1.0	7.7	5.6	3.0	2.3
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	5YR 6/2 pinkish grey	2.5Y 7/2 light grey	10YR 2/1 black	10YR 2/2 very dark brown	5Y 6/4 pale olive	2.5Y 6/6 olive yellow
	Mottles Munsell Colour		..	..	..	..	..	..
	Degree of Mottling (%)		..	..	..	..	..	..

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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 169	Sample 170	Sample 171	Sample 172	Sample 173	Sample 174
	Sample ID:	169	170	171	172	173	174
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter / Method reference	K7399/169	K7399/170	K7399/171	K7399/172	K7399/173	K7399/174

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
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5. Guidelines for phosphorus have been reduced for Australian soils.
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7. Total Acid Extractable Nutrients indicate a store of nutrients.
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9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
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Parameter		Method reference	Sample 175	Sample 176	Sample 177	Sample 178	Sample 179	Sample 180
Sample ID:			175	176	177	178	179	180
Crop:			Soil	Soil	Soil	Soil	Soil	Soil
Client:			Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
			K7399/175	K7399/176	K7399/177	K7399/178	K7399/179	K7399/180
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.94	6.26	6.38	6.70	5.34	6.18
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.047	0.009	0.008	0.010	0.020	0.006
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	4.16	0.61	0.37	0.42	0.81	0.92
	(kg/ha)		1868	273	166	191	365	415
	(mg/kg)		834	122	74	85	163	185
Exchangeable Magnesium	(cmol$_+$/kg)		0.50	0.16	0.10	0.25	0.27	0.33
	(kg/ha)		137	43	28	68	73	89
	(mg/kg)		61	19	13	30	32	40
Exchangeable Potassium	(cmol$_+$/kg)		0.26	0.14	0.18	<0.12	0.25	<0.12
	(kg/ha)		227	127	160	<112	216	<112
	(mg/kg)		101	57	71	<50	97	<50
Exchangeable Sodium	(cmol$_+$/kg)		<0.065	<0.065	<0.065	<0.065	<0.065	<0.065
	(kg/ha)		<33	<33	<33	<33	<33	<33
	(mg/kg)		<15	<15	<15	<15	<15	<15
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.01	0.01	0.01	<0.01	0.09	0.01
	(kg/ha)		3	3	2	2	18	3
	(mg/kg)		1	1	<1	<1	8	1
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	0.09	0.06	<0.01	0.80	0.12
	(kg/ha)		<1	2	1	<1	18	3
	(mg/kg)		<1	<1	<1	<1	8	1
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	4.95	1.04	0.74	0.79	2.23	1.50
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	84.0	58.6	50.1	53.7	36.4	61.7
Magnesium (%)			10.1	15.4	14.0	31.7	11.9	21.9
Potassium (%)			5.2	14.0	24.7	11.4	11.1	5.9
Sodium - ESP (%)			0.3	1.7	1.2	2.1	0.6	1.8
Aluminium (%)			0.3	1.3	1.4	1.0	4.0	0.8
Hydrogen (%)			0.0	9.0	8.5	0.0	36.0	7.9
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	8.3	3.8	3.6	1.7	3.0	2.8
Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	10YR 2/2 very dark brown	10YR 5/4 yellowish brown	10YR 6/4 light yellowish brown	5Y 6/6 olive yellow	7.5YR 3/3 dark brown	7.5YR 4/3 brown
Mottles Munsell Colour			..	..	..	..	..	..
Degree of Mottling (%)			..	..	..	..	..	..

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AGRICULTURAL SOIL ANALYSIS REPORT

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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 175	Sample 176	Sample 177	Sample 178	Sample 179	Sample 180
	Sample ID:	175	176	177	178	179	180
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/175	K7399/176	K7399/177	K7399/178	K7399/179	K7399/180

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
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11. Conversions to kg/ha = mg/kg x 2.24
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			Sample 181	Sample 182	Sample 183	Sample 184	Sample 185	Sample 186
		Sample ID:	181	182	183	184	185	186
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	K7399/181	K7399/182	K7399/183	K7399/184	K7399/185	K7399/186
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.52	6.97	5.07	5.43	6.33	6.11
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.006	0.010	0.031	0.009	0.075	0.177
	Exchangeable Calcium (cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	0.59	0.65	0.47	0.17	1.54	0.84
	Exchangeable Calcium (kg/ha)		265	290	213	75	689	376
	Exchangeable Calcium (mg/kg)		118	129	95	33	308	168
	Exchangeable Magnesium (cmol$_+$/kg)		0.25	0.47	0.22	0.09	6.45	6.83
	Exchangeable Magnesium (kg/ha)		68	128	60	24	1757	1858
	Exchangeable Magnesium (mg/kg)		30	57	27	11	784	830
	Exchangeable Potassium (cmol$_+$/kg)		<0.12	<0.12	<0.12	<0.12	0.19	0.20
	Exchangeable Potassium (kg/ha)		<112	<112	<112	<112	166	176
	Exchangeable Potassium (mg/kg)		<50	<50	<50	<50	74	78
	Exchangeable Sodium (cmol$_+$/kg)		<0.065	<0.065	0.07	<0.065	1.38	2.20
	Exchangeable Sodium (kg/ha)		<33	<33	38	<33	713	1133
	Exchangeable Sodium (mg/kg)		<15	<15	17	<15	318	506
	Exchangeable Aluminium (cmol$_+$/kg)	**Inhouse S37 (KCl)	<0.01	0.01	0.10	0.08	<0.01	<0.01
	Exchangeable Aluminium (kg/ha)		2	3	20	16	1	2
	Exchangeable Aluminium (mg/kg)		<1	1	9	7	<1	<1
	Exchangeable Hydrogen (cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	1.16	0.29	0.57	0.57
	Exchangeable Hydrogen (kg/ha)		<1	<1	26	6	13	13
	Exchangeable Hydrogen (mg/kg)		<1	<1	12	3	6	6
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	0.95	1.23	2.10	0.71	10.14	10.65
	Calcium (%)	**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	62.0	52.6	22.6	23.4	15.2	7.9
	Magnesium (%)		26.3	38.3	10.6	12.4	63.7	64.1
	Potassium (%)		9.6	5.4	3.2	6.3	1.9	1.9
	Sodium - ESP (%)		1.1	2.7	3.5	6.1	13.7	20.7
	Aluminium (%)		1.0	1.1	4.6	11.4	0.1	0.1
	Hydrogen (%)		0.0	0.0	55.6	40.5	5.6	5.4
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol$_+$/kg)	2.4	1.4	2.1	1.9	0.2	0.1
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	2.5Y 5/3 light olive brown	2.5Y 6/2 light brownish grey	10YR 4/2 dark greyish brown	10YR 5/3 brown	2.5Y 6/1 grey	2.5Y 6/1 grey
	Mottles Munsell Colour		..	..	..	..	2.5YR 4/8	2.5YR 4/8
	Degree of Mottling (%)		..	..	..	..	red	red
			..	..	..	..	50	30

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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 181	Sample 182	Sample 183	Sample 184	Sample 185	Sample 186
	Sample ID:	181	182	183	184	185	186
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/181	K7399/182	K7399/183	K7399/184	K7399/185	K7399/186

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
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AGRICULTURAL SOIL ANALYSIS REPORT

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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

			Sample 187	Sample 188	Sample 189	Sample 190	Sample 191	Sample 192
		Sample ID:	187	188	189	190	191	192
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	K7399/187	K7399/188	K7399/189	K7399/190	K7399/191	K7399/192
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.13	5.38	6.38	6.69	4.70	4.94
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.021	0.010	0.008	0.007	0.044	0.035
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	0.64	0.49	0.97	0.94	1.00	0.35
	Exchangeable Calcium (kg/ha)		289	220	437	421	448	156
	Exchangeable Calcium (mg/kg)		129	98	195	188	200	70
	Exchangeable Magnesium (cmol+/kg)		0.18	0.13	0.27	0.20	0.19	0.12
	Exchangeable Magnesium (kg/ha)		49	35	73	56	51	32
	Exchangeable Magnesium (mg/kg)		22	15	33	25	23	14
	Exchangeable Potassium (cmol+/kg)		0.18	0.13	<0.12	<0.12	0.30	0.28
	Exchangeable Potassium (kg/ha)		157	116	<112	<112	263	248
	Exchangeable Potassium (mg/kg)		70	52	<50	<50	117	111
	Exchangeable Sodium (cmol+/kg)		<0.065	<0.065	<0.065	<0.065	<0.065	<0.065
	Exchangeable Sodium (kg/ha)		<33	<33	<33	<33	<33	<33
	Exchangeable Sodium (mg/kg)		<15	<15	<15	<15	<15	<15
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.08	0.11	0.02	0.01	0.10	0.19
	Exchangeable Aluminium (kg/ha)		16	22	4	2	21	38
	Exchangeable Aluminium (mg/kg)		7	10	2	1	9	17
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.88	0.71	0.14	<0.01	1.50	1.07
	Exchangeable Hydrogen (kg/ha)		20	16	3	<1	34	24
	Exchangeable Hydrogen (mg/kg)		9	7	1	<1	15	11
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	1.99	1.58	1.53	1.28	3.11	2.02
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	32.3	31.0	63.5	73.1	32.1	17.2
	Magnesium (%)		9.0	8.0	17.5	16.0	6.0	5.8
	Potassium (%)		9.0	8.4	7.6	7.3	9.7	14.0
	Sodium - ESP (%)		1.7	0.7	1.3	2.8	0.5	0.5
	Aluminium (%)		4.0	6.9	1.1	0.9	3.4	9.3
	Hydrogen (%)		44.1	44.9	9.0	0.0	48.3	53.2
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	3.6	3.9	3.6	4.6	5.3	3.0
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	7.5YR 4/2 brown	2.5Y 4/3 olive brown	10YR 4/3 brown	5YR 5/4 reddish brown	10YR 4/3 brown	2.5YR 4/4 reddish brown
	Mottles Munsell Colour		..	..	..	..	..	..
	Degree of Mottling (%)		..	..	..	..	..	..

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		Sample 187	Sample 188	Sample 189	Sample 190	Sample 191	Sample 192
	Sample ID:	187	188	189	190	191	192
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter / Method reference	K7399/187	K7399/188	K7399/189	K7399/190	K7399/191	K7399/192

Notes:

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

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Parameter		Method reference	Sample 193	Sample 194	Sample 195	Sample 196	Sample 197	Sample 198
Sample ID:			193	194	195	196	197	198
Crop:			Soil	Soil	Soil	Soil	Soil	Soil
Client:			Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
			K7399/193	K7399/194	K7399/195	K7399/196	K7399/197	K7399/198
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.47	6.67	5.57	6.72	7.35	7.72
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.024	0.020	0.058	0.015	0.023	0.031
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	0.78	2.27	2.32	1.33	3.79	4.00
	(kg/ha)		348	1018	1041	595	1701	1797
	(mg/kg)		156	455	465	266	760	802
Exchangeable Magnesium	(cmol$_+$/kg)		0.23	0.44	0.77	0.79	4.49	4.58
	(kg/ha)		62	121	211	214	1222	1246
	(mg/kg)		28	54	94	96	546	556
Exchangeable Potassium	(cmol$_+$/kg)		0.19	0.18	0.51	0.24	0.41	0.36
	(kg/ha)		165	156	445	209	357	316
	(mg/kg)		74	70	199	93	159	141
Exchangeable Sodium	(cmol$_+$/kg)		<0.065	<0.065	<0.065	<0.065	0.08	0.14
	(kg/ha)		<33	<33	<33	<33	40	70
	(mg/kg)		<15	<15	<15	<15	18	31
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.02	<0.01	0.02	<0.01	<0.01	<0.01
	(kg/ha)		4	2	5	2	2	1
	(mg/kg)		2	<1	2	<1	<1	<1
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.27	<0.01	0.68	<0.01	<0.01	<0.01
	(kg/ha)		6	<1	15	<1	<1	<1
	(mg/kg)		3	<1	7	<1	<1	<1
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	1.50	2.93	4.34	2.37	8.77	9.08
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	51.7	77.5	53.5	55.9	43.2	44.1
Magnesium (%)			15.1	15.2	17.9	33.2	51.2	50.4
Potassium (%)			12.5	6.1	11.7	10.1	4.6	4.0
Sodium - ESP (%)			1.0	1.0	0.7	0.6	0.9	1.5
Aluminium (%)			1.5	0.3	0.5	0.3	0.1	0.1
Hydrogen (%)			18.2	0.0	15.7	0.0	0.0	0.0
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	3.4	5.1	3.0	1.7	0.8	0.9
Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	2.5YR 4/4 reddish brown	5YR 4/3 reddish brown	5Y 3/1 very dark grey	2.5Y 6/1 grey	2.5Y 6/3 light yellowish brown	2.5Y 6/3 light yellowish brown
Mottles Munsell Colour			..	..	..	..	10YR 7/8	10YR 7/8
Degree of Mottling (%)			..	..	..	..	yellow	yellow
			..	..	..	..	30	30

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		Sample 193	Sample 194	Sample 195	Sample 196	Sample 197	Sample 198
	Sample ID:	193	194	195	196	197	198
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter / Method reference	K7399/193	K7399/194	K7399/195	K7399/196	K7399/197	K7399/198

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
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11. Conversions to kg/ha = mg/kg x 2.24
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			Sample 199	Sample 200	Sample 201	Sample 202	Sample 203	Sample 204
		Sample ID:	199	200	201	202	203	204
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	K7399/199	K7399/200	K7399/201	K7399/202	K7399/203	K7399/204
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.30	6.03	6.65	7.06	4.85	6.25
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.022	0.009	0.009	0.028	0.066	0.011
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	0.59	0.44	0.46	0.77	0.95	0.26
	Exchangeable Calcium (kg/ha)		267	197	205	346	427	117
	Exchangeable Calcium (mg/kg)		119	88	92	155	191	52
	Exchangeable Magnesium (cmol+/kg)		0.19	0.20	0.29	2.75	0.55	0.26
	Exchangeable Magnesium (kg/ha)		52	54	78	749	149	70
	Exchangeable Magnesium (mg/kg)		23	24	35	334	67	31
	Exchangeable Potassium (cmol+/kg)		0.19	0.16	0.13	0.19	0.24	0.24
	Exchangeable Potassium (kg/ha)		164	137	116	170	208	208
	Exchangeable Potassium (mg/kg)		73	61	52	76	93	93
	Exchangeable Sodium (cmol+/kg)		<0.065	<0.065	<0.065	0.23	0.07	<0.065
	Exchangeable Sodium (kg/ha)		<33	<33	<33	120	36	<33
	Exchangeable Sodium (mg/kg)		<15	<15	<15	54	16	<15
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.10	0.04	0.01	0.01	0.25	0.06
	Exchangeable Aluminium (kg/ha)		19	9	3	2	50	11
	Exchangeable Aluminium (mg/kg)		9	4	1	1	22	5
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.91	0.25	<0.01	<0.01	1.55	0.26
	Exchangeable Hydrogen (kg/ha)		20	6	<1	<1	35	6
	Exchangeable Hydrogen (mg/kg)		9	3	<1	<1	15	3
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	1.99	1.11	0.92	3.96	3.60	1.11
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	29.8	39.8	49.7	19.5	26.4	23.5
	Magnesium (%)		9.6	17.8	31.1	69.4	15.2	23.2
	Potassium (%)		9.4	14.2	14.4	4.9	6.6	21.4
	Sodium - ESP (%)		0.7	1.6	3.2	5.9	1.9	3.1
	Aluminium (%)		4.8	4.0	1.5	0.3	6.9	5.0
	Hydrogen (%)		45.7	22.7	0.0	0.0	42.9	23.7
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	3.1	2.2	1.6	0.3	1.7	1.0
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	7.5YR 4/2 brown	10YR 5/4 yellowish brown	5Y 8/3 pale yellow	2.5Y 7/1 light grey	10YR 2/2 very dark brown	10YR 5/2 greyish brown
	Mottles Munsell Colour		..	..	..	5YR 6/8 reddish yellow	..	..
	Degree of Mottling (%)		..	..	..	50	..	..

