Contents

MALABAR COAL

MAXWELL PROJECT

APPENDIX Q

Agricultural Impact Statement

Maxwell Project

Agricultural Impact Statement

July 2019

DOCUMENT CONTROL

Project name:	Maxwell Project				
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Prepared by	Dr Bronwyn Cameron, Dr Paul Frazier, Dr Hanieh Saremi				
Company	2rog Consulting				
Reviewed by	Dr Julian Wall				
Approved by	Dr Paul Frazier				

EXECUTIVE SUMMARY

Report Purpose

Maxwell Ventures (Management) Pty Ltd, a wholly owned subsidiary of Malabar Coal Limited (Malabar) is seeking to develop an underground coal mine, known as the Maxwell Project (the Project), in the Upper Hunter Valley. This report represents the Agricultural Impact Statement (AIS) required as part of the Environmental Impact Statement (EIS) in accordance with Division 4.1, Part 4 of the NSW *Environmental Planning and Assessment Act 1979.*

As the Project Area was found to contain areas of biophysical strategic agricultural land (BSAL), a Gateway Certificate for the Project was sought and a Conditional Gateway Certificate was issued by the NSW Mining and Petroleum Gateway Panel in 2018. This report specifically addresses the requirements stated in the Secretary's Environmental Assessment Requirements (SEARs) issued by the NSW Department of Planning and Environment (DP&E) and the recommendations of the Conditional Gateway Certificate.

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

Maxwell Project

The Maxwell Underground is located entirely within Exploration Licence (EL) 5460. The Project would involve extraction of coal from four seams within the Wittingham Coal Measures using bord and pillar mining, with partial pillar extraction in the Whynot Seam and longwall mining in the Woodlands Hill Seam, Arrowfield Seam and Bowfield Seam.

Malabar owns and manages the existing infrastructure within Coal Lease (CL) 229, Mining Lease (ML) 1531 and CL 395 (known as the Maxwell Infrastructure). The Maxwell Infrastructure includes an existing coal handling and preparation plant (CHPP), train load-out facilities and other infrastructure and services (including water management infrastructure, administration buildings, workshops and services). The Project would include the use of the existing Maxwell Infrastructure and the development of some new infrastructure.

The Maxwell Infrastructure also contains previous open cut mining areas being rehabilitated to a combination of grazing land use areas (approximately 473 hectares [ha]) and native woodland areas.

Project Area

Land use and land production capability in the Project Area was assessed through: interviews with property managers; review and analysis of soil mapping data; and assessment of local and regional agricultural data and summaries.

Land use within the Project Area consists primarily of previous open cut mining areas undergoing rehabilitation, along with other areas used for cattle grazing and small areas of opportunistic fodder cropping (under favourable conditions). Surface water is the main water source for stock and domestic use.

For the Maxwell Underground, the land surface is moderately to steeply sloping with slopes generally between 10 and 30 degrees in the south-east section and generally less than 10 degrees in the north-west section. Land and soil capability (LSC) is generally moderate to low (LSC Classes 4 to 6) and soil fertility ranges from moderately low to high. Detailed soil investigations, including extensive field sampling, conducted by SLR (2015, 2018, 2019a) mapped approximately 72 ha of a soil landscape unit that meets the criteria of BSAL.

Areas of Equine Critical Industry Cluster (CIC) and Viticulture CIC are located to the south of the Project.

Potential Impacts to Agriculture

Expected subsidence from underground activities across the underground mining area would vary from; nil in certain areas, to a maximum of 5.6 metres in areas where the underground mining in all four seams occur (MSEC 2019). Small areas of ponding along existing drainage lines and some surface cracking are expected to be the main impacts to the surface from the Project. Agricultural infrastructure such as fencing, sheds, yards and internal roads may also be impacted by subsidence. Based on experience drawn from the existing underground mines in the Hunter Valley and elsewhere, there is expected to be minimal to no impact on agricultural resources if routine maintenance is undertaken.

Given the nature of the production systems and the nature of the impacts predicted for the Project, it is likely that agricultural production could continue above the Maxwell Underground throughout the life of the Project, with access to small areas being restricted temporarily during subsidence and any associated remediation activities.

Potential reduction in available agricultural land from surface infrastructure development (approximately 161 ha) and the establishment of potential biodiversity offset areas of nominally 716 ha, within and surrounding the Project Area, is partly offset by the opening of rehabilitated pasture areas within the Maxwell Infrastructure area (approximately 473 ha). A conservative assessment of potential lost productivity that considers the current or recent management regime and inherent land capability shows a potential reduction of cattle carrying capacity in the order of 61 breeding cows per annum during the life of the Project. Following cessation of mining and appropriate decommissioning and rehabilitation of surface infrastructure areas to grazing land use, the potential impact is approximately 13 breeding cows. With improved agricultural management practices (land and livestock), these potential impacts can be completely ameliorated or production could even be increased with negligible impact on agricultural production at the property, site or regional scale.

The Groundwater Assessment (HydroSimulations 2019) and Surface Water Assessment (WRM Water and Environment Pty Ltd 2019) predicted no significant impacts on groundwater or surface water resources used for agricultural activities as a result of the Project. Potential impacts on the ‘highly productive’ Hunter River alluvium would be within the ‘Level 1’ minimal impact thresholds as defined by the Aquifer Interference Policy (NSW Government 2012). Fluvial Systems Pty Ltd (2019) assessed potential impacts to landscape geomorphology, specifically examining potential impacts on drainage lines and determined that no medium or long-term impacts to landscape drainage from the Project were expected if monitoring and remediation activities were undertaken.

Impacts to Neighbouring Properties and CICs

The Project is designed as an underground mine with the mine entry area several kilometres from roads and adjacent properties and largely screened behind a range of hills. Van Pelt Allen Visual Planning and Assessment (2019) found there would be no significant visual impacts on the nearby equine or viticultural enterprises, within the Equine and Viticulture CICs, due to the Project. There would be no identifiable or measurable impacts on the acoustic amenity or air quality of the Equine and Viticulture CICs based on detailed assessments by Wilkinson Murray (2019) and Todoroski Air Sciences (2019). The Transport Planning Partnership (2019) found that the Project would not result in any significant impacts on road transport in the region.

Therefore, there is not anticipated to be any material land use conflict between the Project and nearby Equine and Viticulture CICs.

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ABBREVIATIONS

Abbreviation	Description
ABS	Australian Bureau of Statistics
AIP	Aquifer Interference Policy
AIS	Agricultural Impact Statement
ANZSIC	Australian and New Zealand Standard Industrial Classification
ASC	Australian Soil Classification
BOM	Bureau of Meteorology
BSAL	Biophysical Strategic Agricultural Land
CCC	Community Consultative Committee
CHPP	coal handling and preparation plant
CIC	Critical Industry Cluster
CL	Coal Lease
DPI	NSW Department of Primary Industries
DP&E	NSW Department of Planning and Environment
DP&I	NSW Department of Planning and Infrastructure (now DP&E)
DoI – Water	NSW Department of Industry – Water
DSE	dry sheep equivalents
EIS	Environmental Impact Statement
EL	Exploration Licence
Gateway Panel	NSW Mining and Petroleum Gateway Panel
ha	hectare
km	kilometre
km^2	square kilometres
LGA	Local Government Area
LSC	Land and Soil Capability
LUCRA	Land Use Conflict Risk Assessment
m^2	square metres
m AHD	metres Australian Height Datum
Malabar	Malabar Coal Limited
Mining SEPP	*State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*
mg/L	milligrams per litre
ML	Mining Lease
mm	millimetres
Mt	Million tonnes
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PAC	Planning Assessment Commission (now the Independent Planning Commission)
Project Area	Maxwell Project Area
ROM	run-of-mine
RMS	NSW Roads and Maritime Services
SEARs	Secretary’s Environmental Assessment Requirements
the Project	Maxwell Project
µS/cm	microSiemens per centimetre

01 INTRODUCTION

Maxwell Ventures (Management) Pty Ltd, a wholly owned subsidiary of Malabar Coal Limited (Malabar), is seeking consent to develop an underground coal mining operation, referred to as the Maxwell Project (the Project).

The Project is in the Upper Hunter Valley of New South Wales (NSW), east-south-east of Denman and south-south-west of Muswellbrook (Figure 01-1). The Project underground mining area is located entirely within Exploration Licence (EL) 5460.

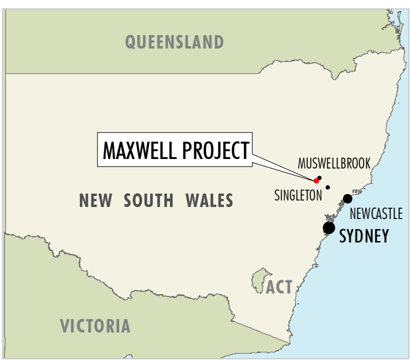
Malabar owns and manages the existing infrastructure within Coal Lease (CL) 229, Mining Lease (ML) 1531 and CL 395 (collectively known as the Maxwell Infrastructure). The Maxwell Infrastructure includes an existing coal handling and preparation plant (CHPP), train load-out facilities and other infrastructure and services including water management infrastructure, administration buildings, workshops and services (Figure 01-2). The Project would include the use of the substantial, existing Maxwell Infrastructure, including areas currently being rehabilitated to grazing land use, along with the development of some new infrastructure.

01.1 Requirements for an Agriculture Impact Statement

Following receipt of a Conditional Gateway Certificate issued by the NSW Mining and Petroleum Gateway Panel (Gateway Panel) in December 2018, Malabar is seeking consent for the Project under the State Significant Development provisions of Part 4 of the NSW *Environmental Planning and Assessment Act 1979.*

This assessment builds upon the assessment of potential impacts to agriculture described and assessed in the Application for a Gateway Certificate (2rog Consulting 2018) and has been prepared in accordance with:

- The Secretary's Environmental Assessment Requirements (SEARs) issued by the NSW Department of Planning and Environment (DP&E);
- The recommendations attached to the Conditional Gateway Certificate (2018);
- *Agricultural Impact Statement technical notes* (NSW Department of Primary Industries [DPI] 2013a);
- *Interim protocol for site verification and mapping biophysical strategic agricultural land* (NSW Office of Environment and Heritage [OEH] and Office of Agricultural Sustainability and Food Security 2013);
- *Strategic Regional Land Use Policy Guideline for Agricultural Impact Statements* (NSW Department of Planning and Infrastructure [DP&I] 2012a);
- *Upper Hunter Strategic Regional Land Use Plan*, September 2012 by DP&I (DP&I 2012b);
- *NSW Aquifer Interference Policy: NSW Government policy for the licensing and assessment of aquifer interference activities* (the AIP) (NSW Government 2012); and
- The NSW *Environmental Planning and Assessment Regulation 2000* and *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (the Mining SEPP).