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		Sample 199	Sample 200	Sample 201	Sample 202	Sample 203	Sample 204
	Sample ID:	199	200	201	202	203	204
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/199	K7399/200	K7399/201	K7399/202	K7399/203	K7399/204

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
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3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
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			Sample 205	Sample 206	Sample 207	Sample 208	Sample 209	Sample 210
		Sample ID:	205	206	207	208	209	210
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	K7399/205	K7399/206	K7399/207	K7399/208	K7399/209	K7399/210
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.35	6.38	5.81	6.44	6.70	5.95
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.007	0.012	0.023	0.008	0.009	0.106
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	0.21	0.16	1.76	0.86	0.33	0.14
	Exchangeable Calcium (kg/ha)		94	74	788	386	149	64
	Exchangeable Calcium (mg/kg)		42	33	352	172	66	29
	Exchangeable Magnesium (cmol+/kg)		0.48	0.86	0.56	0.36	0.76	5.07
	Exchangeable Magnesium (kg/ha)		131	235	153	97	207	1380
	Exchangeable Magnesium (mg/kg)		58	105	68	43	93	616
	Exchangeable Potassium (cmol+/kg)		0.15	<0.12	0.25	0.19	0.13	0.25
	Exchangeable Potassium (kg/ha)		132	<112	221	163	114	216
	Exchangeable Potassium (mg/kg)		59	<50	99	73	51	96
	Exchangeable Sodium (cmol+/kg)		<0.065	<0.065	<0.065	<0.065	<0.065	0.96
	Exchangeable Sodium (kg/ha)		<33	<33	<33	<33	<33	495
	Exchangeable Sodium (mg/kg)		<15	<15	<15	<15	<15	221
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.02	0.01	0.02	0.01	0.01	0.01
	Exchangeable Aluminium (kg/ha)		4	3	5	3	3	3
	Exchangeable Aluminium (mg/kg)		2	1	2	1	1	1
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.17	0.14	0.57	0.13	<0.01	0.63
	Exchangeable Hydrogen (kg/ha)		4	3	13	3	<1	14
	Exchangeable Hydrogen (mg/kg)		2	1	6	1	<1	6
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	1.07	1.31	3.19	1.56	1.29	7.07
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	19.5	12.6	55.1	55.1	25.7	2.0
	Magnesium (%)		44.9	65.7	17.6	22.8	59.1	71.7
	Potassium (%)		14.1	5.4	7.9	11.9	10.1	3.5
	Sodium - ESP (%)		3.9	4.5	0.7	0.6	4.1	13.6
	Aluminium (%)		1.9	1.1	0.8	0.8	1.0	0.2
	Hydrogen (%)		15.7	10.7	18.0	8.6	0.0	9.0
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	0.4	0.2	3.1	2.4	0.4	0.0
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	2.5Y 5/2 greyish brown	10YR 6/4 light yellowish brown	10YR 2/2 very dark brown	5Y 5/1 grey	10YR 5/1 grey	2.5Y 6/2 light greyish brown
	Mottles Munsell Colour		..	2.5YR 5/6	..	..	..	2.5YR 5/6
	Degree of Mottling (%)		..	red	..	..	..	red
			..	10	..	..	..	50

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	Sample ID:	205	206	207	208	209	210
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter / Method reference	K7399/205	K7399/206	K7399/207	K7399/208	K7399/209	K7399/210

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3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
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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
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Agricultural Co-Ordinator KS

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AGRICULTURAL SOIL ANALYSIS REPORT

230 samples supplied by Minesoils Pty. Ltd. on 27/05/2021. Lab Job No.K7399
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

Parameter		Method reference	Sample 211	Sample 212	Sample 213	Sample 214	Sample 215	Sample 216
Sample ID:			211	212	213	214	215	216
Crop:			Soil	Soil	Soil	Soil	Soil	Soil
Client:			Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
			K7399/211	K7399/212	K7399/213	K7399/214	K7399/215	K7399/216
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.10	6.10	6.70	6.92	6.29	6.33
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.038	0.023	0.016	0.015	0.023	0.012
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	2.96	1.96	2.18	2.22	5.87	2.19
	(kg/ha)		1329	878	977	995	2635	983
	(mg/kg)		593	392	436	444	1176	439
Exchangeable Magnesium	(cmol$_+$/kg)		0.48	0.37	0.62	0.71	0.79	0.42
	(kg/ha)		130	101	170	192	214	115
	(mg/kg)		58	45	76	86	95	51
Exchangeable Potassium	(cmol$_+$/kg)		0.83	0.57	0.38	0.25	0.39	0.25
	(kg/ha)		726	499	336	216	345	220
	(mg/kg)		324	223	150	96	154	98
Exchangeable Sodium	(cmol$_+$/kg)		<0.065	<0.065	<0.065	<0.065	<0.065	<0.065
	(kg/ha)		<33	<33	<33	<33	<33	<33
	(mg/kg)		<15	<15	<15	<15	<15	<15
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.02	0.01	<0.01	<0.01	0.02	0.02
	(kg/ha)		3	3	2	2	4	3
	(mg/kg)		2	1	<1	<1	2	1
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.50	0.40	<0.01	<0.01	0.29	0.23
	(kg/ha)		11	9	<1	<1	6	5
	(mg/kg)		5	4	<1	<1	3	2
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	4.82	3.33	3.22	3.20	7.37	3.12
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	61.4	58.7	67.6	69.3	79.6	70.1
Magnesium (%)			9.9	11.1	19.4	22.1	10.7	13.6
Potassium (%)			17.2	17.1	11.9	7.7	5.3	8.1
Sodium - ESP (%)			0.8	0.6	0.8	0.6	0.2	0.4
Aluminium (%)			0.4	0.4	0.3	0.3	0.2	0.5
Hydrogen (%)			10.3	12.1	0.0	0.0	3.9	7.3
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	6.2	5.3	3.5	3.1	7.5	5.2
Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	7.5YR 3/2 dark brown	7.5YR 3/3 dark brown	5YR 4/4 reddish brown	10R 5/8 red	10YR 2/2 very dark brown	7.5YR 4/3 brown
Mottles Munsell Colour			..	..	..	..	..	..
Degree of Mottling (%)			..	..	..	..	..	..

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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

		Sample 211	Sample 212	Sample 213	Sample 214	Sample 215	Sample 216
	Sample ID:	211	212	213	214	215	216
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/211	K7399/212	K7399/213	K7399/214	K7399/215	K7399/216

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
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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.
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			Sample 217	Sample 218	Sample 219	Sample 220	Sample 221	Sample 222
		Sample ID:	217	218	219	220	221	222
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	K7399/217	K7399/218	K7399/219	K7399/220	K7399/221	K7399/222
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.46	6.90	5.59	6.36	6.85	7.33
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.010	0.011	0.021	0.011	0.010	0.058
	Exchangeable Calcium (cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	1.35	1.54	4.20	3.07	5.45	3.44
	Exchangeable Calcium (kg/ha)		606	692	1884	1380	2447	1544
	Exchangeable Calcium (mg/kg)		270	309	841	616	1092	689
	Exchangeable Magnesium (cmol$_+$/kg)		0.27	0.35	1.37	2.81	1.46	1.23
	Exchangeable Magnesium (kg/ha)		73	96	372	764	397	336
	Exchangeable Magnesium (mg/kg)		33	43	166	341	177	150
	Exchangeable Potassium (cmol$_+$/kg)		0.23	0.20	0.33	0.35	1.39	1.13
	Exchangeable Potassium (kg/ha)		204	177	291	306	1217	991
	Exchangeable Potassium (mg/kg)		91	79	130	137	543	442
	Exchangeable Sodium (cmol$_+$/kg)		<0.065	<0.065	<0.065	0.18	<0.065	<0.065
	Exchangeable Sodium (kg/ha)		<33	<33	<33	95	<33	<33
	Exchangeable Sodium (mg/kg)		<15	<15	<15	42	<15	<15
	Exchangeable Aluminium (cmol$_+$/kg)	**Inhouse S37 (KCl)	0.02	<0.01	0.13	0.02	0.01	0.02
	Exchangeable Aluminium (kg/ha)		3	2	27	3	3	4
	Exchangeable Aluminium (mg/kg)		2	<1	12	2	1	2
	Exchangeable Hydrogen (cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.22	<0.01	0.97	0.20	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		5	<1	22	4	<1	<1
	Exchangeable Hydrogen (mg/kg)		2	<1	10	2	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	2.10	2.12	7.05	6.63	8.33	5.85
	Calcium (%)	**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	64.1	72.6	59.5	46.4	65.4	58.8
	Magnesium (%)		12.8	16.6	19.4	42.4	17.5	21.1
	Potassium (%)		11.1	9.5	4.7	5.3	16.7	19.3
	Sodium - ESP (%)		0.7	0.9	0.9	2.8	0.2	0.5
	Aluminium (%)		0.8	0.4	1.9	0.3	0.1	0.3
	Hydrogen (%)		10.5	0.0	13.7	3.0	0.0	0.0
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol$_+$/kg)	5.0	4.4	3.1	1.1	3.7	2.8
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	5YR 4/4 reddish brown	2.5YR 5/3 reddish brown	7.5YR 3/2 dark brown	10YR 6/3 pale brown	10YR 6/4 light yellowish brown	2.5YR 5/8 red
	Mottles Munsell Colour		..	..	..	..	..	2.5Y 6/2 light brownish grey
	Degree of Mottling (%)		..	..	..	..	..	30

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PO BOX 11034 TAMWORTH NSW 2340

		Sample 217	Sample 218	Sample 219	Sample 220	Sample 221	Sample 222
	Sample ID:	217	218	219	220	221	222
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/217	K7399/218	K7399/219	K7399/220	K7399/221	K7399/222

Notes:

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			Sample 223	Sample 224	Sample 225	Sample 226	Sample 227	Sample 228
		Sample ID:	223	224	225	226	227	228
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	K7399/223	K7399/224	K7399/225	K7399/226	K7399/227	K7399/228
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.46	6.61	6.94	7.24	5.86	5.73
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.029	0.009	0.010	0.013	0.009	0.007
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	4.47	2.92	1.71	1.38	1.10	2.34
	Exchangeable Calcium (kg/ha)		2009	1310	767	620	493	1050
	Exchangeable Calcium (mg/kg)		897	585	343	277	220	469
	Exchangeable Magnesium (cmol+/kg)		4.12	5.34	0.89	2.42	7.16	0.95
	Exchangeable Magnesium (kg/ha)		1120	1454	242	659	1950	260
	Exchangeable Magnesium (mg/kg)		500	649	108	294	870	116
	Exchangeable Potassium (cmol+/kg)		2.29	1.62	0.52	0.19	0.23	0.57
	Exchangeable Potassium (kg/ha)		2007	1415	458	167	202	500
	Exchangeable Potassium (mg/kg)		896	632	205	74	90	223
	Exchangeable Sodium (cmol+/kg)		0.13	0.34	0.08	0.19	0.99	<0.065
	Exchangeable Sodium (kg/ha)		66	173	40	98	512	<33
	Exchangeable Sodium (mg/kg)		30	77	18	44	228	<15
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.07	0.01	0.01	0.01	0.03	0.05
	Exchangeable Aluminium (kg/ha)		14	3	3	3	6	9
	Exchangeable Aluminium (mg/kg)		6	1	1	1	3	4
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.74	<0.01	<0.01	<0.01	0.36	0.22
	Exchangeable Hydrogen (kg/ha)		17	<1	<1	<1	8	5
	Exchangeable Hydrogen (mg/kg)		7	<1	<1	<1	4	2
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	11.82	10.22	3.21	4.19	9.87	4.18
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	37.8	28.5	53.2	32.9	11.1	56.0
	Magnesium (%)		34.8	52.2	27.7	57.7	72.6	22.8
	Potassium (%)		19.4	15.8	16.3	4.5	2.3	13.7
	Sodium - ESP (%)		1.1	3.3	2.4	4.5	10.1	1.2
	Aluminium (%)		0.6	0.1	0.4	0.3	0.3	1.1
	Hydrogen (%)		6.3	0.0	0.0	0.0	3.6	5.2
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	1.1	0.5	1.9	0.6	0.2	2.5
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	10YR 3/3 dark brown	10YR 4/3 brown	2.5YR 5/6 red	5YR 6/8 reddish yellow	10YR 4/2 dark greyish brown	7.5YR 6/2 pinkish grey
	Mottles Munsell Colour		..	..	..	..	..	..
	Degree of Mottling (%)		..	..	..	..	..	..

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PO BOX 11034 TAMWORTH NSW 2340

		Sample 223	Sample 224	Sample 225	Sample 226	Sample 227	Sample 228
	Sample ID:	223	224	225	226	227	228
	Crop:	Soil	Soil	Soil	Soil	Soil	Soil
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	K7399/223	K7399/224	K7399/225	K7399/226	K7399/227	K7399/228

Notes:

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			Sample 229	Sample 230	*Heavy Soil*	*Medium Soil*	*Light Soil*	*Sandy Soil*
		Sample ID:	229	230				
		Crop:	Soil	Soil				
		Client:	Yancoal	Yancoal	*Clay*	*Clay Loam*	*Loam*	*Loamy Sand*
	Parameter	**Method reference**	**K7399/229**	**K7399/230**	**Indicative guidelines - refer to Notes 6 and 8**			
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.89	6.30	*6.5*	*6.5*	*6.3*	*6.3*
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.005	0.008	*0.200*	*0.150*	*0.120*	*0.100*
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	2.06	2.48	*15.6*	*10.8*	*5.0*	*1.9*
	Exchangeable Calcium (kg/ha)		923	1115	*7000*	*4816*	*2240*	*840*
	Exchangeable Calcium (mg/kg)		412	498	*3125*	*2150*	*1000*	*375*
	Exchangeable Magnesium (cmol+/kg)		0.82	2.39	*2.4*	*1.7*	*1.2*	*0.60*
	Exchangeable Magnesium (kg/ha)		224	650	*650*	*448*	*325*	*168*
	Exchangeable Magnesium (mg/kg)		100	290	*290*	*200*	*145*	*75*
	Exchangeable Potassium (cmol+/kg)		0.36	0.26	*0.60*	*0.50*	*0.40*	*0.30*
	Exchangeable Potassium (kg/ha)		317	227	*526*	*426*	*336*	*224*
	Exchangeable Potassium (mg/kg)		142	101	*235*	*190*	*150*	*100*
	Exchangeable Sodium (cmol+/kg)		<0.065	0.10	*0.3*	*0.26*	*0.22*	*0.11*
	Exchangeable Sodium (kg/ha)		<33	53	*155*	*134*	*113*	*57*
	Exchangeable Sodium (mg/kg)		<15	24	*69*	*60*	*51*	*25*
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.04	0.02	*0.6*	*0.5*	*0.4*	*0.2*
	Exchangeable Aluminium (kg/ha)		9	4	*121*	*101*	*73*	*30*
	Exchangeable Aluminium (mg/kg)		4	2	*54*	*45*	*32*	*14*
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.13	0.11	*0.6*	*0.5*	*0.4*	*0.2*
	Exchangeable Hydrogen (kg/ha)		3	3	*13*	*11*	*8*	*3*
	Exchangeable Hydrogen (mg/kg)		1	1	*6*	*5*	*4*	*2*
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	3.45	5.36	*20.1*	*14.3*	*7.8*	*3.3*
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	59.6	46.3	*77.6*	*75.7*	*65.6*	*57.4*
	Magnesium (%)		23.9	44.5	*11.9*	*11.9*	*15.7*	*18.1*
	Potassium (%)		10.5	4.8	*3.0*	*3.5*	*5.2*	*9.1*
	Sodium - ESP (%)		1.1	1.9	*1.5*	*1.8*	*2.9*	*3.3*
	Aluminium (%)		1.3	0.3	*6.0*	*7.1*	*10.5*	*12.1*
	Hydrogen (%)		3.7	2.1				
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	2.5	1.0	*6.5*	*6.4*	*4.2*	*3.2*
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	2.5Y 7/2 light grey	2.5Y 6/2 light brownish grey	..			
	Mottles Munsell Colour		..	7.5YR 5/3 brown	..			
	Degree of Mottling (%)		..	1	..			

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AGRICULTURAL SOIL ANALYSIS REPORT

230 samples supplied by Minesoils Pty. Ltd. on 27/05/2021. Lab Job No.K7399
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL

PO BOX 11034 TAMWORTH NSW 2340

			Sample 229	Sample 230	*Heavy Soil*	*Medium Soil*	*Light Soil*	*Sandy Soil*
		Sample ID:	229	230				
		Crop:	Soil	Soil				
		Client:	Yancoal	Yancoal	*Clay*	*Clay Loam*	*Loam*	*Loamy Sand*
	Parameter	**Method reference**	**K7399/229**	**K7399/230**	**Indicative guidelines - refer to Notes 6 and 8**			

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
10. Conversions for 1 $cmol_+/kg$ = 230 mg/kg Sodium, 390 mg/kg Potassium, 122 mg/kg Magnesium, 200 mg/kg Calcium
11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimat
13. ** NATA accreditation does not cover the performance of this service.
14. Analysis conducted between sample arrival date and reporting date.
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16. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditio
17. This report was issued on 21/07/2021.

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AGRICULTURAL SOIL ANALYSIS REPORT

48 samples supplied by Minesoils Pty. Ltd. on 7/09/2021 . Lab Job No.M1061
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

			Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7
		Sample ID:	1 0-10	1 20-30	1 40-50	1 65-75	2 0-10	2 20-30	2 40-50
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	M1061/1	M1061/2	M1061/3	M1061/4	M1061/5	M1061/6	M1061/7
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.15	6.51	6.53	6.85	5.86	6.56	6.87
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.020	0.009	0.016	0.022	0.023	0.010	0.017
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	2.0	1.7	2.2	1.7	2.5	1.7	4.5
	Exchangeable Calcium (kg/ha)		902	774	978	746	1,102	758	2,011
	Exchangeable Calcium (mg/kg)		403	346	437	333	492	338	898
	Exchangeable Magnesium (cmol+/kg)		0.76	1.2	3.4	5.1	0.78	1.0	5.0
	Exchangeable Magnesium (kg/ha)		206	323	929	1,378	212	276	1,358
	Exchangeable Magnesium (mg/kg)		92	144	415	615	95	123	606
	Exchangeable Potassium (cmol+/kg)		0.75	0.33	0.42	0.48	0.71	0.45	0.62
	Exchangeable Potassium (kg/ha)		657	292	369	417	619	393	545
	Exchangeable Potassium (mg/kg)		293	130	165	186	276	175	243
	Exchangeable Sodium (cmol+/kg)		<0.065	<0.065	0.09	0.16	<0.065	<0.065	0.09
	Exchangeable Sodium (kg/ha)		<33	<33	45	81	<33	<33	44
	Exchangeable Sodium (mg/kg)		<15	<15	20	36	<15	<15	20
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.03	0.03	0.04	0.04	0.04	0.02	0.04
	Exchangeable Aluminium (kg/ha)		6.3	6.0	8.0	8.3	8.4	4.1	7.6
	Exchangeable Aluminium (mg/kg)		2.8	2.7	3.6	3.7	3.7	1.8	3.4
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.24	<0.01	<0.01	<0.01	0.41	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		5.3	<1	<1	<1	9.3	<1	<1
	Exchangeable Hydrogen (mg/kg)		2.4	<1	<1	<1	4.1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	3.8	3.3	6.1	7.4	4.4	3.2	10
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	53	52	36	22	56	53	44
	Magnesium (%)		20	36	56	68	18	32	49
	Potassium (%)		20	10	6.9	6.4	16	14	6.1
	Sodium - ESP (%)		0.48	1.5	1.4	2.1	0.53	0.38	0.84
	Aluminium (%)		0.82	0.89	0.64	0.56	0.94	0.64	0.37
	Hydrogen (%)		6.2	0.00	0.00	0.00	9.4	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	2.7	1.5	0.64	0.33	3.2	1.7	0.90

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 10/09/2021.

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AGRICULTURAL SOIL ANALYSIS REPORT

48 samples supplied by Minesoils Pty. Ltd. on 7/09/2021 . Lab Job No.M1061
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

	Parameter		Method reference	Sample 8	Sample 9	Sample 10	Sample 11	Sample 12	Sample 13	Sample 14
	Sample ID:			2 65-75	3 0-10	3 20-30	3 40-50	3 65-75	4 0-10	4 20-30
	Crop:			Soil	Soil	Soil	Soil	Soil	Soil	Soil
	Client:			Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
				M1061/8	M1061/9	M1061/10	M1061/11	M1061/12	M1061/13	M1061/14
	pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.94	6.45	7.08	7.79	8.36	6.06	6.65
	Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.023	0.026	0.013	0.020	0.071	0.024	0.014
	Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	4.7	6.1	5.2	5.1	5.3	2.5	2.2
		(kg/ha)		2,100	2,722	2,350	2,293	2,362	1,129	993
		(mg/kg)		937	1,215	1,049	1,024	1,054	504	443
	Exchangeable Magnesium	(cmol$_+$/kg)		6.1	1.2	1.0	0.98	2.7	0.66	0.70
		(kg/ha)		1,666	326	276	268	743	179	190
		(mg/kg)		744	146	123	120	332	80	85
	Exchangeable Potassium	(cmol$_+$/kg)		0.63	1.00	0.62	0.62	0.60	0.91	0.55
		(kg/ha)		551	872	544	542	523	793	480
		(mg/kg)		246	389	243	242	234	354	214
	Exchangeable Sodium	(cmol$_+$/kg)		0.15	<0.065	<0.065	<0.065	0.10	<0.065	<0.065
		(kg/ha)		79	<33	<33	<33	49	<33	<33
		(mg/kg)		35	<15	<15	<15	22	<15	<15
	Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.04	0.03	0.02	0.02	0.03	0.07	0.03
		(kg/ha)		8.6	6.1	4.2	5.0	5.4	13	5.9
		(mg/kg)		3.8	2.7	1.9	2.2	2.4	5.9	2.6
	Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	0.10	<0.01	<0.01	<0.01	0.36	<0.01
		(kg/ha)		<1	2.3	<1	<1	<1	8.0	<1
		(mg/kg)		<1	1.0	<1	<1	<1	3.6	<1
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	12	8.4	6.9	6.8	8.7	4.5	3.5
	Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	40	72	76	76	60	55	63
	Magnesium (%)			53	14	15	15	31	14	20
	Potassium (%)			5.4	12	9.0	9.2	6.9	20	16
	Sodium - ESP (%)			1.3	0.52	0.55	0.35	1.1	1.0	0.85
	Aluminium (%)			0.37	0.36	0.30	0.37	0.31	1.5	0.83
	Hydrogen (%)			0.00	1.2	0.00	0.00	0.00	7.8	0.00
	Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	0.76	5.1	5.2	5.2	1.9	3.8	3.2

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: Collingwoc
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
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9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil resu
10. Conversions for 1 cmol$_+$/kg = 230 mg/kg Sodium, 390 mg/kg Potassium, 122 mg/kg Magnesium, 200 mg/kg Calcium
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AGRICULTURAL SOIL ANALYSIS REPORT

48 samples supplied by Minesoils Pty. Ltd. on 7/09/2021 . Lab Job No.M1061
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

	Parameter		Method reference	Sample 15	Sample 16	Sample 17	Sample 18	Sample 19	Sample 20	Sample 21
	Sample ID:			4 40-50	4 65-75	5 0-10	5 20-30	5 40-50	5 65-75	6 0-10
	Crop:			Soil	Soil	Soil	Soil	Soil	Soil	Soil
	Client:			Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
				M1061/15	M1061/16	M1061/17	M1061/18	M1061/19	M1061/20	M1061/21
	pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.92	7.60	6.60	8.51	9.16	9.45	5.21
	Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.023	0.043	0.019	0.030	0.084	0.203	0.028
	Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	5.0	4.7	2.6	1.6	1.7	1.9	2.4
		(kg/ha)		2,224	2,090	1,176	701	755	864	1,098
		(mg/kg)		993	933	525	313	337	386	490
	Exchangeable Magnesium	(cmol$_+$/kg)		3.5	7.4	2.2	3.4	6.5	8.7	0.46
		(kg/ha)		952	2,015	599	938	1,761	2,366	125
		(mg/kg)		425	900	267	419	786	1,056	56
	Exchangeable Potassium	(cmol$_+$/kg)		0.72	0.80	0.29	<0.12	0.19	0.27	0.32
		(kg/ha)		631	704	252	<112	165	234	282
		(mg/kg)		282	314	112	<50	74	105	126
	Exchangeable Sodium	(cmol$_+$/kg)		0.09	0.24	0.14	0.78	2.9	6.3	0.12
		(kg/ha)		45	126	71	399	1,487	3,229	63
		(mg/kg)		20	56	32	178	664	1,441	28
	Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.05	0.04	0.03	0.02	0.02	0.03	0.21
		(kg/ha)		9.8	8.1	5.1	3.3	4.8	6.5	43
		(mg/kg)		4.4	3.6	2.3	1.5	2.1	2.9	19
	Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.86
		(kg/ha)		<1	<1	<1	<1	<1	<1	19
		(mg/kg)		<1	<1	<1	<1	<1	<1	8.6
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	9.3	13	5.3	5.9	11	17	4.4
	Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	53	35	50	26	15	11	55
	Magnesium (%)			38	56	42	58	58	51	10
	Potassium (%)			7.7	6.1	5.5	1.8	1.7	1.6	7.3
	Sodium - ESP (%)			0.93	1.9	2.6	13	26	36	2.8
	Aluminium (%)			0.52	0.30	0.48	0.28	0.21	0.19	4.9
	Hydrogen (%)			0.00	0.00	0.00	0.00	0.00	0.00	19
	Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	1.4	0.63	1.2	0.45	0.26	0.22	5.3

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: Collingwoc
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AGRICULTURAL SOIL ANALYSIS REPORT

48 samples supplied by Minesoils Pty. Ltd. on 7/09/2021 . Lab Job No.M1061
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

	Parameter		Method reference	Sample 22	Sample 23	Sample 24	Sample 25	Sample 26	Sample 27	Sample 28
	Sample ID:			6 20-30	6 40-50	6 65-75	8 0-10	8 20-30	8 40-50	8 65-75
	Crop:			Soil	Soil	Soil	Soil	Soil	Soil	Soil
	Client:			Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
				M1061/22	M1061/23	M1061/24	M1061/25	M1061/26	M1061/27	M1061/28
	pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.09	5.85	5.44	5.60	6.02	7.33	8.00
	Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.010	0.025	0.054	0.029	0.012	0.040	0.078
	Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	1.2	1.4	0.91	2.5	1.5	0.78	0.50
		(kg/ha)		534	618	407	1,137	694	350	226
		(mg/kg)		238	276	182	508	310	156	101
	Exchangeable Magnesium	(cmol$_+$/kg)		0.43	3.7	5.0	0.58	0.33	2.7	5.2
		(kg/ha)		116	1,012	1,360	158	89	722	1,424
		(mg/kg)		52	452	607	71	40	322	636
	Exchangeable Potassium	(cmol$_+$/kg)		0.16	0.18	0.20	0.14	<0.12	<0.12	<0.12
		(kg/ha)		142	162	172	122	<112	<112	<112
		(mg/kg)		63	72	77	54	<50	<50	<50
	Exchangeable Sodium	(cmol$_+$/kg)		0.07	0.35	0.68	0.10	0.10	0.58	1.6
		(kg/ha)		34	180	349	54	52	301	806
		(mg/kg)		15	80	156	24	23	134	360
	Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.05	0.13	0.48	0.10	0.04	0.04	0.05
		(kg/ha)		10	25	97	21	8.6	8.5	10
		(mg/kg)		4.6	11	43	9.4	3.8	3.8	4.5
	Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.16	0.55	1.0	0.44	0.15	<0.01	<0.01
		(kg/ha)		3.6	12	23	9.8	3.4	<1	<1
		(mg/kg)		1.6	5.5	10	4.4	1.5	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	2.1	6.3	8.3	3.9	2.2	4.1	7.5
	Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	58	22	11	65	69	19	6.7
	Magnesium (%)			21	59	60	15	15	64	70
	Potassium (%)			7.9	2.9	2.4	3.6	3.0	1.8	1.5
	Sodium - ESP (%)			3.3	5.5	8.2	2.7	4.5	14	21
	Aluminium (%)			2.5	2.0	5.8	2.7	1.9	1.0	0.67
	Hydrogen (%)			7.8	8.7	13	11	6.9	0.00	0.00
	Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	2.8	0.37	0.18	4.4	4.7	0.29	0.10

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwoc
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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11. Conversions to kg/ha = mg/kg x 2.24
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AGRICULTURAL SOIL ANALYSIS REPORT

48 samples supplied by Minesoils Pty. Ltd. on 7/09/2021 . Lab Job No.M1061
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

	Parameter		Method reference	Sample 29	Sample 30	Sample 31	Sample 32	Sample 33	Sample 34	Sample 35
	Sample ID:			9 0-10	9 20-30	9 40-50	9 65-75	10 0-10	10 20-30	10 40-50
	Crop:			Soil	Soil	Soil	Soil	Soil	Soil	Soil
	Client:			Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
				M1061/29	M1061/30	M1061/31	M1061/32	M1061/33	M1061/34	M1061/35
	pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.45	6.49	8.58	8.72	5.63	6.86	7.30
	Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.027	0.014	0.270	0.640	0.044	0.013	0.025
	Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	2.0	1.1	1.3	1.1	4.6	2.6	5.0
		(kg/ha)		881	492	569	510	2,065	1,171	2,232
		(mg/kg)		393	220	254	228	922	523	996
	Exchangeable Magnesium	(cmol$_+$/kg)		0.49	0.88	9.0	12	0.87	0.65	3.9
		(kg/ha)		134	240	2,454	3,157	236	176	1,069
		(mg/kg)		60	107	1,095	1,409	105	78	477
	Exchangeable Potassium	(cmol$_+$/kg)		0.34	0.17	0.34	0.39	0.66	0.21	0.38
		(kg/ha)		294	151	301	344	580	184	334
		(mg/kg)		131	68	134	154	259	82	149
	Exchangeable Sodium	(cmol$_+$/kg)		0.09	0.15	2.7	4.7	0.08	<0.065	0.18
		(kg/ha)		49	79	1,381	2,435	40	<33	94
		(mg/kg)		22	35	616	1,087	18	<15	42
	Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.15	0.06	0.04	0.03	0.08	0.03	0.04
		(kg/ha)		30	13	7.4	6.5	16	5.6	8.0
		(mg/kg)		14	5.6	3.3	2.9	7.0	2.5	3.6
	Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.65	0.09	<0.01	<0.01	0.46	<0.01	<0.01
		(kg/ha)		15	1.9	<1	<1	10	<1	<1
		(mg/kg)		6.5	<1	<1	<1	4.6	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	3.7	2.5	13	18	6.7	3.5	9.5
	Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	53	45	9.5	6.3	68	74	52
	Magnesium (%)			13	36	68	65	13	18	41
	Potassium (%)			9.1	7.0	2.6	2.2	9.8	5.9	4.0
	Sodium - ESP (%)			2.6	6.3	20	26	1.2	1.6	1.9
	Aluminium (%)			4.1	2.5	0.27	0.18	1.1	0.79	0.42
	Hydrogen (%)			18	3.5	0.00	0.00	6.9	0.00	0.00
	Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	4.0	1.2	0.14	0.10	5.3	4.0	1.3

Notes:

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3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
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AGRICULTURAL SOIL ANALYSIS REPORT

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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

	Parameter		Method reference	Sample 36	Sample 37	Sample 38	Sample 39	Sample 40	Sample 41	Sample 42
	Sample ID:			10 65-75	12 0-10	12 20-30	12 40-50	12 65-75	13 0-10	13 20-30
	Crop:			Soil	Soil	Soil	Soil	Soil	Soil	Soil
	Client:			Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
				M1061/36	M1061/37	M1061/38	M1061/39	M1061/40	M1061/41	M1061/42
	pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	7.31	5.63	6.26	7.21	8.18	6.00	6.80
	Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.040	0.028	0.014	0.030	0.083	0.030	0.011
	Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	4.9	2.6	1.7	8.2	9.6	6.6	2.1
		(kg/ha)		2,191	1,170	774	3,688	4,328	2,985	928
		(mg/kg)		978	522	346	1,647	1,932	1,333	414
	Exchangeable Magnesium	(cmol$_+$/kg)		4.2	0.53	0.41	3.9	4.3	1.4	0.92
		(kg/ha)		1,151	145	111	1,052	1,164	390	251
		(mg/kg)		514	65	49	470	519	174	112
	Exchangeable Potassium	(cmol$_+$/kg)		0.48	0.65	0.44	0.71	0.77	0.48	0.17
		(kg/ha)		422	567	389	619	674	417	147
		(mg/kg)		189	253	174	276	301	186	66
	Exchangeable Sodium	(cmol$_+$/kg)		0.38	<0.065	<0.065	0.16	0.15	<0.065	<0.065
		(kg/ha)		196	<33	<33	80	80	<33	<33
		(mg/kg)		87	<15	<15	36	36	<15	<15
	Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.03	0.08	0.04	0.03	0.03	0.03	0.01
		(kg/ha)		6.0	15	7.8	6.6	6.3	5.5	2.6
		(mg/kg)		2.7	6.9	3.5	2.9	2.8	2.5	1.2
	Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	0.50	0.10	<0.01	<0.01	0.27	<0.01
		(kg/ha)		<1	11	2.3	<1	<1	6.1	<1
		(mg/kg)		<1	5.0	1.0	<1	<1	2.7	<1
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	10	4.4	2.7	13	15	8.9	3.2
	Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	49	59	63	63	65	75	64
	Magnesium (%)			42	12	15	30	29	16	29
	Potassium (%)			4.8	15	16	5.4	5.2	5.3	5.2
	Sodium - ESP (%)			3.8	0.87	1.1	1.2	1.0	0.47	1.7
	Aluminium (%)			0.30	1.7	1.4	0.25	0.21	0.31	0.40
	Hydrogen (%)			0.00	11	3.7	0.00	0.00	3.0	0.00
	Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	1.2	4.9	4.2	2.1	2.3	4.6	2.2

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: Collingwoc
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
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AGRICULTURAL SOIL ANALYSIS REPORT

48 samples supplied by Minesoils Pty. Ltd. on 7/09/2021 . Lab Job No.M1061
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

			Sample 43	Sample 44	Sample 45	Sample 46	Sample 47	Sample 48
		Sample ID:	13 40-50	13 65-75	14 0-10	14 20-30	14 40-50	14 65-75
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter		Method reference	M1061/43	M1061/44	M1061/45	M1061/46	M1061/47	M1061/48
	pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	7.48	8.77	5.37	6.45	5.91	6.49
	Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.009	0.078	0.029	0.012	0.027	0.022
	Exchangeable Calcium	(cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	1.3	5.8	3.3	2.6	3.2	3.2
		(kg/ha)		604	2,599	1,484	1,150	1,415	1,429
		(mg/kg)		270	1,160	663	514	632	638
	Exchangeable Magnesium	(cmol+/kg)		1.0	6.6	0.90	0.79	7.0	11
		(kg/ha)		275	1,799	244	214	1,909	3,007
		(mg/kg)		123	803	109	96	852	1,342
	Exchangeable Potassium	(cmol+/kg)		<0.12	0.35	0.61	0.20	0.28	0.41
		(kg/ha)		<112	307	535	174	245	357
		(mg/kg)		<50	137	239	78	110	159
	Exchangeable Sodium	(cmol+/kg)		0.07	1.9	<0.065	0.07	0.32	0.65
		(kg/ha)		36	973	<33	35	163	332
		(mg/kg)		16	434	<15	16	73	148
	Exchangeable Aluminium	(cmol+/kg)	**Inhouse S37 (KCl)	0.01	0.02	0.08	0.02	0.05	0.03
		(kg/ha)		2.7	4.7	16	5.0	9.3	6.3
		(mg/kg)		1.2	2.1	7.3	2.2	4.2	2.8
	Exchangeable Hydrogen	(cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	0.81	0.09	0.39	0.21
		(kg/ha)		<1	<1	18	2.1	8.8	4.7
		(mg/kg)		<1	<1	8.1	<1	3.9	2.1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	2.5	15	5.8	3.7	11	16
	Calcium (%)		**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	53	39	57	69	28	21
	Magnesium (%)			40	45	16	21	63	71
	Potassium (%)			4.2	2.4	11	5.3	2.5	2.6
	Sodium - ESP (%)			2.7	13	0.80	1.8	2.8	4.2
	Aluminium (%)			0.53	0.16	1.4	0.66	0.41	0.20
	Hydrogen (%)			0.00	0.00	14	2.5	3.5	1.4
	Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol+/kg)	1.3	0.88	3.7	3.3	0.45	0.29

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
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AGRICULTURAL SOIL ANALYSIS REPORT

48 samples supplied by Minesoils Pty. Ltd. on 7/09/2021 . Lab Job No.M1061
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL
PO BOX 11034 TAMWORTH NSW 2340

	Parameter		Method reference	Heavy Soil	Medium Soil	Light Soil	Sandy Soil
	Sample ID:						
	Crop:						
	Client:			Clay	Clay Loam	Loam	Loamy Sand
				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

Notes:

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AGRICULTURAL SOIL ANALYSIS REPORT

33 samples supplied by Minesoils Pty. Ltd. on 18/03/2022. Lab Job No.M6945
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL Stage 3
PO BOX 11034 TAMWORTH NSW 2340

			Sample 1	Sample 2	Sample 3	Sample 4
		Sample ID:	82	82	82	82
		Crop:	0-10	20-30	50-60	65-75
		Client:	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	M6945/1	M6945/2	M6945/3	M6945/4
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.02	6.35	7.26	7.49
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.070	0.015	0.019	0.033
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	6.8	6.2	9.3	12
	Exchangeable Calcium (kg/ha)		3,036	2,779	4,165	5,355
	Exchangeable Calcium (mg/kg)		1,355	1,241	1,859	2,391
	Exchangeable Magnesium (cmol+/kg)		1.7	1.3	5.8	9.4
	Exchangeable Magnesium (kg/ha)		465	362	1,587	2,563
	Exchangeable Magnesium (mg/kg)		208	162	709	1,144
	Exchangeable Potassium (cmol+/kg)		2.2	0.42	0.47	0.39
	Exchangeable Potassium (kg/ha)		1,925	367	413	346
	Exchangeable Potassium (mg/kg)		859	164	185	154
	Exchangeable Sodium (cmol+/kg)		<0.065	<0.065	0.07	0.21
	Exchangeable Sodium (kg/ha)		<33	<33	38	110
	Exchangeable Sodium (mg/kg)		<15	<15	17	49
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.02	0.02	<0.01	<0.01
	Exchangeable Aluminium (kg/ha)		4.1	4.3	1.7	<1
	Exchangeable Aluminium (mg/kg)		1.8	1.9	<1	<1
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.16	0.10	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		3.5	2.3	<1	<1
	Exchangeable Hydrogen (mg/kg)		1.6	1.0	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	11	8.1	16	22
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	62	77	59	54
	Magnesium (%)		16	16	37	43
	Potassium (%)		20	5.2	3.0	1.8
	Sodium - ESP (%)		0.09	0.28	0.47	0.97
	Aluminium (%)		0.19	0.27	0.05	0.02
	Hydrogen (%)		1.4	1.3	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	4.0	4.7	1.6	1.3

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AGRICULTURAL SOIL ANALYSIS REPORT