LEGEND
- Mining Operation
- Proposed Mining Operation
- Railway
- Local Government Boundary
- State Forest
- National Parks and Wildlife Service Estate
- Maxwell Project Exploration Licence Boundary
- Maxwell Project Mining and Coal Lease Boundary
- Indicative Extent of Underground Development

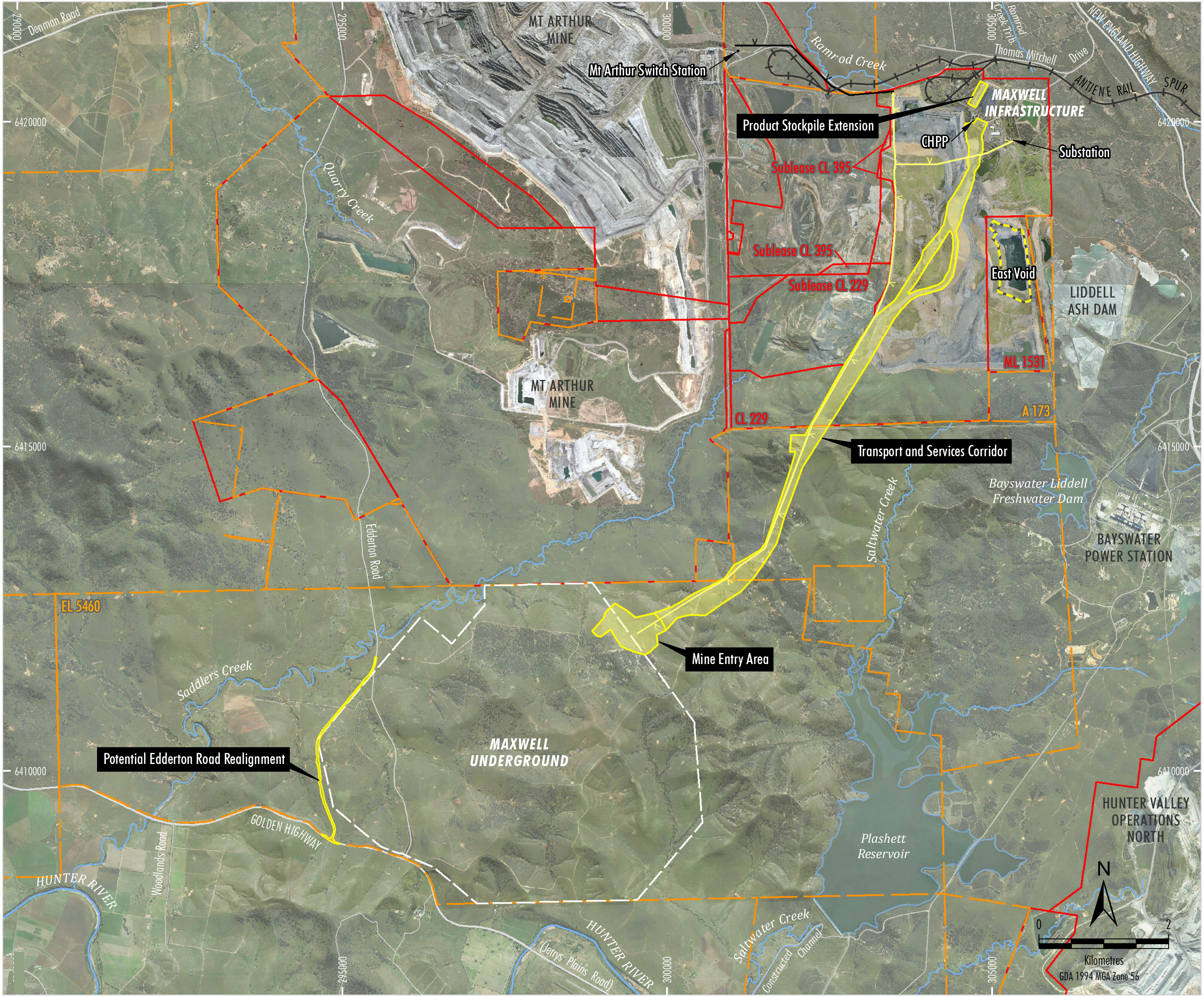
Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services and Innovation (2019); Office of Environment and Heritage NSW (2019)

MALABAR COAL

M A X W E L L   P R O J E C T

Regional Location

Figure 01-1



LEGEND

- Railway
- Exploration Licence Boundary
- Mining and Coal Lease Boundary
- Indicative Extent of Underground Development
- Indicative Surface Development Area
- CHPP Reject Emplacement Area
- Proposed 66 kV Power Supply
- Proposed Ausgrid 66 kV Power Supply Extension#

Subject to separate assessment and approval.

Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019) Orthophoto Mosaic: 2018, 2016, 2011

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MAXWELL PROJECT

Project General Arrangement

Figure 01-2

SHM-18-03 Maxwell_EIS_App AIS_202B

These policies and processes require that an Agricultural Impact Statement (AIS) be developed that contains the following general information:

- Detailed assessment of the agricultural resources and production within the Project Area 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 AIS in support of the Environmental Impact Statement (EIS) required for the Project.

01.3 Addressing Regulatory Requirements, Policies and Guidelines

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

01.3.1 Secretary's Environmental Assessment Requirements

The SEARs for the Project were issued on the 3 September 2018, with supplementary SEARs issued on 20 November 2018. Following the release of the report from the Gateway Panel, revised SEARs were issued on 17 January 2019. Table 01-1 details the general requirements of the SEARs including key issues that relate to agricultural resources and production. Table 01-1 also highlights where each issue is addressed in this AIS and/or the EIS.

Table 01-1 Secretary's Environmental Assessment Requirements Relevant to this AIS

Assessment Requirement	EIS Reference	Reference within this Document
Subsidence including: - preparation of a comprehensive subsidence model incorporating all available geotechnical, geological and geophysical data; and - an assessment of the likely conventional and non-conventional subsidence effects and impacts of the development and the potential consequences of these effects and impacts on the natural and built environment (including Edderton Road), paying particular attention to those features that are considered to have significant economic, social, cultural or environmental value;	Appendix A of the EIS	**Section 08** Impact Assessment
Land Resources including: - an assessment of the likely impacts of the development on the soils and land capability of the site and surrounds, paying particular attention to biophysical strategic agricultural land (BSAL), including verification of the extent and condition of BSAL within the site and assessment of potential direct and indirect impacts of the development on the agricultural productivity of verified BSAL; - justification for any significant long term changes to potential agricultural productivity post-mining, paying particular attention to any highly productive agricultural land that would be affected by the development; - an assessment of the agricultural impacts of the development, including preparation of an Agriculture Impact Statement, in accordance with the *Strategic Regional Land Use Policy*, paying particular attention to the likely impacts of the development on nearby equine and viticulture industry clusters; - a description of measures that would be implemented to avoid, minimise or mitigate adverse impacts on nearby equine or viticulture critical industry clusters; - an assessment of 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 nearby equine and viticulture critical industry clusters;	This AIS	**Section 05** Agricultural Resource Analysis **Section 06** Adjacent Equine and Viticulture Industry Resource Analysis **Section 08** Impact Assessment **Section 09** LUCRA **Attachment 1** Refined BSAL Verification Assessment **Attachment 2** Land and Soil Capability Assessment

Assessment Requirement	EIS Reference	Reference within this Document
Air Quality – including: - a detailed assessment of potential construction and operational air quality impacts, in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*, and with a particular focus on dust emissions including $PM_{2.5}$ and PM_{10}, and having regard to the *Voluntary Land Acquisition and Mitigation Policy*; and - an assessment of the likely greenhouse gas impacts of the development;	Appendix J of the EIS	**Section 08** Impact Assessment **Section 09** LUCRA
Rehabilitation and Final Landform including: - a description of final landform design objectives, having regard to achieving a natural landform that is safe, stable, non-polluting, fit for the nominated post-mining land use and sympathetic with surrounding landforms; - a description of how any outstanding rehabilitation obligations for the former Drayton Mine would be satisfied or altered by the development; - an analysis of final landform and post-mining land use options for the site, including the short and long-term cost and benefits, constraints and opportunities of each, and detailed justification for the preferred option; - a detailed description of the progressive rehabilitation measures that would be implemented over the life of the development and how this rehabilitation would be integrated with surrounding mines and land uses; - a detailed description of the proposed rehabilitation and mine closure strategies for the development, having regard to the key principles in *Strategic Framework for Mine Closure*; and - the measures which would be put in place for the long-term protection and/or management of the site and any biodiversity offset areas post-mining;	Appendix U of the EIS	**Section 08** Impact Assessment
Noise including: - a detailed assessment of the likely construction, operational and off-site transport noise impacts of the development in accordance with the *Interim Construction Noise Guideline, NSW Noise Policy for Industry* and the *NSW Road Noise Policy* respectively, and having regard to the *Voluntary Land Acquisition and Mitigation Policy*;	Appendix I of the EIS	**Section 08** Impact Assessment **Section 09** LUCRA
Visual including: - a detailed assessment of the likely visual impacts (including lighting) of the development (before, during and post-mining) on private landowners in the vicinity of the development and key vantage points in the public domain;	Appendix N of the EIS	**Section 08** Impact Assessment **Section 09** LUCRA
Water including: - an assessment of the likely impacts of the development on the quantity and quality of existing surface and groundwater resources including an assessment of existing connectivity between surface water, alluvial and Permian aquifers and how that could be impacted by the development; - accurate predictions of water take from each water source based on a calibrated transient 3D groundwater flow model that includes both a sensitivity and uncertainty analysis, and has been independently peer reviewed and has regard to the Hunter Bioregional Assessment; - an assessment of the likely impacts of the development on watercourses, riparian land, water-related infrastructure, and other water users (private bores and groundwater dependent ecosystems); - an assessment of the likely impacts of the development on a water resource in relation to coal seam gas development and large coal mining development under the *Environment Protection and Biodiversity Conservation Act 1999* (see Attachment 4); - a detailed site water balance, including a description of site water demands, water disposal methods (inclusive of volume and frequency of any water discharges), water supply infrastructure and water storage structures; - identification of any licensing requirements or other approvals under the *Water Act 1912* and/or *Water Management Act 2000* (including both general and high security licences); - demonstration that water take for the construction and operation of the proposed development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP) or water source embargo; - an assessment of any likely flooding impacts of the development; - a salinity investigation study; and - the measures which would be put in place to control sediment runoff and avoid erosion;	Appendices B, C, D and V of the EIS	**Section 05** Agricultural Resource Analysis **Section 08** Impact Assessment **Section 09** LUCRA

<table>
<tr><th>Assessment Requirement</th><th>EIS Reference</th><th>Reference within this Document</th></tr>
<tr><td>Consultation:
During the preparation of the EIS, you must consult with relevant local, State and Commonwealth Government authorities, service providers, Aboriginal stakeholders, community groups and affected landowners.
In particular you must consult with:
- affected landowners;
- Maxwell Infrastructure (formerly Drayton Mine) Community Consultative Committee;
- local community groups;
- Muswellbrook Shire Council;
- Office of Environment and Heritage (including the Heritage Branch);
- Environment Protection Authority;
- Division of Resources and Geoscience within the Department;
- NSW Resources Regulator;
- Subsidence Advisory NSW;
- Department of Primary Industries (including NSW Forestry, Agriculture and Fisheries);
- Department of Industry (including the Lands and Water Division);
- Hunter Local Land Services;
- NSW Health;
- NSW Rural Fire Service; and
- Roads and Maritime Services.</td><td>Section 5 of the EIS</td><td>Section 03
Consultation</td></tr>
<tr><td>Muswellbrook Shire Council
Soils and Land Degradation – The Project site is identified within the most highly degraded catchment in the Hunter Valley out of 139 catchments by the ‘Soil Conservation Erosion Survey’ prepared by K.A Emery. Council acknowledges that this Survey was completed in the 1980’s, however it maintains that it provides a good base point for some of the soil and land degradation issues that will need to be considered and addressed. Council understands that there are erosion issues in the area, degrading gullies, soil fertility, pH, salinity and structural issues away for the alluvial flat areas. Detailed assessment of the soils and geology will need to be included in the EIS to support establish mechanisms for erosion and sediment control, inform the sites management and intended rehabilitation strategies.
Productive Land – The EIS should consider how productive land within the site area and wider locality is to be maintained throughout the project lifetime and post mining operations. It is recommended that the project is carried out so as not to inhibit productive use of land wherever possible and that the proponent give consideration to employing a monitored sustainable grazing regime for highly productive land sustainable cropping enterprises within the project site.
Compatibility with existing land uses – The project site is situated in close proximity to an existing equine critical industry cluster. As you would be aware a key issue for the assessment of previous mining projects for the site was their compatibility with the existing horse studs in the locality. Council expects that the compatibility of the proposed development with equine related land uses would be a key issue for the Department of Planning and Environment in the assessment of this project. Muswellbrook Shire has a long history with mining and primary productive enterprises and recognises the role both play in the economic prosperity of the region. Accordingly, it is Council’s expectation that the Department of Planning and Environment would require any EIS to be accompanied by a detailed analysis of the social, economic and environmental impacts anticipated as an outcome of the project in respect to existing equine industries in the vicinity of the project.</td><td>This AIS and Appendices C, D and U of the EIS</td><td>Section 08
Impact Assessment</td></tr>
</table>

Assessment Requirement	EIS Reference	Reference within this Document
DoI - 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, 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. • Consideration of relevant legislation, policies and guidelines, including the *NSW Aquifer Interference Policy (2012)*, the DPI Water *Guidelines for Controlled Activities on Waterfront Land (2018)* and the relevant Water Sharing Plans.	Appendices B and C of the EIS	**Section 08** Impact Assessment
DPI – Agriculture • The completion of an Agricultural Impact Statement (AIS). Specific guidance on satisfying the requirements for the AIS should be taken from the DPI's AIS Technical Notes.	This AIS	**This AIS**

01.3.2 Conditional Gateway Certificate Recommendations

As the Project Area contains an area of biophysical strategic agricultural land (BSAL), an Application for a Gateway Certificate was submitted for assessment by the Gateway Panel (2rog Consulting 2018). The Gateway Panel provided a Conditional Gateway Certificate and provided a set of recommendations for further consideration. Those recommendations that relate specifically to this AIS are detailed in Table 01-2.

Table 01-2 Conditional Gateway Certificate Recommendations

Relevant Criteria	Recommendation	EIS Reference	Reference within this Document
17H4(a)(i), (ii), (iii), (vi)	*1. Incorporate all available geotechnical, geological and geophysical information into a comprehensive subsidence model.*	Appendix A of the EIS	**Section 08** Impact Assessment
	2. Provide a detailed assessment of changes to surface water movement and potential subsoil inundation as a result of subsidence.	Appendices C and D of the EIS	**Section 08** Impact Assessment
	3. Provide a comprehensive Extraction Plan including subsidence and rehabilitation management plans.	Section 8 of the EIS (To be prepared prior to commencement of mining for the Project)	-
	4. Complete BSAL verification in the entire GCAA to determine all possible areas of BSAL >20ha..	This AIS	**Section 05** Agricultural Resource Analysis **Attachment 1** Refined BSAL Verification Assessment

Relevant Criteria	Recommendation	EIS Reference	Reference within this Document
17H4(a)(iv)	*1. Using a calibrated transient 3D model re-quantify the impacts on nearby water assets (bores/wells and GDEs).* *This updated modelling and reporting should:* • *Capture the hydrogeological complexity of the site;* • *Use temporal input data;* • *Have distributed input parameters;* • *Quantify any uncertainties in the groundwater/surface water connection;* • *Undertake both sensitivity and uncertainty analysis and have the model independently peer reviewed.*	Appendix B of the EIS	**Section 08** Impact Assessment
	2. Undertake more studies to establish baseline groundwater conditions.	Appendix B of the EIS	**Section 08** Impact Assessment
	3. Monitor and report actual mine water inflows and develop a strategy for complying with Water Sharing Plan rules.	Section 8 of the EIS (Monitoring and reporting to occur throughout the life of the Project)	-
17H4(a)(vi)	*1. Reassess validity of soil sampling scheme density within the area of the 2018 survey and reassess soil sampling and analysis in Soil Unit 2.*	This AIS	**Attachment 1** Refined BSAL Verification Assessment
	2. Complete BSAL verification in the entire GCAA to determine all possible areas of BSAL>20ha.	This AIS	**Section 05** Agricultural Resource Analysis **Attachment 1** Refined BSAL Verification Assessment

01.3.3 Critical Industry Clusters

The Conditional Gateway Certificate and associated report states that no Critical Industry Cluster (CIC) land falls inside the Project Area. However, the Gateway Panel acknowledge that a substantial equine industry exists approximately 500 metres (m) to the south of the Project. This AIS includes an assessment of impacts on the Equine and Viticulture CICs as a result of the Project. Specific assessment sections with reference to criteria in the Mining SEPP are identified in Table 01-3.

Table 01-3 Assessment of Impacts in Relation to CICs

Potential Impact	Where addressed in this document or associated studies
Any impacts on the land through surface area disturbance and subsidence	**Section 08** Impact Assessment Appendix A of the EIS (MSEC 2019)
Reduced access to, or impacts on, water resources and agricultural resources	**Section 08** Impact Assessment Appendices B and C of the EIS (HydroSimulations 2019, WRM Water and Environment 2019)
Reduced access to support services and infrastructure	**Section 08** Impact Assessment
Reduced access to transport routes	**Section 08** Impact Assessment Appendix K of the EIS (TTPP 2019)
Loss of scenic and landscape values	**Section 08** Impact Assessment Appendix N of the EIS (VPA 2019)

01.3.4 Land Use Conflict Risk Assessment (LUCRA)

The NSW government has developed a risk-based assessment – the Land Use Conflict Risk Assessment (LUCRA) method – to help identify and assess potential land use conflict between neighbouring land uses (DPI 2011). It helps land managers and consent authorities to assess the possibility for and potential levels of future land use conflict.

The LUCRA method aims to:

- Accurately identify and address potential land use conflict issues and risk of occurrence before any new land use proceeds or a dispute arises;
- Objectively assess the effect of a proposed land use on neighbouring land;
- Increase the understanding of a potential new land use conflict to inform and complement development control and buffer requirements; and
- Highlight or recommend strategies to help minimise the potential for land use conflicts to occur and contribute to the negotiation, proposal, implementation and evaluation of separation strategies.

This approach has been undertaken and incorporated into this AIS (Section 09).

01.4 Supporting Studies

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

- Subsidence Assessment (2019) prepared by Mine Subsidence Engineering Consultants (MSEC) (Appendix A of the EIS).
- Groundwater Assessment (2019) prepared by HydroSimulations (Appendix B of the EIS).
- Surface Water Assessment (2019) prepared by WRM Water and Environment (WRM) (Appendix C of the EIS).
- Geomorphology Assessment (2019) prepared by Fluvial Systems (Appendix D of the EIS).
- Biodiversity Development Assessment Report (2019a) prepared by Hunter Eco (Appendix E of the EIS), including a Baseline Flora Report (2019b) prepared by Hunter Eco (Attachment A of Appendix E of the EIS).
- Noise Impact Assessment (2019) prepared by Wilkinson Murray (Appendix I of the EIS).
- Air Quality and Greenhouse Gas Assessment (2019) prepared by Todoroski Air Sciences (Appendix J of the EIS).
- Road Transport Assessment (2019) prepared by The Traffic Planning Partnership (TTPP) (Appendix K of the EIS).
- Landscape and Visual Impact Assessment (2019) prepared by Van Pelt Allen Visual Planning and Assessment (VPA) (Appendix N of the EIS).
- Preliminary Rehabilitation and Mine Closure Strategy (2019) prepared by Malabar (Appendix U of the EIS).
- Refined Biophysical Strategic Agricultural Land Verification Assessment (2019a) prepared by SLR Consulting Australia Pty Ltd (SLR) (Attachment A of this AIS).
- Land and Soil Capability Assessment (2019b) prepared by SLR (Attachment B of this AIS).