33 samples supplied by Minesoils Pty. Ltd. on 18/03/2022. Lab Job No.M6945
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL Stage 3
PO BOX 11034 TAMWORTH NSW 2340

		Sample 1	Sample 2	Sample 3	Sample 4
	Sample ID:	82	82	82	82
	Crop:	0-10	20-30	50-60	65-75
	Client:	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	M6945/1	M6945/2	M6945/3	M6945/4

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
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Quality Checked: Kris Saville
Agricultural Co-Ordinator KS

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PO BOX 11034 TAMWORTH NSW 2340

			Sample 5	Sample 6	Sample 7	Sample 8
		Sample ID:	83	83	83	83
		Crop:	0-10	20-30	40-50	65-75
		Client:	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	M6945/5	M6945/6	M6945/7	M6945/8
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.89	6.80	6.78	7.40
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.080	0.025	0.015	0.087
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	12	12	11	24
	Exchangeable Calcium (kg/ha)		5,352	5,461	5,040	10,790
	Exchangeable Calcium (mg/kg)		2,389	2,438	2,250	4,817
	Exchangeable Magnesium (cmol+/kg)		3.0	7.9	5.0	4.5
	Exchangeable Magnesium (kg/ha)		829	2,152	1,358	1,238
	Exchangeable Magnesium (mg/kg)		370	961	606	553
	Exchangeable Potassium (cmol+/kg)		3.6	0.79	1.7	3.3
	Exchangeable Potassium (kg/ha)		3,138	694	1,477	2,934
	Exchangeable Potassium (mg/kg)		1,401	310	659	1,310
	Exchangeable Sodium (cmol+/kg)		<0.065	0.15	<0.065	<0.065
	Exchangeable Sodium (kg/ha)		<33	80	<33	<33
	Exchangeable Sodium (mg/kg)		<15	36	<15	<15
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.02	<0.01	<0.01	0.02
	Exchangeable Aluminium (kg/ha)		5.0	1.5	<1	3.9
	Exchangeable Aluminium (mg/kg)		2.2	<1	<1	1.7
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.18	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		4.1	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		1.8	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	19	21	18	32
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	63	58	63	75
	Magnesium (%)		16	38	28	14
	Potassium (%)		19	3.8	9.4	10
	Sodium - ESP (%)		0.17	0.74	0.31	0.12
	Aluminium (%)		0.13	0.03	0.01	0.06
	Hydrogen (%)		0.98	0.00	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	3.9	1.5	2.3	5.3

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			Sample 5	Sample 6	Sample 7	Sample 8
		Sample ID:	83	83	83	83
		Crop:	0-10	20-30	40-50	65-75
		Client:	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	M6945/5	M6945/6	M6945/7	M6945/8

Notes:

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6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
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			Sample 9	Sample 10	Sample 11	Sample 12
		Sample ID:	84	84	84	84
		Crop:	0-10	20-30	40-50	65-75
		Client:	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	M6945/9	M6945/10	M6945/11	M6945/12
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	7.41	7.47	7.12	7.23
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.086	0.062	0.068	0.041
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	23	15	9.4	18
	Exchangeable Calcium (kg/ha)		10,407	6,639	4,207	7,937
	Exchangeable Calcium (mg/kg)		4,646	2,964	1,878	3,543
	Exchangeable Magnesium (cmol+/kg)		4.5	6.3	5.2	11
	Exchangeable Magnesium (kg/ha)		1,215	1,709	1,422	3,107
	Exchangeable Magnesium (mg/kg)		542	763	635	1,387
	Exchangeable Potassium (cmol+/kg)		3.3	3.8	3.7	1.7
	Exchangeable Potassium (kg/ha)		2,886	3,326	3,284	1,484
	Exchangeable Potassium (mg/kg)		1,289	1,485	1,466	663
	Exchangeable Sodium (cmol+/kg)		<0.065	<0.065	0.07	0.28
	Exchangeable Sodium (kg/ha)		<33	<33	39	144
	Exchangeable Sodium (mg/kg)		<15	<15	17	64
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.02	<0.01	0.01	0.02
	Exchangeable Aluminium (kg/ha)		4.1	2.0	2.0	3.7
	Exchangeable Aluminium (mg/kg)		1.9	<1	<1	1.6
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		<1	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	31	25	18	31
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	75	59	51	57
	Magnesium (%)		14	25	28	37
	Potassium (%)		11	15	20	5.5
	Sodium - ESP (%)		0.12	0.18	0.41	0.90
	Aluminium (%)		0.07	0.04	0.05	0.06
	Hydrogen (%)		0.00	0.00	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	5.2	2.4	1.8	1.5

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			Sample 9	Sample 10	Sample 11	Sample 12
		Sample ID:	84	84	84	84
		Crop:	0-10	20-30	40-50	65-75
		Client:	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	M6945/9	M6945/10	M6945/11	M6945/12

Notes:

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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL Stage 3
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			Sample 13	Sample 14	Sample 15	Sample 16	Sample 17
		Sample ID:	96	96	96	96	96
		Crop:	0-10	10-20	25-35	40-50	65-75
		Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	M6945/13	M6945/14	M6945/15	M6945/16	M6945/17
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.69	6.69	8.03	8.47	8.81
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.066	0.019	0.110	0.223	0.248
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	2.0	0.84	0.82	0.77	0.40
	Exchangeable Calcium (kg/ha)		886	379	367	346	181
	Exchangeable Calcium (mg/kg)		395	169	164	155	81
	Exchangeable Magnesium (cmol+/kg)		1.1	1.3	9.5	12	9.5
	Exchangeable Magnesium (kg/ha)		308	358	2,579	3,246	2,588
	Exchangeable Magnesium (mg/kg)		138	160	1,151	1,449	1,155
	Exchangeable Potassium (cmol+/kg)		0.39	0.13	0.23	0.27	0.23
	Exchangeable Potassium (kg/ha)		342	115	198	234	202
	Exchangeable Potassium (mg/kg)		153	51	88	105	90
	Exchangeable Sodium (cmol+/kg)		0.11	0.18	2.3	3.9	3.6
	Exchangeable Sodium (kg/ha)		57	95	1,171	1,995	1,831
	Exchangeable Sodium (mg/kg)		26	42	523	890	817
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.09	0.02	0.02	0.02	0.03
	Exchangeable Aluminium (kg/ha)		17	3.6	3.7	4.4	5.2
	Exchangeable Aluminium (mg/kg)		7.7	1.6	1.7	2.0	2.3
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.17	<0.01	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		3.8	<1	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		1.7	<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	3.9	2.5	13	17	14
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	51	34	6.4	4.6	2.9
	Magnesium (%)		29	53	74	71	69
	Potassium (%)		10	5.3	1.8	1.6	1.7
	Sodium - ESP (%)		2.9	7.4	18	23	26
	Aluminium (%)		2.2	0.72	0.14	0.13	0.19
	Hydrogen (%)		4.4	0.00	0.00	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	1.7	0.64	0.09	0.06	0.04

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		Sample 13	Sample 14	Sample 15	Sample 16	Sample 17
	Sample ID:	96	96	96	96	96
	Crop:	0-10	10-20	25-35	40-50	65-75
	Client:	Yancoal	Yancoal	Yancoal	Yancoal	Yancoal
Parameter	Method reference	M6945/13	M6945/14	M6945/15	M6945/16	M6945/17

Notes:

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			Sample 18	Sample 19	Sample 20	Sample 21
		Sample ID:	97	97	97	97
		Crop:	0-10	15-25	30-40	65-75
		Client:	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	M6945/18	M6945/19	M6945/20	M6945/21
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.33	6.66	7.56	8.11
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.037	0.016	0.032	0.076
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	6.7	3.8	9.8	8.7
	Exchangeable Calcium (kg/ha)		2,989	1,704	4,383	3,890
	Exchangeable Calcium (mg/kg)		1,334	761	1,957	1,736
	Exchangeable Magnesium (cmol+/kg)		1.7	1.5	8.6	8.7
	Exchangeable Magnesium (kg/ha)		475	401	2,330	2,357
	Exchangeable Magnesium (mg/kg)		212	179	1,040	1,052
	Exchangeable Potassium (cmol+/kg)		0.93	0.43	0.73	0.74
	Exchangeable Potassium (kg/ha)		817	378	642	645
	Exchangeable Potassium (mg/kg)		365	169	287	288
	Exchangeable Sodium (cmol+/kg)		<0.065	<0.065	0.27	0.46
	Exchangeable Sodium (kg/ha)		<33	<33	139	239
	Exchangeable Sodium (mg/kg)		<15	<15	62	107
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.02	<0.01	<0.01	<0.01
	Exchangeable Aluminium (kg/ha)		3.8	<1	1.3	1.3
	Exchangeable Aluminium (mg/kg)		1.7	<1	<1	<1
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.10	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		2.3	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		1.0	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	9.5	5.7	19	19
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	70	66	51	47
	Magnesium (%)		18	26	44	47
	Potassium (%)		9.8	7.5	3.8	4.0
	Sodium - ESP (%)		0.64	0.43	1.4	2.5
	Aluminium (%)		0.20	0.04	0.03	0.03
	Hydrogen (%)		1.1	0.00	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	3.8	2.6	1.1	1.0

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			Sample 18	Sample 19	Sample 20	Sample 21
		Sample ID:	97	97	97	97
		Crop:	0-10	15-25	30-40	65-75
		Client:	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	M6945/18	M6945/19	M6945/20	M6945/21

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
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11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimat
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Agricultural Co-Ordinator KS

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AGRICULTURAL SOIL ANALYSIS REPORT

33 samples supplied by Minesoils Pty. Ltd. on 18/03/2022. Lab Job No.M6945
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL Stage 3
PO BOX 11034 TAMWORTH NSW 2340

			Sample 22	Sample 23	Sample 24	Sample 25
		Sample ID:	98	98	98	98
		Crop:	0-10	20-30	50-60	65-75
		Client:	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	M6945/22	M6945/23	M6945/24	M6945/25
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.99	6.59	7.67	7.87
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.021	0.010	0.027	0.047
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	4.2	2.6	6.0	5.0
	Exchangeable Calcium (kg/ha)		1,901	1,173	2,695	2,241
	Exchangeable Calcium (mg/kg)		849	524	1,203	1,000
	Exchangeable Magnesium (cmol+/kg)		0.88	0.65	6.4	7.7
	Exchangeable Magnesium (kg/ha)		239	177	1,743	2,089
	Exchangeable Magnesium (mg/kg)		107	79	778	933
	Exchangeable Potassium (cmol+/kg)		0.39	0.33	0.81	0.78
	Exchangeable Potassium (kg/ha)		342	290	709	682
	Exchangeable Potassium (mg/kg)		153	129	317	305
	Exchangeable Sodium (cmol+/kg)		<0.065	<0.065	0.24	0.44
	Exchangeable Sodium (kg/ha)		<33	<33	126	226
	Exchangeable Sodium (mg/kg)		<15	<15	56	101
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.02	<0.01	<0.01	<0.01
	Exchangeable Aluminium (kg/ha)		4.9	1.2	<1	<1
	Exchangeable Aluminium (mg/kg)		2.2	<1	<1	<1
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.11	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		2.6	<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)	5.7	3.6	13	14
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	75	72	45	36
	Magnesium (%)		16	18	48	55
	Potassium (%)		6.9	9.2	6.0	5.6
	Sodium - ESP (%)		0.21	0.20	1.8	3.2
	Aluminium (%)		0.43	0.16	0.02	0.02
	Hydrogen (%)		2.0	0.00	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	4.8	4.0	0.94	0.65

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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL Stage 3
PO BOX 11034 TAMWORTH NSW 2340

			Sample 22	Sample 23	Sample 24	Sample 25
		Sample ID:	98	98	98	98
		Crop:	0-10	20-30	50-60	65-75
		Client:	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	M6945/22	M6945/23	M6945/24	M6945/25

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
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33 samples supplied by Minesoils Pty. Ltd. on 18/03/2022. Lab Job No.M6945
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL Stage 3
PO BOX 11034 TAMWORTH NSW 2340

			Sample 26	Sample 27	Sample 28	Sample 29
		Sample ID:	99	99	99	99
		Crop:	0-10	20-30	50-60	65-75
		Client:	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	M6945/26	M6945/27	M6945/28	M6945/29
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.98	6.79	7.83	7.82
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.022	0.009	0.025	0.028
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	2.8	1.5	8.5	7.3
	Exchangeable Calcium (kg/ha)		1,263	676	3,798	3,278
	Exchangeable Calcium (mg/kg)		564	302	1,695	1,463
	Exchangeable Magnesium (cmol+/kg)		0.52	0.29	1.7	3.7
	Exchangeable Magnesium (kg/ha)		141	80	474	995
	Exchangeable Magnesium (mg/kg)		63	36	211	444
	Exchangeable Potassium (cmol+/kg)		0.47	0.30	0.64	0.72
	Exchangeable Potassium (kg/ha)		415	265	563	632
	Exchangeable Potassium (mg/kg)		185	118	252	282
	Exchangeable Sodium (cmol+/kg)		<0.065	<0.065	<0.065	<0.065
	Exchangeable Sodium (kg/ha)		<33	<33	<33	<33
	Exchangeable Sodium (mg/kg)		<15	<15	<15	<15
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.01	<0.01	0.02	0.01
	Exchangeable Aluminium (kg/ha)		2.9	1.6	4.6	2.0
	Exchangeable Aluminium (mg/kg)		1.3	<1	2.0	<1
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.12	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		2.8	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		1.2	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	4.0	2.1	11	12
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	71	71	78	62
	Magnesium (%)		13	14	16	31
	Potassium (%)		12	14	5.9	6.1
	Sodium - ESP (%)		0.20	0.64	0.26	0.43
	Aluminium (%)		0.36	0.37	0.21	0.09
	Hydrogen (%)		3.1	0.00	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	5.4	5.1	4.9	2.0

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33 samples supplied by Minesoils Pty. Ltd. on 18/03/2022. Lab Job No.M6945
Analysis requested by Clayton Richards. Your Job: MS-057 BSAL Stage 3
PO BOX 11034 TAMWORTH NSW 2340

			Sample 26	Sample 27	Sample 28	Sample 29
		Sample ID:	99	99	99	99
		Crop:	0-10	20-30	50-60	65-75
		Client:	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	M6945/26	M6945/27	M6945/28	M6945/29

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL Stage 3
PO BOX 11034 TAMWORTH NSW 2340

			Sample 30	Sample 31	Sample 32	Sample 33
		Sample ID:	100	100	100	100
		Crop:	0-10	20-30	40-50	65-75
		Client:	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	M6945/30	M6945/31	M6945/32	M6945/33
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.14	6.78	7.10	7.88
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.026	0.009	0.006	0.079
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	1.7	0.88	0.46	1.9
	Exchangeable Calcium (kg/ha)		746	397	207	860
	Exchangeable Calcium (mg/kg)		333	177	93	384
	Exchangeable Magnesium (cmol+/kg)		0.91	1.2	1.0	5.9
	Exchangeable Magnesium (kg/ha)		249	332	284	1,616
	Exchangeable Magnesium (mg/kg)		111	148	127	722
	Exchangeable Potassium (cmol+/kg)		0.35	0.24	0.16	0.27
	Exchangeable Potassium (kg/ha)		302	208	137	236
	Exchangeable Potassium (mg/kg)		135	93	61	105
	Exchangeable Sodium (cmol+/kg)		<0.065	<0.065	<0.065	0.97
	Exchangeable Sodium (kg/ha)		<33	<33	<33	498
	Exchangeable Sodium (mg/kg)		<15	<15	<15	222
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.02	0.04	<0.01	<0.01
	Exchangeable Aluminium (kg/ha)		5.0	7.6	1.5	<1
	Exchangeable Aluminium (mg/kg)		2.2	3.4	<1	<1
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.11	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		2.6	<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)	3.1	2.4	1.7	9.1
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	54	37	27	21
	Magnesium (%)		30	51	61	65
	Potassium (%)		11	9.9	9.2	3.0
	Sodium - ESP (%)		0.31	0.28	2.1	11
	Aluminium (%)		0.81	1.6	0.44	0.01
	Hydrogen (%)		3.7	0.00	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	1.8	0.72	0.44	0.32

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			Sample 30	Sample 31	Sample 32	Sample 33
		Sample ID:	100	100	100	100
		Crop:	0-10	20-30	40-50	65-75
		Client:	Yancoal	Yancoal	Yancoal	Yancoal
	Parameter	Method reference	M6945/30	M6945/31	M6945/32	M6945/33

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
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PO BOX 11034 TAMWORTH NSW 2340

	Parameter		Method reference	Heavy Soil	Medium Soil	Light Soil	Sandy Soil
	Sample ID:						
	Crop:						
	Client:			Clay	Clay Loam	Loam	Loamy Sand
				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

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Analysis requested by Clayton Richards. Your Job: MS-057 BSAL Stage 3
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			
Notes:						

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
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Agricultural Co-Ordinator KS

GRAIN SIZE ANALYSIS (hydrometer and sieving techniques)