02 PROJECT DESCRIPTION

02.1 Overview of the Maxwell Project

The Project would involve an underground mining operation that would produce high quality coals over a period of approximately 26 years. At least 75% of coal produced by the Project would be capable of being used in the making of steel (coking coals). The balance would be export thermal coals suitable for the new generation High Efficiency, Low Emissions power generators.

The Project would involve extraction of run-of-mine (ROM) coal from four seams within the Wittingham Coal Measures using the following underground mining methods:

- underground bord and pillar mining with partial pillar extraction in the Whynot Seam; and
- underground longwall extraction in the Woodlands Hill Seam, Arrowfield Seam and Bowfield Seam.

The substantial existing Maxwell Infrastructure would be used for handling, processing and transportation of coal for the life of the Project. The Maxwell Infrastructure includes an existing CHPP, train load-out facilities and other infrastructure and services (including water management infrastructure, administration buildings, workshops and services).

A mine entry area would be developed for the Project in a natural valley in the north of EL 5460 to support underground mining and coal handling activities and provide for personnel and materials access.

ROM coal brought to the surface at the mine entry area would be transported to the Maxwell Infrastructure area. Early ROM coal would be transported via internal roads during the construction and commissioning of a covered overland conveyor system. Subsequently, ROM coal would be transported to the Maxwell Infrastructure area via the covered overland conveyor system.

The existing product coal stockpile area at the Maxwell Infrastructure would be extended to allow for better management of different product coal blends. An additional ROM stockpile would also be developed adjacent to the CHPP to cater for delivery of ROM coal via the covered overland conveyor.

The Project would support continued rehabilitation of previously mined areas and overburden emplacements areas within CL 229, ML 1531 and CL 395. The volume of the East Void would be reduced through the emplacement of reject material generated by Project coal processing activities and would be capped and rehabilitated at the completion of mining.

A detailed description of the Project is provided in the Section 3 in the Main Report of the EIS.

The Project Area comprises the following main domains:

- Maxwell Underground – comprising the proposed area of underground mining operations and the mine entry area within EL 5460.
- Maxwell Infrastructure – the area within existing mining leases comprising the substantial existing infrastructure (including the CHPP) and previous mining areas.
- The transport and services corridor between the Maxwell Underground and Maxwell Infrastructure – this would comprise a site access road, a covered, overland conveyor, power supply and other ancillary infrastructure and services.
- A potential realignment of Edderton Road.

An indicative footprint of the Project general arrangement showing the Maxwell Underground and substantial, existing Maxwell Infrastructure is provided in Figure 01-2.

02.2 Project Rationale and Alternatives

The Project would facilitate the underground mining, processing and sale of coal within EL 5460.

Malabar has elected to proceed with the Project as proposed due to:

- substantial capital savings associated with the use of the existing Maxwell Infrastructure;
- the proximity of the Project underground mining area to the existing Maxwell Infrastructure;
- the extensive geological and geotechnical data available within the target area in EL 5460 (Section 3.1 of the EIS);
- the short development time to coal extraction and full employment;
- extraction of a significant coal resource that provides an attractive return on investment; and
- the development of a Project design that is substantially different to previous proposals and takes account of stakeholder concerns and perceptions.

The Project would produce the following benefits for the local area, for NSW more broadly and for the national economy:

- generation of approximately 350 new direct, long-term jobs for the region, along with many more indirect jobs;
- substantial corporate tax contributions and royalties (in the order of $110 million to $140 million per annum on average[1]);
- continued support for the vitality and growth of local and regional businesses from the initial capital expenditure and the substantial ongoing operating inputs; and
- support for continued rehabilitation activities within CL 229, ML 1531 and CL 395, including reduction in the volume of final voids through emplacement of reject material generated by coal processing activities.

Malabar is committed to developing the Project solely as an underground mining operation. Underground mining methods significantly reduce environmental impacts, such as disturbance of agricultural land and air quality and noise impacts, in comparison to open cut mining methods.

Malabar's commitment to an underground mining operation has been reaffirmed through:

- a public statement in May 2017, when Malabar first announced its intention to acquire EL 5460 and the Maxwell Infrastructure, that the resource would be developed as an underground mine;
- voluntary acceptance of conditions that prevent any open cut development that were imposed on EL 5460 as part of the renewal process in December 2017;
- a public submission in December 2017 in support of changes to the Mining SEPP that prohibit a development application for open cut mining in EL 5460;
- consistent communication of Malabar's intentions through interactions with stakeholders;
- Malabar's significant investment in technical and environmental studies into the development of the site solely as an underground mining operation; and
- Malabar's recent addition to the team of a highly experienced underground mine manager to take responsibility for the delivery of the Project.

[1] Based on coal price forecast assumptions used by Deloitte Access Economics and Malabar, respectively.

In addition to the proposed mining method, the following key Project design measures and constraints have been incorporated by Malabar in response to stakeholder feedback:

- limiting the requirement to develop new infrastructure through the use of the substantial existing Maxwell Infrastructure;
- placement of the mine entry area in a natural valley, and reducing the height of infrastructure components, to restrict direct views of the mine entry area from the Golden Highway and neighbouring horse studs;
- use of the existing site access to the Maxwell Infrastructure from Thomas Mitchell Drive, to limit Project traffic movements on the Golden Highway and Edderton Road;
- sealing the extended site access road to the mine entry area in the first year of operation;
- use of a covered overland conveyor to transport coal extracted by longwall mining machinery to further reduce potential dust and noise impacts;
- voluntary relinquishment of the portion of EL 5460 that extended south of the Golden Highway beneath the neighbouring Godolphin Woodlands Stud;
- avoiding direct subsidence impacts on the Hunter River, the Hunter River alluvium and Saddlers Creek by imposing constraints on the design of the mine layout;
- limiting the extent of the underground mine layout to beneath freehold land owned by Malabar (i.e. there would be no direct subsidence impacts to land owned by neighbouring horse studs);
- use of water treatment systems that maximise the re-use of water on-site and remove any requirement to source water externally for mining operations (e.g. from the Hunter River); and
- development of a site water management system that avoids the need for controlled release of mine-affected water to the Hunter River.

03 CONSULTATION

This AIS is based upon review and consideration of:

- feedback provided by the local community, government agencies and other stakeholders on projects previously proposed by other companies at the Project site; and
- consultation since Malabar announced its intention to acquire the Project site in early 2017.

As described in Section 02.2, Malabar has incorporated significant design measures into the Project to address the concerns raised in relation to previous proposals.

Malabar has undertaken a number of engagement activities in relation to the Project and has made key senior Malabar personnel approachable and available for consultation to allow for direct consideration of stakeholder feedback. Key consultation activities of particular relevance to this AIS include:

- Consultation with a wide range of government agencies and documentation of relevant assessment considerations identified by key government agencies in the SEARs (Section 01.3.1) and Gateway Certificate (Section 01.3.2).
- Consultation with neighbouring landholders, including BHP, AGL Energy Limited (AGL), Coolmore Australia and Godolphin Australia Pty Ltd (Godolphin), which has included meetings, site inspections and the provision of information regarding the Project and potential land use interactions.
- Community consultation, including (but not limited to) distributing community newsletters to local residents and other stakeholders, conducting community information sessions, providing briefings to Malabar's Community Consultative Committees (CCCs) and proactively providing information through local media.
- Interviews with the property managers of the Bowfield and Llanillo properties in support of this AIS (Section 05.2).
- Preparation of a Social Impact Assessment (Elliott Whiteing 2019) in accordance with the NSW Government's Social Impact Assessment Guidelines (DP&E 2017) (Appendix L of the EIS).

Further details of the consultation program conducted for the Project are provided in Section 5 in the Main Report of the EIS.

04 REGIONAL AGRICULTURAL OVERVIEW

The Project Area is located in the Muswellbrook Local Government Area (LGA) which is part of the Hunter region. The purpose of this section is to provide:

- Contextual information about the broader Hunter region and the Muswellbrook LGA.
- More detailed information about the local biophysical setting of the Project Area.

04.1 Hunter Region

The Hunter region is the leading regional economy in NSW. The Hunter region population is approaching 1 million people and supports major sectors that include agriculture, coal mining, tourism, defence, energy and transport. It contains 10 LGAs and covers a total area of 32,870 square kilometres (km^2). The Hunter River Valley (21,400 km^2) occupies over half of this area and most economic activity in the region is stimulated by assets located within the river valley (DP&E 2016).

The coastal city of Newcastle is the regional capital for the Hunter region. Newcastle's port is a vital hub for export of coal and local rural produce to various markets across the Asia-Pacific. In 2014-15 a total of $15.8 billion of exports was shipped from the Port of Newcastle, 90% of which was coal (DP&E 2016).

Within the Hunter region, the Upper Hunter is recognised as a major supplier of coal, energy, wine and thoroughbred horses, to national and international markets. These industries have driven investment in transport and energy infrastructure and will continue to underpin the growth and diversification of the Hunter's economy and employment base (DP&E 2016).

Data from the Australian Bureau of Statistics (ABS 2008) identify beef cattle and grape production as the most significant agricultural businesses in the Hunter region. Beef cattle in the Hunter make up approximately 9% of beef cattle producing businesses in NSW and cover 6-8% of the land area occupied by beef cattle production enterprises (Table 04-1). The Hunter region has 16% of the grape growing businesses with grape bearing vines in NSW, covering an area that is 7-14% of total vineyards (Table 04-1).

Recent data from the ABS for 2016-17 (Table 04-2) show a general decrease in agricultural output in the Hunter region between 2008 and 2017. The grape growing industry experienced the most significant change, decreasing by approximately 41% in area used to grow grapes for wine production. Over the same period, beef production increased slightly, but the total number of businesses reduced by approximately half.

Table 04-1 Agricultural Production Statistics, Hunter Valley and NSW (ABS 2008)

	NSW		Hunter Valley			
Livestock - cattle	**No. of agricultural businesses**	**Estimate of stock numbers or area sown**	**Number of agricultural businesses**	**Estimate of stock numbers or area sown**	**% of agricultural businesses**	**% of stock numbers or area sown**
Beef cattle						
Livestock - cattle for all purposes - total number (n)	29,997	5,934,675	2,788	447,632	9%	8%
Livestock - cattle - meat cattle						
Livestock - cattle - meat cattle - **total number** (n)	29,301	5,609,002	2,704	407,583	9%	7%
Livestock - cattle - meat cattle - beef breed bulls and bull calves intended for breeding - number (n)	21,684	186,112	1,959	14,092	9%	8%
Livestock - cattle - meat cattle - cows and heifers - 1 year and over - number (n)	25,635	2,882,899	2,290	224,192	9%	8%
Livestock - cattle - meat cattle - calves, excluding bull calves intended for breeding - number (n)	20,818	1,290,432	1,957	96,723	9%	7%
Livestock - cattle - meat cattle n.e.c. (steers bullocks etc.) – 1 year and over - number (n)	15,317	1,249,559	1,237	72,576	8%	6%
Grapes						
Fruit and nuts - grapes - **total area of vines** (ha)	1,581	43,728	250	4,416	16%	10%
Fruit and nuts - grapes **- total area not yet bearing** (ha)	320	3,056	31	112	10%	4%
Grapes - red						
Fruit and nuts - grapes - red - total area of vines (ha)	1,388	21,405	214	1,600	15%	7%
Fruit and nuts - grapes - red - area not yet bearing (ha)	159	1,143	14	52	9%	5%
Fruit and nuts - grapes - red - area bearing (ha)	1,365	20,262	211	1,548	15%	8%
Grapes - white						
Fruit and nuts - grapes - white - total area of vines (ha)	1,389	22,323	224	2,816	16%	13%
Fruit and nuts - grapes - white - area not yet bearing (ha)	227	1,913	21	60	9%	3%
Fruit and nuts - grapes - white - area bearing (ha)	1,359	20,409	217	2,756	16%	14%

ha = hectares

Table 04-2 Comparison of Agricultural Production Statistics between 2008 and 2017, Hunter Valley (ABS 2017)

Business	Hunter Valley					
	2008 Estimate of stock numbers or area sown	2008 No. of agricultural businesses	2017 Estimate of stock numbers or area sown	2017 No. of agricultural businesses	% change in estimate of stock numbers or area sown	% change in no. of agricultural businesses
Beef cattle						
Livestock - cattle - total cattle (no.)	447,632	2,788	504,701	1,425	**+13%**	**-49%**
Livestock - meat cattle - total (no.)	407,583	2,704	457,077	1,286	**+12%**	**-52%**
Livestock - meat cattle - cows and heifers 1 year and over (no.)	224,192	2,290	223,517	1,140	**-0.3%**	**-50%**
Livestock - meat cattle - calves less than 1 year (no.)	n/a	n/a	112,328	1,078	**n/a**	**n/a**
Grapes						
Fruit and nuts - grapes - total - total area (ha)	4,416 ha	250	2,618 ha	69	**-41%**	**-72%**
Fruit and nuts - grapes - total - area not yet of bearing age (ha)	112 ha	31	90 ha	16	**-20%**	**-48%**
Fruit and nuts - grapes for wine production - total area (ha)	4,416 ha[1]	n/a	2,610 ha	n/a	**-41%**	**n/a**

1 Calculated using the total for both red and white grapes in the ABS 2008 data.

04.2 Muswellbrook Local Government Area

Muswellbrook LGA covers an area of 3,405 km^2 and supports a population of about 16,000 (Muswellbrook Shire Council 2015). Muswellbrook is the largest town in the LGA and is the administrative centre. Other towns and villages include Bengalla, Bureen, Denman, Manobolai, Sandy Hollow and Wybong (Muswellbrook Shire Council 2018).

Muswellbrook LGA contains large areas of productive farmland that support a diverse range of agricultural enterprises, including beef, dairy, horse breeding, viticulture, and other horticulture and cropping. Muswellbrook LGA is home to the largest critical mass of thoroughbred horse rearing properties in Australia (over 20 individual stud farms) and is recognised nationally and internationally as a 'Centre for Thoroughbred Breeding Excellence' (Muswellbrook Shire Council 2018). The region's viticultural industry is also renowned for its wine production and processing.

Based on Australian and New Zealand Standard Industrial Classification (ANZSIC) class type categories and statistics from the Australian Bureau of Statistics (ABS 2010) beef cattle farming (ANZSIC 0142) is the dominant agricultural land use within the LGA with approximately 35,750 head (Table 04-3). Dairy cattle farming is also significant with approximately 10,420 head.

Table 04-3 ANZSIC Classes, Muswellbrook LGA (ABS 2010)

ANZSIC Class	Statistic
0131 Grape growing	n/a (4,416 ha in Hunter Valley)
0142 Beef cattle farming	35,745 head
0145 Grain-beef cattle farming	n/a
0149 Other grain growing	345.7 ha (cereals for grain)
0159 Other crop growing n.e.c.	31.9 ha (non-cereal broadacre crops)
0160 Dairy cattle farming	10,421 head
0191 Horse farming	n/a

Muswellbrook LGA is also home to a buoyant resource and minerals sector, principally coal extraction and baseload power generation. The LGA represents one of two of the major centres for coal production in the Hunter Valley (Muswellbrook Shire Council 2014). A portion of locally-extracted thermal coal feeds into the Liddell and Bayswater Power Stations which currently provide approximately 40% of NSW's base load energy requirements (Muswellbrook Shire Council 2018).

From the combined data sources analysed by REMPLAN (2018), mining provides over 68% of the LGA's income (approximately \$2.6 billion), and agriculture, forestry and fishing provide 3.6% (approximately \$140 million). REMPLAN collates data from ABS, Gross State Product, June 2017, National Input Output Tables and 2014 / 2015 Census Place of Work Employment Data to estimate the regional exports (Table 04-4).

Table 04-4 Muswellbrook LGA Regional Exports by Industry

Industry	Muswellbrook	
	$M	%
Mining	$2,634.926 M	68.26%
Electricity, Gas, Water & Waste Services	$780.626 M	20.22%
Agriculture, Forestry & Fishing	$139.093 M	3.60%
Manufacturing	$106.471 M	2.76%
Construction	$42.991 M	1.11%
Rental, Hiring & Real Estate Services	$30.031 M	0.78%
Administrative & Support Services	$24.179 M	0.63%
Transport, Postal & Warehousing	$23.251 M	0.60%
Wholesale Trade	$21.442 M	0.56%
Financial & Insurance Services	$14.833 M	0.38%
Accommodation & Food Services	$10.070 M	0.26%
Public Administration & Safety	$7.588 M	0.20%
Education & Training	$7.314 M	0.19%
Other Services	$4.595 M	0.12%
Information Media & Telecommunications	$4.431 M	0.11%
Professional, Scientific & Technical Services	$4.187 M	0.11%
Retail Trade	$2.932 M	0.08%
Health Care & Social Assistance	$0.954 M	0.02%
Arts & Recreation Services	$0.375 M	0.01%
Total	**$3,860.289 M**	**100.00%**

Source: https://www.economyprofile.com.au/muswellbrook/industries/regional-exports

04.3 Project Area

04.3.1 Location

The Project is in the Upper Hunter Valley NSW, east-south-east of Denman and south-south-west of Muswellbrook (Figure 01-1). It is wholly within the Muswellbrook LGA and is situated within the Hunter River catchment.

04.3.2 Climate

The Upper Hunter Valley is located in the Australian temperate zone, characterised by hot summers and mild dry winters. Heatwaves can occur between October and March, while night-time frost can occur between May and August (AGE 2012). Historical climatic data from 1884 to 2014 is available from Jerrys Plains Post Office (061086), which is approximately 7 kilometres (km) south-south-east of the Project. These data have been compiled by the Bureau of Meteorology (BOM) to produce the following statistics (BOM 2019):

Mean maximum temperature of hottest month (January)	31.8°C
Mean minimum temperature of hottest month (January)	17.2°C
Highest recorded temperature (December 1957)	45.6°C
Mean maximum temperature of coolest month (July)	17.4°C
Mean minimum temperature of coolest month (July)	3.8°C
Lowest recorded temperature (July 1971)	-4.5°C
Mean annual rainfall (summer-dominant)	645 mm
Mean number of rain days (> 1mm)	68
Mean daily evaporation	4.5 mm

Daily evaporation data from Jerrys Plains Post Office (061086) can be combined to calculate an average annual evaporation of 1,640 millimetres (mm). This is more than twice the mean annual rainfall, with the highest moisture deficit occurring in summer.

The monthly distribution of temperature and rainfall recorded at Jerrys Plains Post Office (061086) is shown in Figure 04-1 and Figure 04-2 respectively.

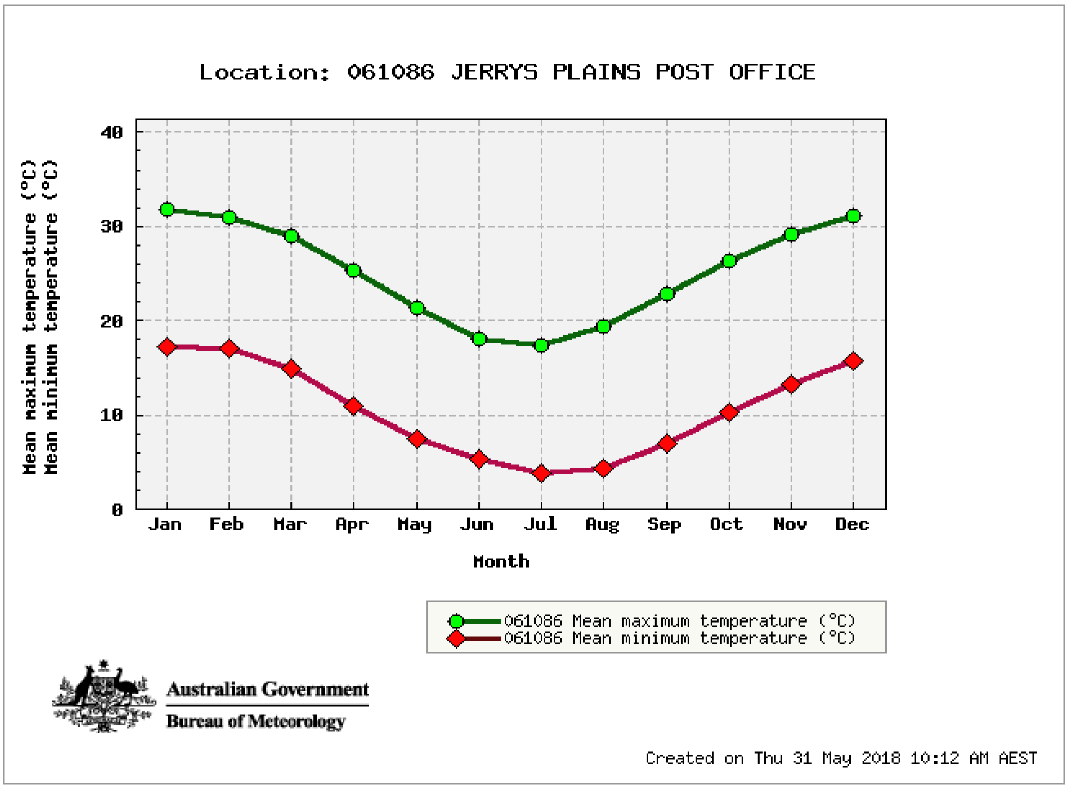


Figure 04-1 Mean Monthly Temperatures (Maximum and Minimum) Recorded at Jerrys Plains Post Office (061086)