230 soil samples supplied by Minesoils Pty Ltd on 27th May, 2021 - Lab Job No. K7399.
Analysis requested by Clayton Richards. **Your Project: MS-057 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 ISSS (% of total oven-dry equivalent)	CLAY < 2 µm (% of total oven-dry equivalent)	Total soil fractions (incl. Gravel)
Sample 1	K7399/1	7.0%	3.4%	0.0%	3.4%	43.6%	36.5%	13.4%	3.1%	100.0%
Sample 2	K7399/2	4.3%	5.6%	0.0%	5.6%	44.4%	38.2%	5.8%	6.1%	100.0%
Sample 3	K7399/3	3.8%	9.6%	0.0%	9.6%	42.0%	37.7%	5.4%	5.2%	100.0%
Sample 4	K7399/4	2.7%	37.9%	27.6%	10.3%	31.2%	22.6%	6.2%	2.1%	100.0%
Sample 5	K7399/5	11.3%	4.0%	0.0%	4.0%	15.7%	39.2%	21.5%	19.6%	100.0%
Sample 6	K7399/6	7.5%	18.0%	0.0%	18.0%	11.8%	32.4%	20.3%	17.5%	100.0%
Sample 7	K7399/7	13.2%	17.8%	13.7%	4.1%	5.8%	16.3%	14.9%	45.2%	100.0%
Sample 8	K7399/8	13.7%	1.5%	0.0%	1.5%	9.3%	42.1%	6.3%	40.8%	100.0%
Sample 9	K7399/9	9.0%	1.8%	0.0%	1.8%	26.2%	42.8%	16.5%	12.8%	100.0%
Sample 10	K7399/10	5.8%	2.2%	0.0%	2.2%	28.5%	35.5%	25.0%	8.9%	100.0%
Sample 11	K7399/11	12.7%	3.1%	0.0%	3.1%	15.1%	30.0%	10.0%	41.9%	100.0%
Sample 12	K7399/12	13.0%	0.8%	0.0%	0.8%	24.4%	22.9%	11.5%	40.3%	100.0%
Sample 13	K7399/13	21.6%	7.0%	0.0%	7.0%	44.7%	37.6%	0.5%	10.2%	100.0%
Sample 14	K7399/14	9.7%	9.7%	0.0%	9.7%	36.1%	38.9%	0.1%	15.3%	100.0%
Sample 15	K7399/15	8.1%	10.7%	0.0%	10.7%	29.3%	42.9%	0.5%	16.6%	100.0%
Sample 16	K7399/16	9.2%	9.5%	0.0%	9.5%	22.9%	31.9%	4.3%	31.5%	100.0%
Sample 17	K7399/17	9.1%	12.8%	0.0%	12.8%	39.7%	34.7%	5.2%	7.6%	100.0%
Sample 18	K7399/18	6.3%	19.8%	0.0%	19.8%	38.3%	28.9%	7.0%	5.9%	100.0%
Sample 19	K7399/19	4.8%	54.2%	47.7%	6.5%	25.0%	14.0%	4.6%	2.2%	100.0%
Sample 20	K7399/20	9.6%	16.1%	0.0%	16.1%	33.8%	11.5%	1.5%	37.0%	100.0%
Sample 21	K7399/21	10.0%	2.5%	0.0%	2.5%	47.2%	28.7%	12.0%	9.7%	100.0%
Sample 22	K7399/22	5.6%	9.4%	0.0%	9.4%	48.5%	26.2%	12.2%	3.7%	100.0%
Sample 23	K7399/23	5.9%	5.9%	0.0%	5.9%	41.6%	32.5%	15.1%	4.9%	100.0%
Sample 24	K7399/24	10.4%	5.4%	0.0%	5.4%	33.6%	25.6%	10.0%	25.4%	100.0%
Sample 25	K7399/25	6.0%	3.3%	0.0%	3.3%	62.5%	24.6%	3.5%	6.1%	100.0%
Sample 26	K7399/26	4.4%	6.8%	0.0%	6.8%	60.4%	22.6%	7.4%	2.8%	100.0%
Sample 27	K7399/27	4.4%	9.0%	0.0%	9.0%	59.5%	19.2%	7.9%	4.3%	100.0%
Sample 28	K7399/28	10.8%	10.0%	0.0%	10.0%	60.4%	11.3%	9.3%	8.9%	100.0%
Sample 29	K7399/29	5.8%	5.5%	0.0%	5.5%	58.9%	19.1%	7.3%	9.1%	100.0%
Sample 30	K7399/30	6.0%	11.3%	0.0%	11.3%	60.5%	18.1%	6.4%	3.7%	100.0%
Sample 31	K7399/31	6.1%	11.8%	0.0%	11.8%	55.1%	17.9%	7.6%	7.6%	100.0%
Sample 32	K7399/32	6.5%	16.9%	0.0%	16.9%	51.0%	21.4%	3.6%	7.1%	100.0%
Sample 33	K7399/33	10.0%	6.7%	0.0%	6.7%	26.1%	50.1%	7.4%	9.7%	100.0%
Sample 34	K7399/34	8.4%	3.6%	0.0%	3.6%	25.6%	52.6%	7.3%	10.9%	100.0%
Sample 35	K7399/35	13.2%	0.7%	0.0%	0.7%	14.1%	44.5%	6.1%	34.6%	100.0%
Sample 36	K7399/36	12.5%	0.0%	0.0%	0.0%	10.9%	40.3%	10.5%	38.3%	100.0%
Sample 37	K7399/37	7.7%	12.9%	0.0%	12.9%	62.4%	15.3%	2.5%	6.9%	100.0%
Sample 38	K7399/38	5.9%	16.7%	0.0%	16.7%	61.4%	14.0%	2.0%	6.0%	100.0%
Sample 39	K7399/39	6.3%	15.2%	0.0%	15.2%	63.4%	10.6%	3.0%	7.8%	100.0%
Sample 40	K7399/40	7.9%	12.5%	0.0%	12.5%	61.9%	11.9%	4.9%	8.8%	100.0%
Sample 41	K7399/41	10.0%	3.9%	0.0%	3.9%	37.1%	36.6%	10.9%	11.5%	100.0%
Sample 42	K7399/42	6.4%	29.7%	24.1%	5.7%	26.4%	26.1%	9.9%	7.8%	100.0%
Sample 43	K7399/43	14.4%	6.6%	0.0%	6.6%	14.3%	21.3%	5.9%	52.0%	100.0%
Sample 44	K7399/44	9.5%	16.7%	0.0%	16.7%	28.2%	26.2%	6.1%	22.8%	100.0%
Sample 45	K7399/45	10.4%	11.0%	0.0%	11.0%	51.9%	21.9%	7.7%	7.5%	100.0%
Sample 46	K7399/46	8.0%	14.3%	0.0%	14.3%	48.3%	22.4%	8.2%	6.8%	100.0%
Sample 47	K7399/47	7.7%	11.8%	3.2%	8.6%	44.2%	26.1%	12.6%	5.4%	100.0%
Sample 48	K7399/48	7.9%	11.8%	2.6%	9.1%	43.4%	25.2%	12.8%	6.8%	100.0%
Sample 49	K7399/49	18.6%	8.3%	0.7%	7.6%	33.8%	25.0%	20.0%	12.9%	100.0%
Sample 50	K7399/50	9.9%	8.4%	0.0%	8.4%	32.0%	26.7%	20.7%	12.1%	100.0%
Sample 51	K7399/51	10.9%	7.8%	3.5%	4.3%	25.8%	34.1%	11.0%	21.3%	100.0%
Sample 52	K7399/52	10.6%	14.5%	5.1%	9.3%	37.6%	26.3%	7.8%	13.8%	100.0%
Sample 53	K7399/53	12.2%	7.2%	0.0%	7.2%	44.8%	31.0%	10.0%	7.0%	100.0%
Sample 54	K7399/54	6.1%	9.8%	4.0%	5.7%	39.3%	33.4%	11.6%	5.9%	100.0%
Sample 55	K7399/55	12.5%	5.4%	1.5%	3.9%	28.9%	21.6%	10.6%	33.5%	100.0%
Sample 56	K7399/56	11.8%	5.3%	0.9%	4.4%	40.0%	21.0%	8.9%	24.8%	100.0%
Sample 57	K7399/57	8.7%	5.8%	0.5%	5.3%	48.8%	23.9%	12.1%	9.5%	100.0%
Sample 58	K7399/58	8.3%	9.5%	2.5%	7.0%	45.6%	22.0%	13.5%	9.4%	100.0%
Sample 59	K7399/59	7.4%	7.6%	1.3%	6.3%	48.3%	23.6%	10.1%	10.4%	100.0%
Sample 60	K7399/60	7.4%	10.1%	4.8%	5.3%	42.7%	27.1%	9.1%	11.0%	100.0%
Sample 61	K7399/61	11.7%	11.3%	2.4%	8.8%	41.2%	21.1%	14.6%	11.8%	100.0%
Sample 62	K7399/62	6.5%	7.6%	1.8%	5.9%	33.3%	37.4%	14.1%	7.6%	100.0%
Sample 63	K7399/63	5.5%	10.2%	3.9%	6.3%	47.0%	25.9%	11.3%	5.6%	100.0%
Sample 64	K7399/64	6.0%	12.9%	4.5%	8.4%	57.3%	18.4%	6.1%	5.4%	100.0%
Sample 65	K7399/65	10.9%	1.2%	0.4%	0.8%	33.3%	39.6%	17.7%	8.2%	100.0%
Sample 66	K7399/66	5.6%	0.5%	0.0%	0.5%	27.6%	36.6%	24.9%	10.3%	100.0%
Sample 67	K7399/67	19.2%	0.2%	0.0%	0.2%	9.8%	24.2%	12.4%	53.4%	100.0%
Sample 68	K7399/68	14.0%	1.3%	0.0%	1.3%	26.8%	30.1%	14.2%	27.6%	100.0%
Sample 69	K7399/69	9.9%	5.5%	1.0%	4.5%	49.0%	25.0%	15.0%	5.5%	100.0%
Sample 70	K7399/70	4.7%	3.1%	0.0%	3.1%	47.8%	28.8%	14.4%	5.8%	100.0%
Sample 71	K7399/71	10.0%	2.7%	0.8%	1.9%	32.2%	24.5%	9.8%	30.8%	100.0%
Sample 72	K7399/72	4.0%	5.3%	1.0%	4.3%	51.3%	25.5%	12.9%	5.0%	100.0%
Sample 73	K7399/73	10.2%	4.2%	1.1%	3.1%	26.4%	34.3%	17.7%	17.4%	100.0%
Sample 74	K7399/74	7.3%	0.0%	0.0%	0.0%	4.4%	47.5%	21.9%	26.3%	100.0%
Sample 75	K7399/75	12.2%	0.7%	0.0%	0.7%	12.3%	20.1%	14.4%	52.5%	100.0%
Sample 76	K7399/76	13.1%	0.0%	0.0%	0.0%	4.1%	21.8%	18.0%	56.1%	100.0%
Sample 77	K7399/77	7.6%	10.4%	3.7%	6.6%	42.9%	24.3%	13.6%	8.8%	100.0%
Sample 78	K7399/78	5.7%	14.2%	6.8%	7.3%	44.3%	20.2%	13.8%	7.5%	100.0%
Sample 79	K7399/79	5.2%	9.5%	3.4%	6.1%	45.1%	26.7%	12.5%	6.3%	100.0%
Sample 80	K7399/80	5.9%	18.0%	12.2%	5.8%	35.7%	29.9%	10.9%	5.5%	100.0%

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

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 ISSS (% of total oven-dry equivalent)	CLAY < 2 µm (% of total oven-dry equivalent)	Total soil fractions (incl. Gravel)
Sample 81	K7399/81	9.6%	5.6%	1.5%	4.1%	28.6%	41.7%	14.0%	10.1%	100.0%
Sample 82	K7399/82	7.6%	6.4%	3.3%	3.1%	23.0%	38.1%	22.0%	10.5%	100.0%
Sample 83	K7399/83	11.5%	0.8%	0.0%	0.8%	15.0%	33.5%	15.2%	35.5%	100.0%
Sample 84	K7399/84	12.4%	8.5%	3.2%	5.3%	17.0%	33.4%	10.6%	30.5%	100.0%
Sample 85	K7399/85	6.3%	5.6%	0.0%	5.6%	48.0%	27.5%	9.9%	9.0%	100.0%
Sample 86	K7399/86	4.9%	9.2%	3.5%	5.7%	44.0%	27.5%	11.4%	8.0%	100.0%
Sample 87	K7399/87	5.8%	30.8%	24.0%	6.8%	34.9%	17.0%	12.1%	5.2%	100.0%
Sample 88	K7399/88	8.0%	8.2%	3.4%	4.8%	35.5%	24.6%	13.3%	18.5%	100.0%
Sample 89	K7399/89	5.9%	10.9%	4.4%	6.5%	46.4%	23.5%	9.9%	9.3%	100.0%
Sample 90	K7399/90	5.9%	5.1%	0.4%	4.7%	48.8%	20.4%	13.0%	12.7%	100.0%
Sample 91	K7399/91	7.7%	7.3%	1.8%	5.5%	41.2%	22.4%	12.9%	16.2%	100.0%
Sample 92	K7399/92	12.4%	4.8%	1.1%	3.7%	21.6%	31.1%	21.5%	21.0%	100.0%
Sample 93	K7399/93	16.9%	0.7%	0.0%	0.7%	13.3%	14.8%	15.2%	55.9%	100.0%
Sample 94	K7399/94	19.0%	3.8%	0.0%	3.8%	15.0%	14.0%	12.0%	55.3%	100.0%
Sample 95	K7399/95	14.7%	12.5%	0.0%	12.5%	23.6%	20.1%	14.9%	28.9%	100.0%
Sample 96	K7399/96	16.6%	4.1%	0.0%	4.1%	8.6%	30.8%	30.9%	25.6%	100.0%
Sample 97	K7399/97	16.8%	2.5%	0.0%	2.5%	7.4%	21.5%	28.2%	40.4%	100.0%
Sample 98	K7399/98	19.2%	0.6%	0.0%	0.6%	5.9%	10.1%	25.0%	58.5%	100.0%
Sample 99	K7399/99	21.0%	1.6%	0.0%	1.6%	8.7%	9.6%	24.4%	55.7%	100.0%
Sample 100	K7399/100	6.1%	2.8%	0.0%	2.8%	50.4%	21.2%	10.4%	15.2%	100.0%
Sample 101	K7399/101	7.3%	2.0%	0.0%	2.0%	46.2%	17.2%	15.8%	18.7%	100.0%
Sample 102	K7399/102	8.2%	6.6%	5.5%	1.1%	36.4%	17.1%	12.8%	27.2%	100.0%
Sample 103	K7399/103	12.0%	2.4%	0.0%	2.4%	53.9%	7.1%	10.4%	26.2%	100.0%
Sample 104	K7399/104	7.3%	6.9%	1.3%	5.6%	57.8%	14.9%	8.0%	12.3%	100.0%
Sample 105	K7399/105	7.4%	9.5%	2.2%	7.3%	54.5%	13.5%	7.5%	15.0%	100.0%
Sample 106	K7399/106	8.9%	5.8%	0.4%	5.4%	58.2%	10.1%	9.1%	16.8%	100.0%
Sample 107	K7399/107	18.2%	5.2%	0.0%	5.2%	67.1%	4.3%	12.7%	10.7%	100.0%
Sample 108	K7399/108	8.9%	4.7%	1.5%	3.2%	35.5%	39.2%	8.8%	11.8%	100.0%
Sample 109	K7399/109	8.1%	2.6%	0.3%	2.3%	25.3%	37.5%	15.4%	19.2%	100.0%
Sample 110	K7399/110	9.3%	2.3%	0.0%	2.3%	23.1%	37.7%	15.0%	21.9%	100.0%
Sample 111	K7399/111	10.1%	2.5%	0.0%	2.5%	25.5%	25.4%	14.9%	31.7%	100.0%
Sample 112	K7399/112	12.2%	7.4%	0.0%	7.4%	26.6%	45.0%	14.4%	6.7%	100.0%
Sample 113	K7399/113	7.7%	32.7%	29.1%	3.6%	14.1%	33.3%	13.1%	6.8%	100.0%
Sample 114	K7399/114	12.6%	7.3%	3.5%	3.8%	14.4%	26.9%	10.7%	40.8%	100.0%
Sample 115	K7399/115	10.9%	40.5%	33.5%	7.0%	18.9%	14.7%	8.4%	17.5%	100.0%
Sample 116	K7399/116	13.7%	7.7%	1.5%	6.1%	10.6%	46.9%	23.5%	11.4%	100.0%
Sample 117	K7399/117	12.1%	3.2%	0.9%	2.3%	4.4%	36.6%	26.3%	29.5%	100.0%
Sample 118	K7399/118	15.6%	0.8%	0.8%	0.1%	0.6%	23.6%	18.8%	56.2%	100.0%
Sample 119	K7399/119	11.7%	4.2%	0.0%	4.2%	25.2%	41.7%	16.2%	12.7%	100.0%
Sample 120	K7399/120	9.8%	19.6%	16.1%	3.5%	20.1%	35.9%	15.1%	9.3%	100.0%
Sample 121	K7399/121	8.8%	2.1%	0.6%	1.4%	19.7%	34.7%	15.3%	28.1%	100.0%
Sample 122	K7399/122	12.3%	2.6%	0.0%	2.6%	18.0%	31.8%	12.7%	34.9%	100.0%
Sample 123	K7399/123	10.0%	12.6%	2.8%	9.7%	27.2%	35.6%	14.8%	9.8%	100.0%
Sample 124	K7399/124	8.5%	28.8%	22.3%	6.5%	22.0%	27.5%	14.6%	7.2%	100.0%
Sample 125	K7399/125	8.5%	7.2%	0.6%	6.6%	28.8%	33.3%	16.3%	14.4%	100.0%
Sample 126	K7399/126	9.5%	1.1%	0.0%	1.1%	26.7%	26.9%	20.2%	25.1%	100.0%
Sample 127	K7399/127	10.5%	3.9%	0.0%	3.9%	51.0%	25.2%	11.6%	8.3%	100.0%
Sample 128	K7399/128	6.9%	4.6%	0.0%	4.6%	49.4%	26.9%	12.6%	6.5%	100.0%
Sample 129	K7399/129	7.0%	9.2%	0.0%	9.2%	44.8%	24.1%	13.4%	8.5%	100.0%
Sample 130	K7399/130	14.3%	3.0%	0.0%	3.0%	24.2%	13.2%	16.2%	43.4%	100.0%
Sample 131	K7399/131	9.0%	5.0%	0.0%	5.0%	32.2%	29.3%	21.5%	12.1%	100.0%
Sample 132	K7399/132	8.6%	5.1%	1.0%	4.1%	30.7%	26.2%	23.8%	14.2%	100.0%
Sample 133	K7399/133	9.4%	5.0%	0.0%	5.0%	27.3%	27.2%	25.4%	15.1%	100.0%
Sample 134	K7399/134	9.9%	2.2%	0.0%	2.2%	20.9%	24.2%	24.2%	28.5%	100.0%
Sample 135	K7399/135	8.5%	3.5%	0.0%	3.5%	60.9%	14.4%	8.4%	12.9%	100.0%
Sample 136	K7399/136	5.0%	6.6%	2.1%	4.5%	60.8%	16.8%	6.6%	9.2%	100.0%
Sample 137	K7399/137	6.0%	6.8%	0.0%	6.8%	55.1%	21.9%	9.6%	6.7%	100.0%
Sample 138	K7399/138	5.5%	9.3%	1.9%	7.4%	61.1%	15.3%	7.0%	7.3%	100.0%
Sample 139	K7399/139	9.5%	4.5%	0.0%	4.5%	49.8%	30.2%	8.9%	6.7%	100.0%
Sample 140	K7399/140	7.7%	8.3%	2.4%	5.9%	37.8%	32.7%	12.6%	8.6%	100.0%
Sample 141	K7399/141	8.3%	4.5%	0.0%	4.5%	35.9%	29.7%	14.0%	15.9%	100.0%
Sample 142	K7399/142	13.0%	11.1%	3.8%	7.3%	32.6%	23.1%	6.8%	26.4%	100.0%
Sample 143	K7399/143	5.8%	2.9%	0.0%	2.9%	57.1%	23.9%	8.9%	7.2%	100.0%
Sample 144	K7399/144	5.1%	3.1%	0.0%	3.1%	58.6%	26.7%	8.0%	3.6%	100.0%
Sample 145	K7399/145	5.0%	3.9%	0.0%	3.9%	58.5%	25.1%	7.5%	4.9%	100.0%
Sample 146	K7399/146	6.4%	3.9%	0.4%	3.5%	55.0%	22.6%	8.3%	10.3%	100.0%
Sample 147	K7399/147	10.6%	8.0%	0.0%	8.0%	20.8%	44.5%	13.6%	13.1%	100.0%
Sample 148	K7399/148	10.3%	3.5%	0.0%	3.5%	15.4%	46.4%	16.4%	18.3%	100.0%
Sample 149	K7399/149	10.6%	3.5%	0.0%	3.5%	15.4%	38.7%	17.3%	25.1%	100.0%
Sample 150	K7399/150	13.4%	4.9%	2.3%	2.6%	9.6%	38.7%	14.4%	32.4%	100.0%
Sample 151	K7399/151	10.3%	3.5%	0.0%	3.5%	52.2%	23.7%	12.0%	8.6%	100.0%
Sample 152	K7399/152	7.2%	8.3%	0.0%	8.3%	45.2%	28.9%	11.3%	6.4%	100.0%
Sample 153	K7399/153	6.3%	8.7%	2.0%	6.7%	44.2%	28.6%	9.8%	8.7%	100.0%
Sample 154	K7399/154	8.4%	2.6%	0.0%	2.6%	42.5%	23.5%	18.3%	13.1%	100.0%
Sample 155	K7399/155	6.5%	4.3%	0.5%	3.8%	52.8%	25.5%	10.9%	6.4%	100.0%
Sample 156	K7399/156	4.8%	6.3%	1.4%	4.9%	46.5%	29.5%	11.4%	6.3%	100.0%
Sample 157	K7399/157	4.6%	34.6%	31.6%	2.9%	32.4%	20.9%	7.6%	4.6%	100.0%
Sample 158	K7399/158	5.9%	7.2%	1.7%	5.5%	45.5%	26.3%	12.6%	8.5%	100.0%
Sample 159	K7399/159	7.4%	7.7%	3.1%	4.6%	50.7%	22.0%	11.0%	8.6%	100.0%
Sample 160	K7399/160	6.5%	9.1%	1.7%	7.4%	50.7%	20.1%	11.0%	9.1%	100.0%
Sample 161	K7399/161	6.9%	12.1%	6.2%	5.9%	41.7%	28.8%	9.4%	8.1%	100.0%
Sample 162	K7399/162	6.6%	10.6%	4.5%	6.1%	48.6%	22.9%	9.6%	8.2%	100.0%
Sample 163	K7399/163	6.8%	4.8%	0.0%	4.8%	31.4%	37.8%	15.1%	10.8%	100.0%
Sample 164	K7399/164	5.4%	30.5%	28.1%	2.4%	21.4%	26.6%	13.5%	7.9%	100.0%
Sample 165	K7399/165	11.5%	20.8%	15.7%	5.1%	15.2%	31.1%	4.5%	28.4%	100.0%