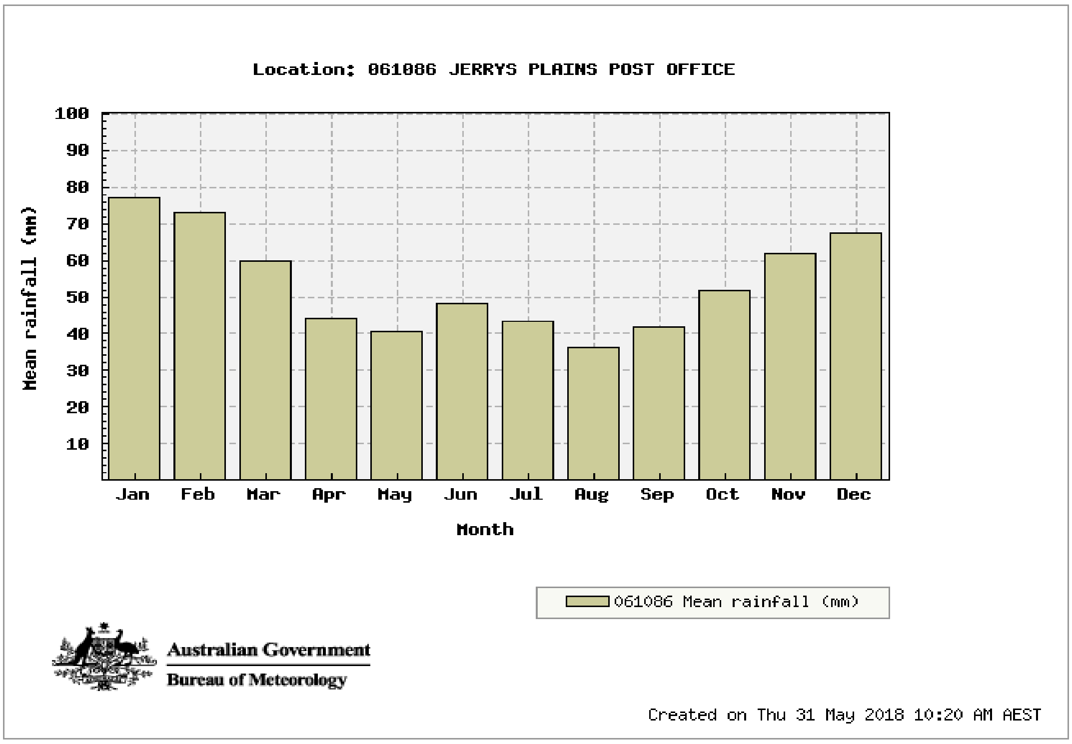


Figure 04-2 Mean Monthly Rainfall Recorded at Jerrys Plains Post Office (061086)

04.3.3 Geology and Landform

The Project is located in the Hunter Coalfield in the northern part of the Permo-Triassic Sydney Basin. The Wittingham Coal Measures occur widely within the Hunter Coalfield and contain many recoverable seams. The Project targets mining of the Whynot, Woodlands Hill, Arrowfield and Bowfield Seams. The target seams for the Project are within the Jerrys Plains Subgroup, forming part of the upper and middle units of the Wittingham Coal Measures. Above the target seams, the stratigraphy of the area consists of a sequence of sandstone, siltstone and laminate units within the Wittingham Coal Measures.

A conceptual model of the existing groundwater regime was developed by HydroSimulations (2019), based on the geology and a review of the available baseline groundwater data and relevant water sharing plans under the *Water Management Act 2000*. The three main groundwater systems identified by HydroSimulations (2019) are:

- alluvium associated with the Hunter River;
- alluvium associated with Saddlers Creek and regolith; and
- Permian strata that host the coal measures.

Further discussion regarding the groundwater systems in the vicinity of the Project is provided in Sections 05.4 and 08.4.

Topography of the Project Area comprises moderately to steeply undulating low hills. Sedimentary coal measures are overlain by alluvial sediments in areas immediately adjacent to drainage features such as Saddlers Creek and the Hunter River. The undulating topography ranges from 110 to 240 metres Australian Height Datum (m AHD) on-site (MSEC 2019) and has created a network of small, ephemeral creeks that drain the Maxwell Underground area into the Hunter River via two tributaries – Saddlers Creek and Saltwater Creek.

The Maxwell Infrastructure consists of areas of previous open cut mining and rehabilitated overburden emplacement, with existing infrastructure located in the north of the area.

04.3.4 Vegetation

The Project Area outside of the existing mining and coal lease areas at the Maxwell Infrastructure, has been used for grazing and the occasional fodder crop on a small portion where the soil and land capability has allowed. The land has been used as such since as far back as 1824 when it was settled, therefore much of the land has been cleared for agricultural production. Vegetation communities across the Project Area include the following (Hunter Eco 2019b):

- Weeping Myall woodland;
- Fuzzy Box woodland and derived native grassland;
- Grey Box - Spotted Gum - Narrow-leaved Ironbark woodland and derived native grassland;
- White Box - Ironbark - Red Gum shrubby forest and derived native grassland;
- Red Gum - Ironbark - Apple shrubby woodland and derived native grassland;
- Slaty Box shrubby woodland and derived native grassland;
- Ironbark - Grey Box grassy woodland and derived native grassland;
- Bull Oak grassy woodland;
- Hunter Lowland Red Gum forest;
- Yellow Box - Apple grassy woodland and derived native grassland; and
- Swamp Oak forest.

04.3.5 Surrounding Land Use

Cattle grazing, thoroughbred horse breeding, cropping and viticulture are the main agricultural activities that occur within 2 km of the boundary of the Project, and a large proportion of these enterprises are situated on the Hunter River floodplain. The major equine enterprises, Coolmore Stud and Godolphin Woodlands Stud, are each located to the south of the Project on and adjacent to the floodplain, which provides prime agricultural land while the river delivers an ongoing source of water for pasture and crop irrigation. Hollydene Estate, which comprises a vineyard, winery, restaurant and cellar door, is also located to the south of the Project. Several other agricultural enterprises operate in the locality, including dairy farms, an olive grove and olive processing plant (Barnett 2015).

Land to the north of the Maxwell Underground is associated with coal mining, including the Mt Arthur Mine and the Maxwell Infrastructure (which was the site of former open cut mining activities), power generation and a small, rural residential area. Plashett Reservoir is located to the east of the Maxwell Underground (Figure 01-2) and is an off-river storage that provides water for operation of Bayswater Power Station, along with water supply to the Jerrys Plains township.

05 AGRICULTURAL RESOURCE ANALYSIS OF PROJECT AREA

Agricultural resource analysis of the Project Area comprised: review of key literature; site inspection and interviews; and review of expert studies in soil resources (SLR 2019a, SLR 2019b) and water resources (HydroSimulations 2019, WRM 2019).

05.1 Review of Key Literature

05.1.1 Upper Hunter Strategic Regional Land Use Plan

The *Upper Hunter Strategic Regional Land Use Plan* (DP&I 2012b) was developed specifically to describe and help protect Strategic Agricultural Land in the Upper Hunter region of NSW (comprising BSAL and CIC land). The *Upper Hunter Strategic Regional Land Use Plan* estimated the population of the region to be approximately 67,500 with the largest towns (Singleton and Muswellbrook) supporting approximately one third (23,900 people). The region's economy is underpinned by:

- coal mining;
- agriculture (particularly dairy and beef cattle and pasture production);
- agriculture associated services;
- horse breeding;
- electricity production;
- tourism; and
- viticulture and wine making.

Agricultural industries are supported by rich soils adjacent to the Hunter River, temperate climate and proximity and access to Sydney markets. The Upper Hunter region contributes approximately 2% of the grazing and cropping area of NSW but provides a higher contribution of dairy and beef cattle. It is estimated to produce 15% of the nation's milk and 6% of the nation's cattle for slaughter. The most productive cropping lands are found on the alluvial floodplains along the major rivers and on the volcanic soil plains. On the lower slopes, lands are more suited to grazing, orchard or viticultural development.

State wide mapping of Strategic Agricultural Land shows significant areas in the Upper Hunter, including BSAL, Equine CIC and Viticulture CIC in the vicinity of the Project Area.

05.1.2 Drayton South Coal Project: Agricultural Impact Statement

The findings of the Agricultural Impact Statements for the Drayton South Coal Project applications (Barnett 2012, 2015) are particularly relevant for this study as they assess the agricultural resources directly within EL 5460. While the Barnett (2012, 2015) assessments were undertaken to assess the impacts of an open cut coal mine with a different footprint to the Project, the Barnett assessments provide a detailed and relevant agricultural profile of the Project Area and surrounds.

Barnett (2015) undertook literature review of regional, local and site-specific (within EL 5460) reports and data to assess the agricultural resources of the Project Area and surrounds. The review included detailed assessment of data associated with soil and land capability, surface water resources (WRM 2012) and groundwater (AGE 2012, 2015) undertaken for the *Drayton South Coal Project Environmental Impact Statement* (Anglo American plc 2015). Barnett (2015) also undertook a site inspection of the two properties contained within EL 5460 (Plashett and Bowfield), interviewed land managers, and modelled potential agricultural production assuming best practice property and livestock management.

The Project-owned land over EL 5460 was leased to two land managers, primarily for beef cattle production with some land sown to winter fodder crop. One of the land managers also operated opportunistic horse agistment of dry mares. Barnett (2012) estimated the total land area in EL 5460, subject to farming, was turning over 1,140 head of cattle per year with an estimated gross value of approximately $700,000 per annum. Further analysis, considering improved land and livestock management, led to an estimate that 1,998 cattle could be turned over each year with an estimated gross value of approximately $1.23 million per annum.