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Graham Lancaster (Nata signatory)
Laboratory Manager

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 ISSS (% of total oven-dry equivalent)	CLAY < 2 µm (% of total oven-dry equivalent)	Total soil fractions (incl. Gravel)
Sample 166	K7399/166	13.3%	3.3%	0.0%	3.3%	15.6%	17.2%	7.5%	56.4%	100.0%
Sample 167	K7399/167	21.7%	1.2%	0.0%	1.2%	51.4%	32.4%	9.5%	5.5%	100.0%
Sample 168	K7399/168	13.6%	3.6%	1.3%	2.3%	46.7%	38.2%	8.4%	3.1%	100.0%
Sample 169	K7399/169	14.4%	4.2%	0.4%	3.8%	66.5%	21.7%	5.9%	1.7%	100.0%
Sample 170	K7399/170	8.5%	13.2%	4.1%	9.1%	52.9%	21.8%	8.0%	4.0%	100.0%
Sample 171	K7399/171	11.2%	2.4%	0.0%	2.4%	40.3%	22.4%	21.0%	13.9%	100.0%
Sample 172	K7399/172	9.2%	4.1%	0.0%	4.1%	37.4%	24.0%	20.7%	13.7%	100.0%
Sample 173	K7399/173	6.2%	5.5%	1.1%	4.3%	44.7%	23.7%	17.3%	8.9%	100.0%
Sample 174	K7399/174	5.7%	13.5%	6.6%	6.9%	46.1%	24.0%	11.3%	5.2%	100.0%
Sample 175	K7399/175	11.7%	4.8%	1.0%	3.8%	53.9%	22.5%	11.8%	6.9%	100.0%
Sample 176	K7399/176	6.2%	6.8%	0.0%	6.8%	56.5%	23.5%	10.0%	3.2%	100.0%
Sample 177	K7399/177	6.0%	31.2%	28.0%	3.2%	40.4%	18.1%	7.6%	2.7%	100.0%
Sample 178	K7399/178	6.3%	26.4%	19.5%	6.9%	48.4%	14.6%	6.6%	4.0%	100.0%
Sample 179	K7399/179	6.5%	5.5%	0.0%	5.5%	63.8%	15.0%	8.4%	7.4%	100.0%
Sample 180	K7399/180	5.9%	3.4%	0.0%	3.4%	43.1%	41.1%	7.6%	4.8%	100.0%
Sample 181	K7399/181	4.4%	2.9%	0.0%	2.9%	48.6%	35.9%	7.6%	4.9%	100.0%
Sample 182	K7399/182	4.7%	4.7%	0.2%	4.4%	54.7%	27.9%	8.6%	4.1%	100.0%
Sample 183	K7399/183	2.2%	3.3%	0.8%	2.5%	54.4%	22.8%	12.9%	6.6%	100.0%
Sample 184	K7399/184	2.0%	7.1%	1.6%	5.4%	51.7%	26.1%	10.6%	4.5%	100.0%
Sample 185	K7399/185	7.2%	2.6%	0.0%	2.6%	32.2%	27.3%	4.5%	33.4%	100.0%
Sample 186	K7399/186	13.1%	6.3%	3.2%	3.1%	41.0%	21.8%	9.6%	21.4%	100.0%
Sample 187	K7399/187	1.9%	3.3%	0.0%	3.3%	67.9%	17.3%	5.3%	6.2%	100.0%
Sample 188	K7399/188	2.5%	2.7%	0.0%	2.7%	66.8%	20.1%	4.3%	6.0%	100.0%
Sample 189	K7399/189	3.2%	3.4%	0.5%	2.9%	64.5%	19.1%	6.5%	6.6%	100.0%
Sample 190	K7399/190	3.4%	8.7%	2.7%	5.9%	58.1%	23.7%	4.7%	4.8%	100.0%
Sample 191	K7399/191	5.5%	3.2%	0.0%	3.2%	56.3%	20.9%	10.6%	9.0%	100.0%
Sample 192	K7399/192	4.8%	4.1%	0.9%	3.2%	52.3%	26.2%	9.9%	7.6%	100.0%
Sample 193	K7399/193	5.3%	4.5%	0.8%	3.7%	51.4%	24.0%	11.9%	8.1%	100.0%
Sample 194	K7399/194	6.9%	7.6%	0.6%	7.0%	40.4%	31.8%	10.7%	9.5%	100.0%
Sample 195	K7399/195	7.2%	2.7%	0.0%	2.7%	37.0%	38.0%	14.9%	7.5%	100.0%
Sample 196	K7399/196	4.0%	5.1%	0.0%	5.1%	35.1%	35.3%	15.3%	9.3%	100.0%
Sample 197	K7399/197	10.1%	21.7%	15.5%	6.1%	21.2%	33.3%	5.7%	18.1%	100.0%
Sample 198	K7399/198	9.9%	4.1%	0.3%	3.8%	26.8%	33.5%	10.0%	25.5%	100.0%
Sample 199	K7399/199	10.5%	4.4%	0.0%	4.4%	51.3%	27.9%	8.4%	8.0%	100.0%
Sample 200	K7399/200	6.8%	2.7%	0.3%	2.4%	25.8%	63.4%	4.5%	3.6%	100.0%
Sample 201	K7399/201	6.5%	11.2%	4.0%	7.2%	43.8%	27.2%	12.0%	5.8%	100.0%
Sample 202	K7399/202	9.1%	13.5%	6.8%	6.8%	38.0%	21.2%	5.0%	22.3%	100.0%
Sample 203	K7399/203	13.5%	3.2%	0.0%	3.2%	47.4%	32.7%	9.8%	6.8%	100.0%
Sample 204	K7399/204	8.6%	6.6%	0.4%	6.2%	47.2%	28.6%	13.6%	4.0%	100.0%
Sample 205	K7399/205	7.3%	8.7%	2.7%	6.0%	45.2%	30.1%	12.3%	3.7%	100.0%
Sample 206	K7399/206	8.3%	14.5%	2.8%	11.7%	49.3%	22.7%	7.8%	5.7%	100.0%
Sample 207	K7399/207	12.6%	5.9%	1.3%	4.7%	42.9%	25.8%	16.5%	8.9%	100.0%
Sample 208	K7399/208	7.7%	6.5%	0.3%	6.2%	43.7%	28.8%	15.5%	5.5%	100.0%
Sample 209	K7399/209	7.2%	8.7%	3.2%	5.5%	38.4%	27.4%	16.4%	9.2%	100.0%
Sample 210	K7399/210	11.2%	2.1%	0.0%	2.1%	25.2%	18.5%	13.4%	40.8%	100.0%
Sample 211	K7399/211	10.2%	2.3%	0.0%	2.3%	31.8%	33.7%	20.3%	11.8%	100.0%
Sample 212	K7399/212	8.7%	5.1%	0.0%	5.1%	29.1%	30.6%	23.0%	12.2%	100.0%
Sample 213	K7399/213	8.9%	8.5%	3.1%	5.4%	28.0%	28.3%	19.9%	15.3%	100.0%
Sample 214	K7399/214	8.2%	11.3%	2.9%	8.4%	30.5%	30.2%	14.9%	13.2%	100.0%
Sample 215	K7399/215	7.2%	5.6%	0.6%	5.0%	39.6%	36.1%	10.6%	8.0%	100.0%
Sample 216	K7399/216	4.0%	8.5%	0.5%	8.0%	41.8%	31.2%	11.8%	6.6%	100.0%
Sample 217	K7399/217	4.4%	23.1%	20.8%	2.3%	34.9%	26.6%	8.5%	6.9%	100.0%
Sample 218	K7399/218	6.0%	9.4%	5.3%	4.0%	37.7%	33.7%	12.3%	6.9%	100.0%
Sample 219	K7399/219	5.2%	2.0%	0.0%	2.0%	41.2%	37.7%	11.7%	7.3%	100.0%
Sample 220	K7399/220	4.8%	3.8%	0.5%	3.3%	33.6%	39.7%	17.0%	5.9%	100.0%
Sample 221	K7399/221	5.5%	7.4%	5.0%	2.4%	29.1%	38.5%	15.3%	9.6%	100.0%
Sample 222	K7399/222	17.6%	0.3%	0.0%	0.3%	16.0%	16.4%	15.8%	51.5%	100.0%
Sample 223	K7399/223	5.2%	6.3%	0.3%	5.9%	51.2%	22.3%	10.4%	9.9%	100.0%
Sample 224	K7399/224	4.9%	4.4%	0.4%	4.0%	49.0%	24.9%	12.4%	9.3%	100.0%
Sample 225	K7399/225	5.9%	7.3%	2.1%	5.2%	44.8%	23.8%	12.3%	11.7%	100.0%
Sample 226	K7399/226	7.0%	7.2%	2.5%	4.7%	45.0%	23.8%	9.8%	14.2%	100.0%
Sample 227	K7399/227	6.1%	2.5%	0.0%	2.5%	71.9%	19.5%	4.1%	2.0%	100.0%
Sample 228	K7399/228	5.4%	2.9%	0.0%	2.9%	75.8%	16.1%	4.5%	0.6%	100.0%
Sample 229	K7399/229	7.1%	7.4%	1.7%	5.7%	69.9%	16.8%	4.5%	1.4%	100.0%
Sample 230	K7399/230	11.0%	8.8%	3.8%	5.0%	67.0%	16.8%	6.5%	0.9%	100.0%

Note:

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

2: Australian Standard 1289.3.8.1-1997 (see attached)

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

4. 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 2/08/2021.

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)

48 soil samples supplied by Minesoils Pty Ltd on 7 September, 2021 - Lab Job No. M1061
Analysis requested by Clayton Richards. Client reference: MS-057 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 ISSS (% of total oven-dry equivalent)	CLAY < 2 µm (% of total oven-dry equivalent)	Total soil fractions (incl. Gravel)
1 0-10	M1061/1	14.9%	3.5%	0.0%	3.5%	25.7%	46.4%	15.2%	9.1%	100.0%
1 20-30	M1061/2	12.4%	4.0%	2.2%	1.9%	17.4%	43.7%	19.1%	15.7%	100.0%
1 40-50	M1061/3	13.9%	2.2%	0.0%	2.2%	12.7%	31.6%	23.2%	30.3%	100.0%
1 65-75	M1061/4	15.6%	2.8%	0.5%	2.3%	17.8%	24.7%	26.1%	28.6%	100.0%
2 0-10	M1061/5	17.4%	8.1%	1.2%	6.9%	38.6%	29.8%	14.0%	9.4%	100.0%
2 20-30	M1061/6	13.8%	8.8%	4.3%	4.5%	34.0%	28.1%	16.7%	12.4%	100.0%
2 40-50	M1061/7	15.8%	4.5%	1.1%	3.3%	15.4%	18.6%	18.0%	43.6%	100.0%
2 65-75	M1061/8	15.8%	10.7%	5.2%	5.5%	11.7%	29.7%	12.9%	35.0%	100.0%
3 0-10	M1061/9	17.8%	4.1%	1.2%	2.9%	30.1%	33.0%	15.5%	17.3%	100.0%
3 20-30	M1061/10	15.8%	7.8%	0.7%	7.1%	0.0%	55.2%	22.0%	15.1%	100.0%
3 40-50	M1061/11	14.9%	4.1%	0.0%	4.1%	22.4%	29.8%	13.6%	30.2%	100.0%
3 65-75	M1061/12	17.2%	16.2%	8.4%	7.9%	19.5%	20.1%	17.9%	26.2%	100.0%
4 0-10	M1061/13	15.0%	17.6%	4.7%	12.9%	37.8%	24.8%	12.4%	7.3%	100.0%
4 20-30	M1061/14	12.3%	16.0%	11.6%	4.4%	36.8%	23.1%	15.9%	8.2%	100.0%
4 40-50	M1061/15	15.7%	3.6%	0.7%	3.0%	21.5%	24.2%	16.3%	34.5%	100.0%
4 65-75	M1061/16	15.0%	4.8%	1.6%	3.3%	17.1%	24.7%	13.6%	39.7%	100.0%
5 0-10	M1061/17	16.1%	3.5%	0.2%	3.3%	40.6%	19.1%	25.2%	11.7%	100.0%
5 20-30	M1061/18	15.3%	10.3%	9.5%	0.8%	25.2%	21.2%	30.0%	13.3%	100.0%
5 40-50	M1061/19	14.3%	0.7%	0.0%	0.7%	14.8%	19.8%	38.3%	26.4%	100.0%
5 65-75	M1061/20	15.8%	1.1%	0.3%	0.8%	17.3%	17.8%	29.7%	34.1%	100.0%
6 0-10	M1061/21	18.9%	4.5%	1.1%	3.4%	54.1%	19.0%	14.7%	7.7%	100.0%
6 20-30	M1061/22	11.5%	10.9%	6.2%	4.6%	35.8%	29.8%	18.9%	4.6%	100.0%
6 40-50	M1061/23	15.6%	5.8%	3.6%	2.2%	29.4%	21.4%	19.2%	24.3%	100.0%
6 65-75	M1061/24	16.7%	3.7%	0.6%	3.1%	38.2%	16.2%	14.3%	27.6%	100.0%
8 0-10	M1061/25	19.3%	3.1%	0.0%	3.1%	53.8%	19.8%	15.2%	8.1%	100.0%
8 20-30	M1061/26	13.5%	4.9%	0.6%	4.2%	56.1%	16.2%	17.1%	5.7%	100.0%
8 40-50	M1061/27	8.3%	11.0%	3.0%	8.0%	50.4%	16.6%	11.1%	10.9%	100.0%
8 65-75	M1061/28	10.8%	11.2%	6.2%	5.1%	42.3%	16.4%	11.2%	18.9%	100.0%
9 0-10	M1061/29	16.6%	10.3%	4.0%	6.3%	50.3%	22.0%	9.5%	8.0%	100.0%
9 20-30	M1061/30	9.7%	19.8%	14.1%	5.7%	34.1%	22.0%	12.6%	11.5%	100.0%
9 40-50	M1061/31	12.3%	16.5%	12.4%	4.1%	26.1%	10.4%	15.4%	31.6%	100.0%
9 65-75	M1061/32	16.3%	8.5%	3.9%	4.6%	13.2%	9.1%	22.9%	46.3%	100.0%
10 0-10	M1061/33	18.7%	5.1%	1.0%	4.1%	34.5%	22.3%	21.6%	16.6%	100.0%
10 20-30	M1061/34	11.5%	4.9%	2.3%	2.6%	29.0%	31.4%	23.3%	11.5%	100.0%
10 40-50	M1061/35	14.5%	3.6%	0.0%	3.6%	13.6%	24.2%	18.1%	40.4%	100.0%
10 65-75	M1061/36	15.3%	2.5%	1.6%	0.9%	15.3%	22.3%	20.5%	39.4%	100.0%
12 0-10	M1061/37	13.3%	5.3%	0.4%	5.0%	50.8%	19.8%	13.0%	11.1%	100.0%
12 20-30	M1061/38	9.6%	7.1%	2.7%	4.4%	49.2%	15.8%	16.7%	11.3%	100.0%
12 40-50	M1061/39	18.7%	0.8%	0.0%	0.8%	16.2%	11.8%	11.8%	59.5%	100.0%
12 65-75	M1061/40	15.7%	1.2%	0.0%	1.2%	24.3%	13.5%	13.3%	47.7%	100.0%
13 0-10	M1061/41	15.7%	2.4%	0.0%	2.4%	45.0%	25.2%	16.6%	10.8%	100.0%
13 20-30	M1061/42	9.1%	7.4%	2.2%	5.3%	52.5%	23.2%	12.4%	4.5%	100.0%
13 40-50	M1061/43	6.9%	16.8%	12.4%	4.4%	50.7%	19.2%	9.8%	3.5%	100.0%
13 65-75	M1061/44	13.8%	5.7%	0.4%	5.3%	47.7%	12.8%	9.7%	24.1%	100.0%
14 0-10	M1061/45	20.4%	11.4%	2.9%	8.6%	21.9%	21.9%	27.6%	17.2%	100.0%
14 20-30	M1061/46	15.6%	10.0%	2.8%	7.2%	11.2%	34.0%	31.9%	13.0%	100.0%
14 40-50	M1061/47	22.3%	13.1%	9.6%	3.4%	4.6%	17.7%	16.5%	48.2%	100.0%
14 65-75	M1061/48	20.4%	0.8%	0.0%	0.8%	3.9%	19.7%	16.8%	58.8%	100.0%

Note:

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

2: Australian Standard 1289.3.8.1-1997 (see attached)

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

4. 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 15/09/2021 and replaces the report published 10/09/2021. QA data has been finalised.