The cattle production enterprises are supported by sale yards at Scone and Singleton and to a lesser extent Denman. A number of nearby agricultural producers supply hay, silage and green crop for cattle feed as required by the on-site land managers. Other agricultural support industries include veterinary practices, input suppliers (fertiliser, seed, chemicals and agricultural hardware), irrigation suppliers and engineering services. The Golden Highway, New England Highway and Edderton Road are the key transport routes used by the agricultural enterprises.

The enterprises generally rely on surface-fed water infrastructure with some pumping from the Hunter River.

Within the previously proposed mining footprints, Barnett (2012, 2015) found that the area was dominated by soil and landscapes suitable for grazing with only small areas suitable for occasional cropping.

05.2 Site Inspection and Interviews

Three properties cover the Project Area outside of previous mining areas at the Maxwell Infrastructure: Plashett; Bowfield; and Llanillo. Each is owned by Malabar. A site inspection of these properties was undertaken on 8 June 2018 (Figure 05-1, Figure 05-2). Initial interviews were held with Malabar personnel Richard Webb (Property Manager at Malabar) and Donna McLaughlin (Manager Environment and Community at Malabar). An interview was also held with the current property managers of Bowfield and Llanillo properties. The husband and wife managers have been managing livestock on Bowfield and Llanillo for over 15 years. They assumed the role of lead property managers in early 2018, the lease being previously held by a relative. The lessee for the Plashett property at the time was unavailable for interview.

05.2.1 Inspection and Interview Findings

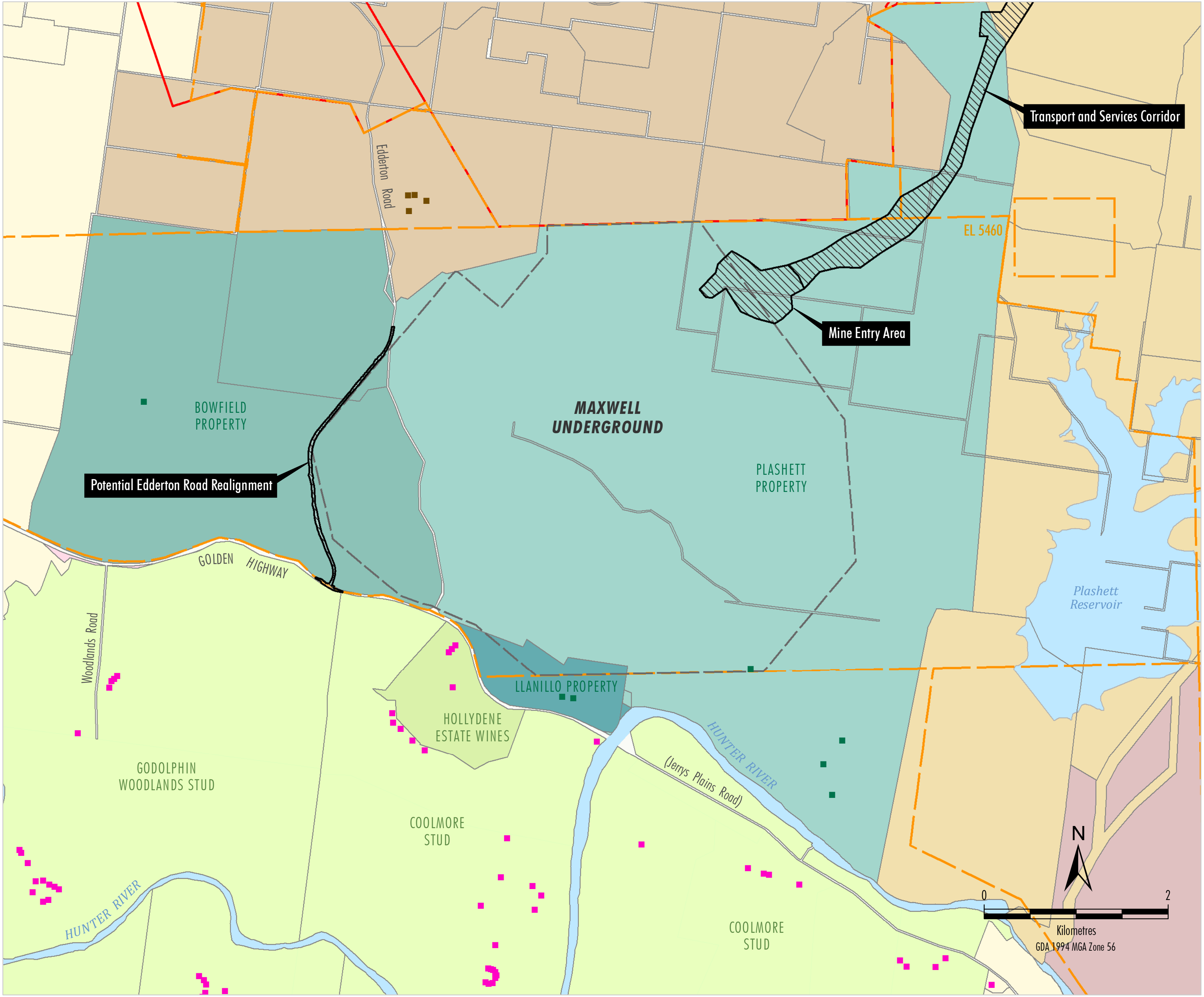
The properties within the Maxwell Underground area have been owned by resource companies, formerly Anglo American plc and now Malabar, for over 15 years. During that time, Bowfield and Llanillo properties have been leased to the one family, while Plashett was managed separately. Lease conditions for the Bowfield and Llanillo properties state that land management shall be for grazing use (primarily beef cattle) with stocking limits set at: 340 adult cattle plus horses on Bowfield; and 40 adult cattle and 20 ewes on Llanillo.

Plashett is currently being rested from production following a period of extended grazing lease operation. Options for the future management of Plashett as a grazing property are being considered by Malabar at present. The previous lease agreement set stocking limits for Plashett at 990 adult cattle plus agreed sheep and horses.

Bowfield and Llanillo Properties

The current practice at Bowfield and Llanillo is to produce beef cattle. The lessees currently run Brangus and Angus cattle producing approximately 100 Brangus calves and 100 Angus calves per annum. They also run a small herd of sheep (approximately 15 ewes), as well as horses for recreational use, along with some horse breaking-in and training. Fodder cropping is undertaken opportunistically with approximately 80 ha sown to either oats or lucerne. Fodder crops are mostly grazed along with some hay production.

The properties are managed by a family (2 adults, 2 sons). Cattle are generally sold via Elders at the Singleton or Scone saleyards. Farm infrastructure and input requirements are generally purchased at Pursehouse Rural in Muswellbrook and occasionally at Dapkos in Denman. On the Bowfield property, stock water is sourced directly from dams that capture surface runoff, Saddlers Creek and 2 bores. The bore on the southern side of the creek provides relatively poor quality water for livestock, while the bore on the northern side, serviced by a windmill, provides relatively higher quality stock water.



LEGEND
Exploration Licence Boundary
Mining and Coal Lease Boundary
Indicative Extent of Underground Development
Indicative Surface Development Area
Malabar-owned Receiver
Other mine-owned Receiver
Privately-owned Receiver
Land Ownership
Malabar Coal
Mt Arthur Mine (BHP)
Hunter Valley Operations (Yancoal/Glencore)
AGL
RMS
Crown
Equine Enterprise
Viticulture Enterprise
Other Privately-owned Land

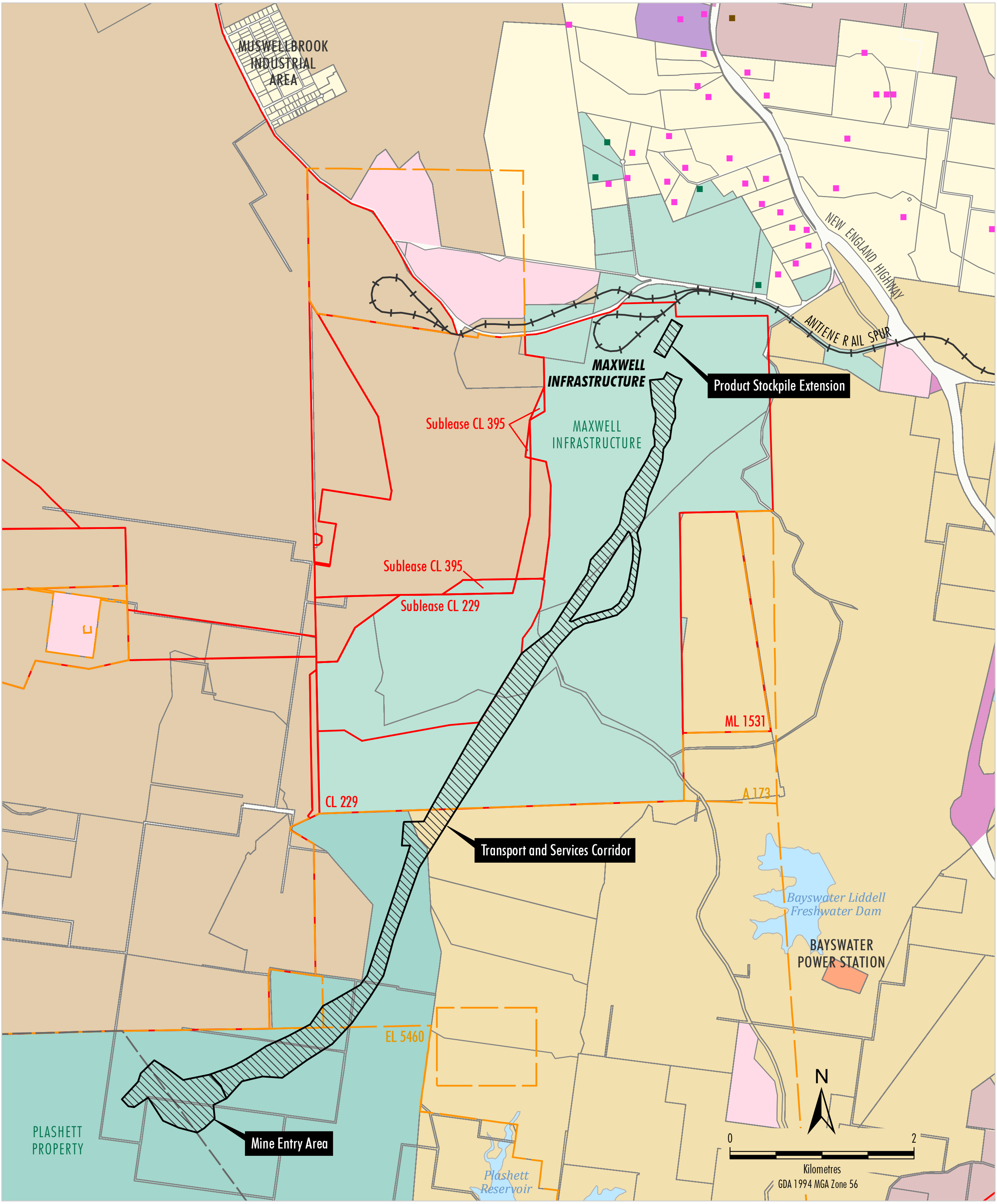
Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019)