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 on 28th February, 2022 - Lab Job No. M6945
Analysis requested by Clayton Richards. Client reference: MS-057 BSAL Stage 3
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)	COARSE SAND 200-2000 µm (0.2-2.0 mm) (% of total oven-dry equivalent)	FINE SAND 20-200 µm (0.02-0.2 mm) (% of total oven-dry equivalent)	SILT 2-20 µm ISSS (% of total oven-dry equivalent)	CLAY < 2 µm (% of total oven-dry equivalent)	Total soil fractions (incl. Gravel)
82 0-10	M6945/1	8.5%	2.9%	37.2%	31.6%	11.2%	17.1%	100.0%
82 20-30	M6945/2	6.8%	4.8%	31.5%	33.8%	10.4%	19.5%	100.0%
82 50-60	M6945/3	14.6%	5.8%	14.3%	19.6%	6.3%	54.1%	100.0%
82 65-75	M6945/4	12.7%	0.2%	3.7%	26.0%	18.7%	51.4%	100.0%
83 0-10	M6945/5	13.0%	15.2%	1.5%	37.6%	27.4%	18.3%	100.0%
83 20-30	M6945/6	20.5%	0.8%	4.9%	6.7%	23.7%	63.9%	100.0%
83 40-50	M6945/7	21.8%	0.2%	0.8%	13.7%	22.0%	63.3%	100.0%
83 65-75	M6945/8	22.6%	0.2%	0.8%	20.3%	18.7%	60.0%	100.0%
84 0-10	M6945/9	13.2%	4.8%	0.8%	43.0%	29.8%	21.6%	100.0%
84 20-30	M6945/10	20.4%	0.0%	0.5%	17.0%	26.3%	56.1%	100.0%
84 40-50	M6945/11	21.9%	0.4%	0.5%	15.4%	20.1%	63.5%	100.0%
84 65-75	M6945/12	22.8%	0.6%	0.8%	17.3%	22.8%	58.6%	100.0%
96 0-10	M6945/13	4.4%	5.4%	42.4%	24.7%	17.8%	9.7%	100.0%
96 10-20	M6945/14	3.1%	12.0%	33.4%	25.7%	20.9%	8.0%	100.0%
96 25-35	M6945/15	8.5%	5.6%	24.8%	19.2%	16.6%	33.8%	100.0%
96 40-50	M6945/16	10.9%	2.4%	22.3%	15.4%	18.9%	41.1%	100.0%
96 65-75	M6945/17	12.8%	8.2%	31.2%	19.0%	18.2%	23.5%	100.0%
97 0-10	M6945/18	8.3%	2.7%	14.0%	43.1%	22.2%	18.0%	100.0%
97 15-25	M6945/19	6.6%	3.6%	12.9%	49.2%	20.9%	13.4%	100.0%
97 30-40	M6945/20	16.8%	0.2%	2.8%	19.8%	11.6%	65.7%	100.0%
97 65-75	M6945/21	17.7%	0.0%	2.7%	23.9%	24.2%	49.2%	100.0%
98 0-10	M6945/22	5.5%	3.0%	36.5%	41.0%	12.4%	7.0%	100.0%
98 20-30	M6945/23	5.6%	2.6%	31.9%	41.1%	14.6%	9.8%	100.0%
98 50-60	M6945/24	13.1%	5.3%	17.5%	26.2%	7.3%	43.7%	100.0%
98 65-75	M6945/25	11.8%	11.5%	10.7%	20.8%	7.8%	49.1%	100.0%
99 0-10	M6945/26	3.8%	10.1%	36.7%	33.7%	12.7%	6.8%	100.0%
99 20-30	M6945/27	4.3%	11.3%	33.7%	35.8%	14.0%	5.1%	100.0%
99 50-60	M6945/28	12.1%	7.5%	15.8%	29.2%	10.6%	36.8%	100.0%
99 65-75	M6945/29	12.5%	6.1%	19.9%	26.8%	11.7%	35.5%	100.0%
100 0-10	M6945/30	3.7%	8.2%	45.8%	29.4%	10.1%	6.4%	100.0%
100 20-30	M6945/31	4.4%	7.0%	43.0%	29.0%	14.0%	6.9%	100.0%
100 40-50	M6945/32	6.0%	7.2%	38.1%	32.2%	12.2%	10.2%	100.0%
100 65-75	M6945/33	13.5%	0.4%	14.7%	34.1%	19.6%	31.3%	100.0%

Note:

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

2: Australian Standard 1289.3.8.1-1997 (see attached)

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

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6. This report was issued on 29/03/2022 and replaces the report published on 24/03/2022. Data for M6945/21 has been added.

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

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

MUNSELL COLOUR ANALYSIS

49 soil samples supplied by Minesoils Pty Ltd on 14 February, 2022 - Lab Job No. M6051.
Analysis requested by Clayton Richards. Client reference: MS-016 BSAL2
PO Box 11034 TAMWORTH NSW 2340

SAMPLE ID	Lab Code	MOIST MUNSELL COLOUR		MOTTLE MUNSELL COLOUR		DEGREE OF MOTTLING (%)
		Code	Description	Code	Description	
82 0-10	M6945/1	5YR2.5/2	dark reddish brown	..	..	..
82 20-30	M6945/2	5YR4/6	yellowish red	..	..	..
82 50-60	M6945/3	2.5YR4/8	red	..	..	..
82 65-75	M6945/4	10YR7/3	very pale brown	2.5YR5/8	..	30
83 0-10	M6945/5	5YR3/4	dark reddish brown	..	..	..
83 20-30	M6945/6	2.5YR2.5/4	dark reddish brown	..	..	..
83 40-50	M6945/7	2.5YR3/6	dark reddish brown	..	..	..
83 65-75	M6945/8	2.5YR2.5/4	dark reddish brown	..	..	..
84 0-10	M6945/9	7.5YR2.5/2	very dark brown	..	..	..
84 20-30	M6945/10	2.5YR2.5/4	dark reddish brown	..	..	..
84 40-50	M6945/11	2.5YR2.5/4	dark reddish brown	..	..	..
84 65-75	M6945/12	2.5YR2.5/4	dark reddish brown	..	..	..
96 0-10	M6945/13	7.5YR3/4	dark brown	..	..	..
96 10-20	M6945/14	7.5YR8/1	white	..	..	..
96 25-35	M6945/15	10YR6/3	pale brown	..	..	..
96 40-50	M6945/16	7.5YR5/2	brown	5YR5/8	yellowish red	40
96 65-75	M6945/17	10YR6/4	light yellowish brown	..	..	..
97 0-10	M6945/18	7.5YR4/3	brown	..	..	..
97 15-25	M6945/19	5YR5/4	reddish brown	..	..	..
97 30-40	M6945/20	2.5YR4/8	red	2.5Y6/3	light yellowish brown	20
97 65-75	M6945/21	10YR5/2	grayish brown	10YR3/3 and 10YR5/8	dusky red and yellowish brown	10 and 40
98 0-10	M6945/22	7.5YR4/2	brown	..	..	..
98 20-30	M6945/23	10YR6/3	pale brown	..	..	..
98 50-60	M6945/24	10YR7/1	light grey	7.5YR6/8	reddish yellow	40
98 65-75	M6945/25	10YR7/1	light grey	7.5YR6/8	reddish yellow	40
99 0-10	M6945/26	10YR4/3	brown	..	..	..
99 20-30	M6945/27	10YR7/2	light grey	..	..	..
99 50-60	M6945/28	2.5Y7/2	light grey	7.5YR5/8 and 10R3/6	strong brown and dark red	10 and 30
99 65-75	M6945/29	2.5YR5/8	red	10YR6/2	light brownish grey	60
100 0-10	M6945/30	10YR5/2	light brownish grey	..	..	..
100 20-30	M6945/31	10YR6/3	pale brown	..	..	..
100 40-50	M6945/32	2.5Y7/4	pale brown	..	..	..
100 65-75	M6945/33	5Y7/1	light grey	10YR5/6	yellowish brown	50

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 24/03/2022.

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ANALYSIS REPORT SOIL

PROJECT NO: EW220849		**Date of Issue:**	**14/04/2022**
Customer:	Minesoils Pty Ltd	Report No:	1
Address:	PO Box 11034 TAMWORTH 2340	Date Received:	6/04/2022
		Matrix:	Soil
Attention:	Clayton Richards	Location:	MS-057 BSAL Stage 3
Phone:	0408 474 248	Sampler ID:	Client
Fax:		Date of Sampling:	24/03/2022
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: Anne Michie

ASPAC
PROFICIENT LAB
Visit www.aspac-australasia.com to view our certification details.

East West is certified by the Australian-Asian Soil & Plant Analysis Council to perform various soil and plant tissue analysis. The tests reported herein have been performed in accordance with our terms of accreditation.

This report must not be reproduced except in full and EWEA takes no responsibility of the end use of the results within this report.

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: EW220849 Location: MS-057 BSAL Stage 3

			CLIENT SAMPLE ID		85	85	85	85
			DEPTH		0-10	20-30	40-50	65-75
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**220849-1**	**220849-2**	**220849-3**	**220849-4**
pH (1:5 in H20)	Electrode	R&L 4A2	pH units	na	5.30	5.01	6.20	6.71
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.04	0.01	0.01	0.02
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	209	99.3	124	85.7
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	493	267	328	428
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	120	93.3	129	293
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	25.7	11.2	12.4	34.1
Exchangeable Aluminium	KCl/ICP	R&L 15G1	mg/kg	1	4.10	2.45	<1.00	<1.00
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na	0.54	0.25	0.32	0.22
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	2.47	1.34	1.64	2.14
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	1.00	0.78	1.08	2.44
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.11	0.05	0.05	0.15
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.05	0.03	0.01	0.01
ECEC	Calculation	PMS-15A1	cmol/kg	na	4.16	2.44	3.10	4.96
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	2.47	1.72	1.53	0.88
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.54	0.33	0.30	0.09
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	12.9	10.4	10.3	4.43
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	59.3	54.6	52.9	43.1
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	24.0	31.8	34.7	49.2
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	2.69	1.99	1.74	2.99
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na	1.10	1.11	0.36	0.22
Soil Colour (wet interior)	Dry	Munsell	Class	na	10YR 3/6	10YR 6/6	10YR 6/6	10YR 6/4



ANALYSIS REPORT

PROJECT NO: EW220849 Location: MS-057 BSAL Stage 3

				CLIENT SAMPLE ID	85	85	85	85
				DEPTH	0-10	20-30	40-50	65-75
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**220849-1**	**220849-2**	**220849-3**	**220849-4**
Gravel >2.0mm	Sieve	ASTMD422-63	%	na	6.9	10.2	15.4	8.9
Coarse Sand 0.2-2.0mm	Sieve	ASTMD422-63	%	na	50.2	45.4	37.1	36.0
Fine Sand 0.02-0.2mm	Sieve	ASTMD422-63	%	na	22.6	24.5	25.2	27.8
Silt 0.002-0.02mm	Hydrometer	ASTMD422-63	%	na	10.4	10.1	8.1	8.6
Clay <0.002mm	Hydrometer	ASTMD422-63	%	na	10.0	9.7	14.2	18.6



ANALYSIS REPORT

PROJECT NO: EW220849 Location: MS-057 BSAL Stage 3

				CLIENT SAMPLE ID	89	89	89	89
				DEPTH	0-10	20-30	40-50	65-75
Test Parameter	Method Description	Method Reference	Units	LOR	220849-5	220849-6	220849-7	220849-8
pH (1:5 in H20)	Electrode	R&L 4A2	pH units	na	4.96	6.04	6.47	6.78
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.03	0.02	0.01	0.03
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	344	165	61.9	105
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	558	841	630	828
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	148	186	259	972
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	36.7	49.8	43.7	81.8
Exchangeable Aluminium	KCl/ICP	R&L 15G1	mg/kg	1	34.1	<1.00	<1.00	<1.00
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na	0.88	0.42	0.16	0.27
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	2.79	4.21	3.15	4.14
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	1.23	1.55	2.16	8.10
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.16	0.22	0.19	0.36
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.38	0.01	0.01	0.01
ECEC	Calculation	PMS-15A1	cmol/kg	na	5.44	6.41	5.67	12.9
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	2.26	2.71	1.46	0.51
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.72	0.27	0.07	0.03
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	16.2	6.60	2.80	2.09
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	51.3	65.6	55.6	32.2
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	22.7	24.2	38.1	62.9
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	2.93	3.38	3.35	2.76
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na	6.96	0.17	0.20	0.09
Soil Colour (wet interior)	Dry	Munsell	Class	na	5YR 4/6	5YR 4/6	5YR 5/8	5YR 6/6



ANALYSIS REPORT

PROJECT NO: EW220849 **Location: MS-057 BSAL Stage 3**

					CLIENT SAMPLE ID	89	89	89	89
					DEPTH	0-10	20-30	40-50	65-75
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**220849-5**	**220849-6**	**220849-7**	**220849-8**
Gravel >2.0mm	Sieve	ASTMD422-63	%	na	3.6	2.4	7.2	7.3
Coarse Sand 0.2-2.0mm	Sieve	ASTMD422-63	%	na	51.5	48.8	40.0	26.1
Fine Sand 0.02-0.2mm	Sieve	ASTMD422-63	%	na	19.7	19.7	21.0	20.3
Silt 0.002-0.02mm	Hydrometer	ASTMD422-63	%	na	9.2	11.1	8.9	7.8
Clay <0.002mm	Hydrometer	ASTMD422-63	%	na	16.1	18.1	22.8	38.6

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Soils are air dried at 40^{0}C and ground <2mm.

NB: LOR is the Lowest Obtainable Reading.

DOCUMENT END

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ANALYSIS REPORT SOIL

PROJECT NO: EW221569		**Date of Issue:**	**09/09/2022**
Customer:	Minesoils Pty Ltd	Report No:	1
Address:	PO Box 11034 PO Box 11034, TAMWORTH NSW 2340 TAMWORTH 2340	Date Received:	2/09/2022
		Matrix:	Soil
Attention:	Clayton Richards	Location:	Moolarben Stage 3 BSA
Phone:	0408 474 248	Sampler ID:	Client
Fax:		Date of Sampling:	1/09/2022
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: Anne Michie

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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: EW221569 **Location: Moolarben Stage 3 BSAL September 2**

				CLIENT SAMPLE ID	103	103	103	103
				DEPTH	0-10	20-30	40-50	65-75
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**221569-1**	**221569-2**	**221569-3**	**221569-4**
pH (1:5 in H20)	Electrode	R&L 4A2	pH units	na	5.69	6.14	6.15	6.43
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.03	0.01	0.01	0.01
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	130	105	101	105
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	389	95.2	66.8	109
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	50.1	31.5	11.1	74.7
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	31.5	10.6	31.9	11.8
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	0.33	0.27	0.26	0.27
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	1.95	0.48	0.33	0.55
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	0.42	0.26	0.09	0.62
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.14	0.05	0.14	0.05
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.02	0.02	0.02	0.02
ECEC	Calculation	PMS-15A1	cmol/kg	na	2.86	1.08	0.85	1.51
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	4.66	1.81	3.61	0.88
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.80	1.03	2.80	0.43
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	11.7	25.0	30.6	17.8
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	68.1	44.2	39.5	36.1
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	14.6	24.4	10.9	41.2
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	4.80	4.28	16.4	3.40
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na	0.78	2.07	2.63	1.47
Soil Colour (wet interior)	Dry	Munsell	Class	na	7.5YR 2.5/3	10YR 6/3	10YR 6/4	2.5Y 7/4



ANALYSIS REPORT

PROJECT NO: EW221569 **Location: Moolarben Stage 3 BSAL September 2**

				CLIENT SAMPLE ID	103	103	103	103
				DEPTH	0-10	20-30	40-50	65-75
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**221569-1**	**221569-2**	**221569-3**	**221569-4**
Gravel >2.0mm	Sieve	ASTMD422-63	%	na	2.8	5.9	30.1	8.0
Coarse Sand 0.2-2.0mm	Sieve	ASTMD422-63	%	na	69.9	69.9	49.5	61.0
Fine Sand 0.02-0.2mm	Sieve	ASTMD422-63	%	na	14.5	14.1	16.0	14.2
Silt 0.002-0.02mm	Hydrometer	ASTMD422-63	%	na	6.2	5.9	2.8	3.7
Clay <0.002mm	Hydrometer	ASTMD422-63	%	na	6.6	4.1	1.7	13.1



ANALYSIS REPORT

PROJECT NO: EW221569 **Location: Moolarben Stage 3 BSAL September 2**

				CLIENT SAMPLE ID	104	104	104	104
				DEPTH	0-10	20-30	40-50	65-75
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**221569-5**	**221569-6**	**221569-7**	**221569-8**
pH (1:5 in H20)	Electrode	R&L 4A2	pH units	na	6.05	6.68	7.60	8.65
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.02	0.01	0.05	0.07
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	157	129	168	135
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	411	271	367	155
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	153	170	923	669
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	20.7	50.5	293	322
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	0.40	0.33	0.43	0.35
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	2.06	1.36	1.84	0.78
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	1.28	1.42	7.69	5.58
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.09	0.22	1.27	1.40
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.02	0.02	0.02	0.02
ECEC	Calculation	PMS-15A1	cmol/kg	na	3.84	3.34	11.3	8.12
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	1.61	0.96	0.24	0.14
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.32	0.23	0.06	0.06
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	10.5	9.89	3.83	4.26
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	53.4	40.5	16.3	9.55
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	33.2	42.4	68.3	68.7
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	2.34	6.57	11.3	17.2
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na	0.58	0.66	0.20	0.27
Soil Colour (wet interior)	Dry	Munsell	Class	na	7.5YR 3/4	10YR 6/3	10YR 5/4	5YR 5/6

ANALYSIS REPORT

PROJECT NO: EW221569 **Location: Moolarben Stage 3 BSAL September 2**

				CLIENT SAMPLE ID	104	104	104	104
				DEPTH	0-10	20-30	40-50	65-75
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**221569-5**	**221569-6**	**221569-7**	**221569-8**
Gravel >2.0mm	Sieve	ASTMD422-63	%	na	6.3	12.6	3.2	10.6
Coarse Sand 0.2-2.0mm	Sieve	ASTMD422-63	%	na	34.0	24.7	31.2	41.0
Fine Sand 0.02-0.2mm	Sieve	ASTMD422-63	%	na	33.8	31.4	14.7	21.5
Silt 0.002-0.02mm	Hydrometer	ASTMD422-63	%	na	11.6	13.5	6.9	5.3
Clay <0.002mm	Hydrometer	ASTMD422-63	%	na	14.3	17.7	44.0	21.6



ANALYSIS REPORT

PROJECT NO: EW221569 **Location: Moolarben Stage 3 BSAL September 2**

				CLIENT SAMPLE ID	105	105	105	105
				DEPTH	0-10	20-30	40-50	65-75
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**221569-9**	**221569-10**	**221569-11**	**221569-12**
pH (1:5 in H20)	Electrode	R&L 4A2	pH units	na	6.15	6.62	6.75	7.04
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.03	0.02	0.19	0.41
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	203	153	207	192
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	719	417	426	331
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	167	193	702	587
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	71.3	112	633	844
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	0.52	0.39	0.53	0.49
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	3.60	2.09	2.13	1.66
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	1.39	1.61	5.85	4.89
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.31	0.49	2.75	3.67
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.02	0.02	0.02	0.02
ECEC	Calculation	PMS-15A1	cmol/kg	na	5.84	4.59	11.3	10.7
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	2.58	1.30	0.36	0.34
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.37	0.24	0.09	0.10
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	8.91	8.54	4.70	4.59
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	61.6	45.4	18.9	15.4
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	23.8	35.0	51.8	45.6
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	5.31	10.6	24.4	34.2
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na	0.38	0.48	0.20	0.21
Soil Colour (wet interior)	Dry	Munsell	Class	na	5YR 3/4	5YR 5/6	7.5YR 5/6	2.5YR 5/4



ANALYSIS REPORT

PROJECT NO: EW221569 **Location: Moolarben Stage 3 BSAL September 2**

				CLIENT SAMPLE ID	105	105	105	105
				DEPTH	0-10	20-30	40-50	65-75
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**221569-9**	**221569-10**	**221569-11**	**221569-12**
Gravel >2.0mm	Sieve	ASTMD422-63	%	na	6.7	3.3	1.1	3.0
Coarse Sand 0.2-2.0mm	Sieve	ASTMD422-63	%	na	25.3	11.7	9.7	18.7
Fine Sand 0.02-0.2mm	Sieve	ASTMD422-63	%	na	17.6	34.0	24.5	30.2
Silt 0.002-0.02mm	Hydrometer	ASTMD422-63	%	na	20.0	23.4	15.0	14.5
Clay <0.002mm	Hydrometer	ASTMD422-63	%	na	30.4	27.6	49.7	33.6



ANALYSIS REPORT

PROJECT NO: EW221569 **Location: Moolarben Stage 3 BSAL September 2**

				CLIENT SAMPLE ID	106	106	106	106
				DEPTH	0-10	20-30	40-50	65-75
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**221569-13**	**221569-14**	**221569-15**	**221569-16**
pH (1:5 in H20)	Electrode	R&L 4A2	pH units	na	6.93	8.71	8.76	9.02
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.08	0.15	0.45	0.49
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	171	122	187	181
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	310	100	52.0	55.1
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	338	312	696	677
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	368	500	1615	1493
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	0.44	0.31	0.48	0.46
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	1.55	0.50	0.26	0.28
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	2.82	2.60	5.80	5.64
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	1.60	2.17	7.02	6.49
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.02	0.02	0.02	0.02
ECEC	Calculation	PMS-15A1	cmol/kg	na	6.43	5.61	13.6	12.9
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.55	0.19	0.04	0.05
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.16	0.12	0.08	0.08
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	6.82	5.58	3.53	3.60
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	24.1	8.91	1.91	2.14
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	43.8	46.4	42.7	43.8
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	24.9	38.8	51.7	50.3
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na	0.35	0.40	0.16	0.17
Soil Colour (wet interior)	Dry	Munsell	Class	na	7.5YR 3/3	7.5YR 6/3	7.5YR 6/6	5YR 6/8

ANALYSIS REPORT

PROJECT NO: EW221569 **Location: Moolarben Stage 3 BSAL September 2**

				CLIENT SAMPLE ID	106	106	106	106
				DEPTH	0-10	20-30	40-50	65-75
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**221569-13**	**221569-14**	**221569-15**	**221569-16**
Gravel >2.0mm	Sieve	ASTMD422-63	%	na	0.3	2.7	0.4	0.4
Coarse Sand 0.2-2.0mm	Sieve	ASTMD422-63	%	na	24.0	14.9	5.5	14.0
Fine Sand 0.02-0.2mm	Sieve	ASTMD422-63	%	na	35.0	34.1	25.3	42.9
Silt 0.002-0.02mm	Hydrometer	ASTMD422-63	%	na	20.1	23.9	18.2	12.7
Clay <0.002mm	Hydrometer	ASTMD422-63	%	na	20.5	24.3	50.5	30.0



ANALYSIS REPORT

PROJECT NO: EW221569 **Location: Moolarben Stage 3 BSAL September 2**

				CLIENT SAMPLE ID	107	107	107	107
				DEPTH	0-10	20-30	40-50	65-75
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**221569-17**	**221569-18**	**221569-19**	**221569-20**
pH (1:5 in H20)	Electrode	R&L 4A2	pH units	na	5.40	6.34	8.65	8.91
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.02	0.02	0.11	0.22
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	142	137	232	193
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	169	154	1158	214
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	160	244	1110	922
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	23.9	23.9	371	460
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	0.36	0.35	0.59	0.49
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	0.85	0.77	5.79	1.07
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	1.33	2.03	9.25	7.68
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.10	0.10	1.61	2.00
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.02	0.02	0.02	0.02
ECEC	Calculation	PMS-15A1	cmol/kg	na	2.67	3.28	17.3	11.3
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.63	0.38	0.63	0.14
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.27	0.17	0.06	0.06
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	13.6	10.7	3.44	4.39
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	31.7	23.5	33.5	9.49
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	50.0	62.0	53.6	68.2
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	3.89	3.17	9.34	17.7
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na	0.83	0.68	0.13	0.20
Soil Colour (wet interior)	Dry	Munsell	Class	na	7.5YR 3/4	7.5YR 6/4	7.5YR 6/8	5YR 6/4



ANALYSIS REPORT

PROJECT NO: EW221569 **Location: Moolarben Stage 3 BSAL September 2**

				CLIENT SAMPLE ID	107	107	107	107
				DEPTH	0-10	20-30	40-50	65-75
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**221569-17**	**221569-18**	**221569-19**	**221569-20**
Gravel >2.0mm	Sieve	ASTMD422-63	%	na	4.8	4.3	0.7	1.0
Coarse Sand 0.2-2.0mm	Sieve	ASTMD422-63	%	na	28.9	26.1	19.6	24.1
Fine Sand 0.02-0.2mm	Sieve	ASTMD422-63	%	na	34.9	35.6	28.3	32.2
Silt 0.002-0.02mm	Hydrometer	ASTMD422-63	%	na	15.5	12.6	11.6	11.1
Clay <0.002mm	Hydrometer	ASTMD422-63	%	na	15.9	21.4	39.8	31.5



ANALYSIS REPORT

PROJECT NO: EW221569 **Location: Moolarben Stage 3 BSAL September 2**

				CLIENT SAMPLE ID	108	108	108	108
				DEPTH	0-10	20-30	40-50	65-75
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**221569-21**	**221569-22**	**221569-23**	**221569-24**
pH (1:5 in H20)	Electrode	R&L 4A2	pH units	na	5.85	6.41	6.78	7.10
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.03	0.01	0.02	0.03
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	238	168	199	195
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	569	331	766	815
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	153	152	492	744
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	16.3	15.8	57.9	86.5
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	0.61	0.43	0.51	0.50
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	2.85	1.66	3.83	4.08
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	1.28	1.27	4.10	6.20
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.07	0.07	0.25	0.38
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.02	0.02	0.02	0.02
ECEC	Calculation	PMS-15A1	cmol/kg	na	4.82	3.44	8.71	11.2
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	2.23	1.31	0.93	0.66
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.48	0.34	0.12	0.08
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	12.7	12.5	5.86	4.47
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	59.0	48.1	44.0	36.5
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	26.4	36.8	47.0	55.5
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	1.47	2.00	2.89	3.37
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na	0.46	0.65	0.26	0.20
Soil Colour (wet interior)	Dry	Munsell	Class	na	7.5YR 3/4	7.5YR 6/4	10YR 5/4	7.5YR 5/8



ANALYSIS REPORT

PROJECT NO: EW221569 **Location: Moolarben Stage 3 BSAL September 2**

				CLIENT SAMPLE ID	108	108	108	108
				DEPTH	0-10	20-30	40-50	65-75
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**221569-21**	**221569-22**	**221569-23**	**221569-24**
Gravel >2.0mm	Sieve	ASTMD422-63	%	na	6.8	13.7	20.6	22.7
Coarse Sand 0.2-2.0mm	Sieve	ASTMD422-63	%	na	29.4	22.5	13.4	14.5
Fine Sand 0.02-0.2mm	Sieve	ASTMD422-63	%	na	41.2	39.7	26.3	26.1
Silt 0.002-0.02mm	Hydrometer	ASTMD422-63	%	na	14.2	10.9	7.2	8.7
Clay <0.002mm	Hydrometer	ASTMD422-63	%	na	8.5	13.1	32.6	28.0



ANALYSIS REPORT

PROJECT NO: EW221569 **Location: Moolarben Stage 3 BSAL September 2**

				CLIENT SAMPLE ID	110	110	110	110
				DEPTH	0-10	20-30	40-50	65-75
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**221569-25**	**221569-26**	**221569-27**	**221569-28**
pH (1:5 in H20)	Electrode	R&L 4A2	pH units	na	5.61	6.39	6.53	7.17
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.02	0.01	0.02	0.03
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	222	136	154	286
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	474	284	422	1545
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	59.1	42.4	64.0	276
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	<10.0	<10.0	<10.0	14.1
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	0.57	0.35	0.39	0.73
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	2.37	1.42	2.11	7.73
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	0.49	0.35	0.53	2.30
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.04	0.04	0.04	0.06
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.02	0.02	0.02	0.02
ECEC	Calculation	PMS-15A1	cmol/kg	na	3.50	2.19	3.10	10.8
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	4.81	4.02	3.96	3.36
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	1.16	0.99	0.74	0.32
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	16.3	15.9	12.7	6.76
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	67.8	64.9	68.0	71.3
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	14.1	16.2	17.2	21.2
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	1.24	1.99	1.40	0.57
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na	0.64	1.02	0.72	0.20
Soil Colour (wet interior)	Dry	Munsell	Class	na	7.5YR 3/3	10YR 6/4	10YR 6/4	10YR 5/4



ANALYSIS REPORT

PROJECT NO: EW221569 **Location: Moolarben Stage 3 BSAL September 2**

				CLIENT SAMPLE ID	110	110	110	110
				DEPTH	0-10	20-30	40-50	65-75
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**221569-25**	**221569-26**	**221569-27**	**221569-28**
Gravel >2.0mm	Sieve	ASTMD422-63	%	na	4.4	5.6	23.2	12.1
Coarse Sand 0.2-2.0mm	Sieve	ASTMD422-63	%	na	38.7	30.0	21.4	20.7
Fine Sand 0.02-0.2mm	Sieve	ASTMD422-63	%	na	34.4	39.1	32.1	27.4
Silt 0.002-0.02mm	Hydrometer	ASTMD422-63	%	na	8.0	11.5	7.7	5.6
Clay <0.002mm	Hydrometer	ASTMD422-63	%	na	14.4	13.8	15.6	34.1

This Analysis Report shall not be reproduced except in full without the written approval of the laboratory.

Soils are air dried at 40^{0}C and ground <2mm.

NB: LOR is the Lowest Obtainable Reading.

DOCUMENT END

APPENDIX B: SELF REPLACING STOCK DIAGRAMS

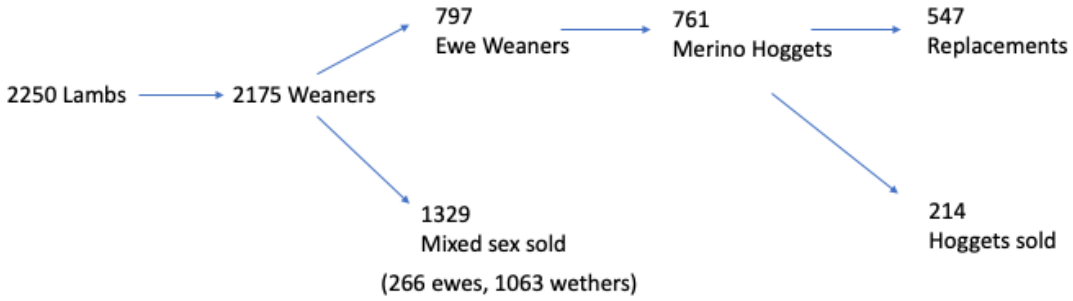
B.1: Production Type 1

Sheep Self Replacing Herd Structure (NSW DPI, 2020)

Flock structure

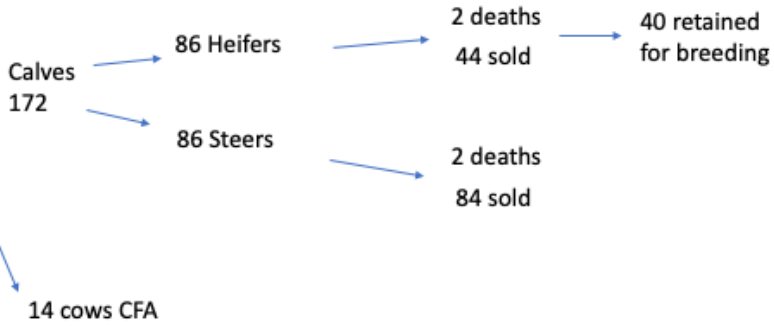
Age	Number of Ewes	Number sold each year
1.5	547	
2.5	523	24
3.5	499	24
4.5	477	22
		455
5.5	455	(cast for age)
6.5	0	
Total	2500	

455 CFA's sold



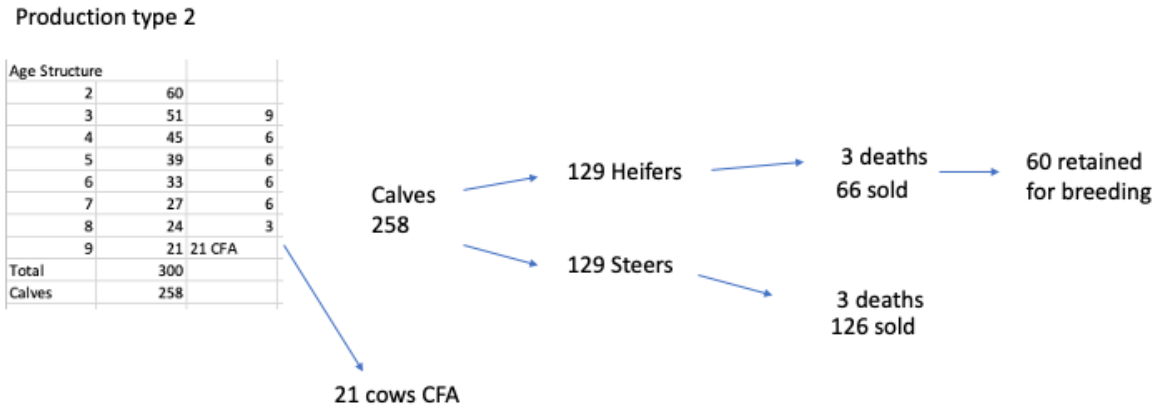
Cattle Self Replacing Herd Structure (NSW DPI, 2019)

Age Structur	No. head	Sell
2	40	
3	34	6
4	30	4
5	26	4
6	22	4
7	18	4
8	16	2
9	14	14 CFA
Total	200	
calves	172	



B.2: Production Type 2

Cattle Self Replacing Herd Structure (NSW DPI, 2019)



APPENDIX C: GIS CHECKLIST

Layer name	Source	Visual check	Area check	Checked by	Other comments
Moolarben_Coal_Complex_DisturbanceFootprint_GDA2020_MGAz55	Client	✓	✓	JO	Coal complex disturbance area
Agricultural_Landform_Minus_ApprovedOC3_180822.shp	Client	✓	✓	JO	Landform map
Indicative_ProjectSurfaceDisturbance_GDA2020_MGAz55	Client	✓	✓	JO	Project Area
Moolarben Stage 3 Previous Ownership.shp	Client	✓	✓	JO	Properties areas with historic/ current ownership and names
Rural Licences.shp	Client	✓	✓	JO	Rural lease properties
Central_Tablelands_LLS.shp NSW_LLS	State Gov of NSW	✓	✓	JO	Locality map
GSG_NSW_v170505_GDA94	State Gov of NSW	✓	✓	JO	Soil type mapping
LSC_NSW_v170505_GDA94	State Gov of NSW	✓	✓	JO	Soil fertility mapping
NSWLanduse2017v1p2	State Gov of NSW	✓	✓	JO	Landuse mapping
VEG_CentTableSVM_v1p0_PCT_E_4778	State Gov of NSW	✓	✓	JO	Used for visualisation of vegetation types
Soil_MappingUnits_GD94	State Gov of NSW	✓	✓	JO	Soil Mapping Units map
GA_3sec_SRTM_DEMs_v01	Aust Gov, Geoscience Aust	✓	✓	JO	Slope mapping

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