MALABAR COAL
MAXWELL PROJECT

Property Ownership - Maxwell Underground

Figure 05-1

SHM-18-03 Maxwell_EIS_App AIS_204A



LEGEND
Railway
Exploration Licence Boundary
Mining and Coal Lease Boundary
Indicative Extent of Underground Development
Indicative Surface Development Area
Malabar-owned Receiver
Other Mine-owned Receiver
Privately-owned Receiver

Land Ownership
Malabar Coal
Mt Arthur Mine (BHP)
Hunter Valley Operations (Yancoal/Glencore)
AGL
TransGrid
RMS
Council
Crown
Other Privately-owned Land

Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019)

MALABAR COAL

MAXWELL PROJECT

Property Ownership
- Maxwell Infrastructure

Figure 05-2

The Llanillo property is used for grazing and fodder crop production in conjunction with Bowfield. The Llanillo property holds a licence to pump 90 megalitres per annum (ML per annum) from the Hunter River for irrigation or stock use.

Both the Bowfield and Llanillo properties have infrastructure common to beef grazing properties with fences, sheds, small cattle yards, residences and roads (Figure 05-3, Figure 05-4, Figure 05-5).

Figure 05-3 Bowfield from the Main Entrance Road near the Primary Residence, View South-easterly over Paddocks and Yards

Figure 05-4 Bowfield from the Main Entrance Road near the Primary Residence, View North-westerly towards Saddlers Creek

Figure 05-5 Llanillo View across River Flats Paddock from Golden Highway towards Residence

Plashett Property

The property has infrastructure common to beef grazing properties with fences, sheds, small cattle yards, residences and roads (Figure 05-6, Figure 05-7, Figure 05-8).

Evidence from the site inspection showed that the property was used primarily for beef cattle grazing. Internal fencing was poorly maintained, cattle were free to move around the property at will, making it difficult to estimate current production on the property.

Water for stock is sourced from surface-fed dams, Saddlers Creek and a series of troughs that are fed from tanks that access water from the Hunter River. The property has a licence to draw 90 ML per annum from the Hunter River.

Richard Webb understands that stock from the property was sold, via an agent, directly to abattoirs in Singleton or Scone.

Subsequent to the site inspection, areas of the Plashett property were destocked to allow for an improvement in pasture condition. Malabar intends to recommence grazing on the property in the future.

Figure 05-6 Plashett from a High Point at the Southern Side of the Property Overlooking part of the Llanillo Property and Other River Flats to the South along the Hunter River

Figure 05-7 Plashett from a High Point at the Southern Side of the Property. The View is to the West toward the Property's Primary Residences

Figure 05-8 Plashett from a High Vantage Point looking North-west towards the Mine Entry Area

05.3 Soil and Land Capability

05.3.1 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 05-1.

LSC Class has been mapped across the majority of the Project Area and surrounds, excluding the existing mining and coal lease areas at the Maxwell Infrastructure, by SLR (2019b). Within the Project Area, LSC Classes 4 and 6 are dominant (Figure 05-9, Table 05-2). LSC Class 4 is considered to be moderately capable land and Class 6 is considered low capability land. In general, the land is capable of supporting grazing land use with small areas capable of opportunistic cropping and a smaller area capable of supporting a more frequent cropping regime.

Table 05-1 Land and Soil Capability Classes (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.

Table 05-2 LSC Classes within the Project Area (SLR 2019b)

LSC Class	Maxwell Underground (ha)[1]	Surface Development Area (ha)[2]
3	340	25
4	1,019	74
5	26	28
6	506	34
Total	**1,891**	**162**

1 Area within the angle of draw of proposed secondary extraction.

2 Includes the disturbance associated with the mine entry area, transport and services corridor and potential Edderton Road realignment, and excludes areas previously disturbed by open cut mining activities, or not currently used for agriculture.

05.3.2 Project Area Land Slope

The topography within the Project Area can be largely described as moderate to steeply inclined (McDonald *et al.* 1990). Within the Maxwell Underground, slope is steepest in the south-eastern area, generally ranging from 5 to 30 degrees. In the north-eastern area slopes are moderate, generally ranging from 0 to 10 degrees, with localised areas of steeper slopes mostly associated with drainage lines (Figure 05-10).

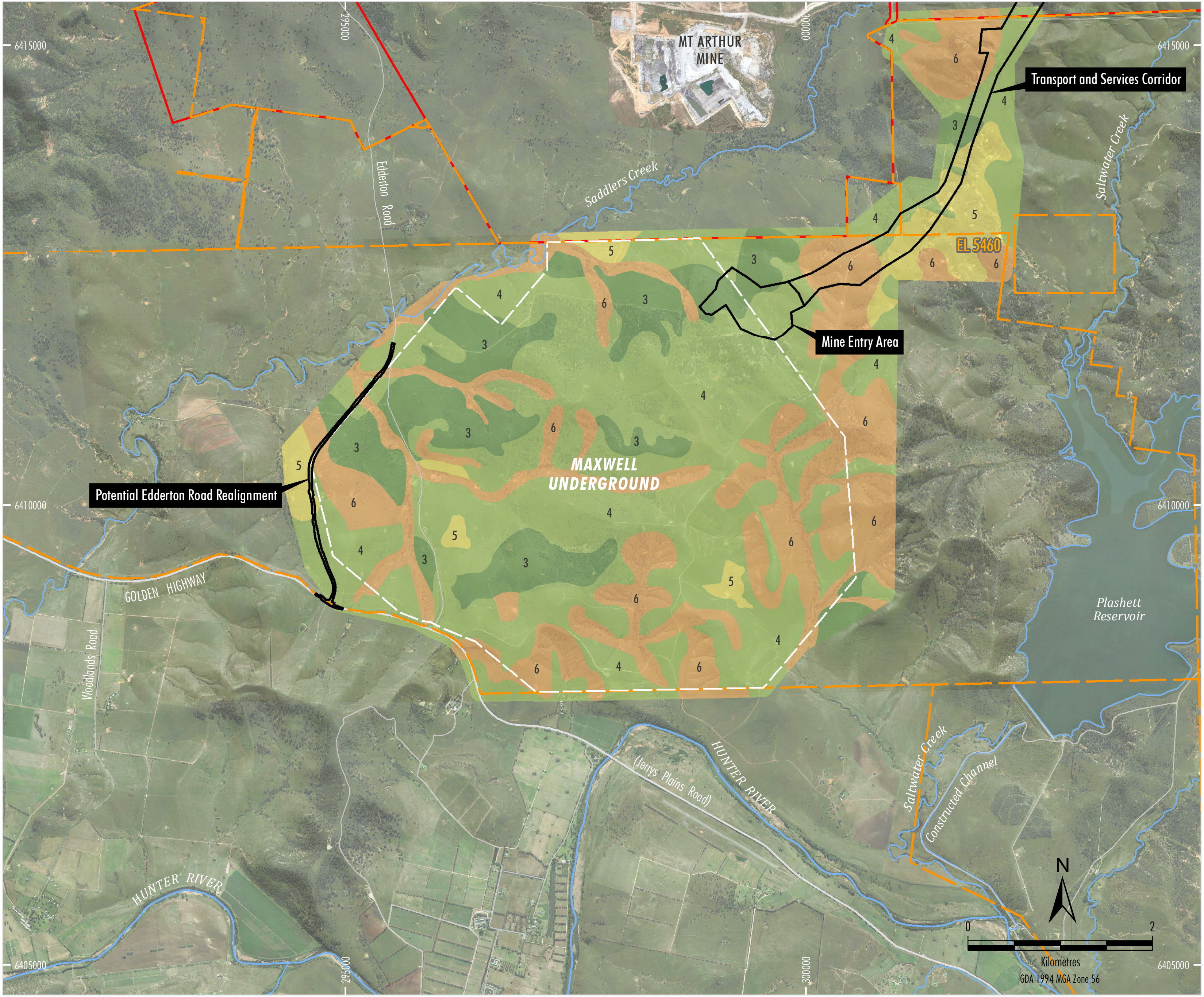
05.3.3 Survey and BSAL Assessment

Detailed soil mapping and assessment was undertaken by SLR (2019a) to provide site verification of BSAL across the entire Project Area (outside of existing coal and mining lease areas) (Figure 05-11). Soil survey was conducted in two stages. A 1,458 ha area was originally surveyed and assessed in 2015 (SLR 2015) and this was augmented by an additional survey of 1,757 ha in 2018 (SLR 2018) to cover the entire Gateway Certificate Application Area, including a 100 m buffer. Additional survey was undertaken in 2019 to address the conditions of the Gateway Certificate (SLR 2019a). For this assessment, the combined spatial dataset of soil mapping was used.

The soil survey and assessment were undertaken in accordance with standards and guidelines for BSAL mapping identified in the Interim Protocol (OEH 2013).

SLR (2019a) mapped eight different Australian Soil Classification (ASC) soil types classified into 14 soil landscape units across the Project Area (outside of existing coal and mining lease areas) (Figure 05-12). Following this assessment only Eutrophic Brown Chromosols (Deep) were found to satisfy the BSAL criteria (SLR 2019a). This unit covers approximately 72 ha in the western portion of the Maxwell Underground and is bisected by Edderton Road (Figure 05-13).

The Sodosol soil units (approximately 658 ha) were considered to have moderately low inherent soil fertility (SLR 2019a) (Figure 05-12). All other soil units were considered to have moderately high or high inherent soil fertility. Observations from SLR (2019a) confirm that cattle grazing is the dominant agricultural land use across the Project Area.



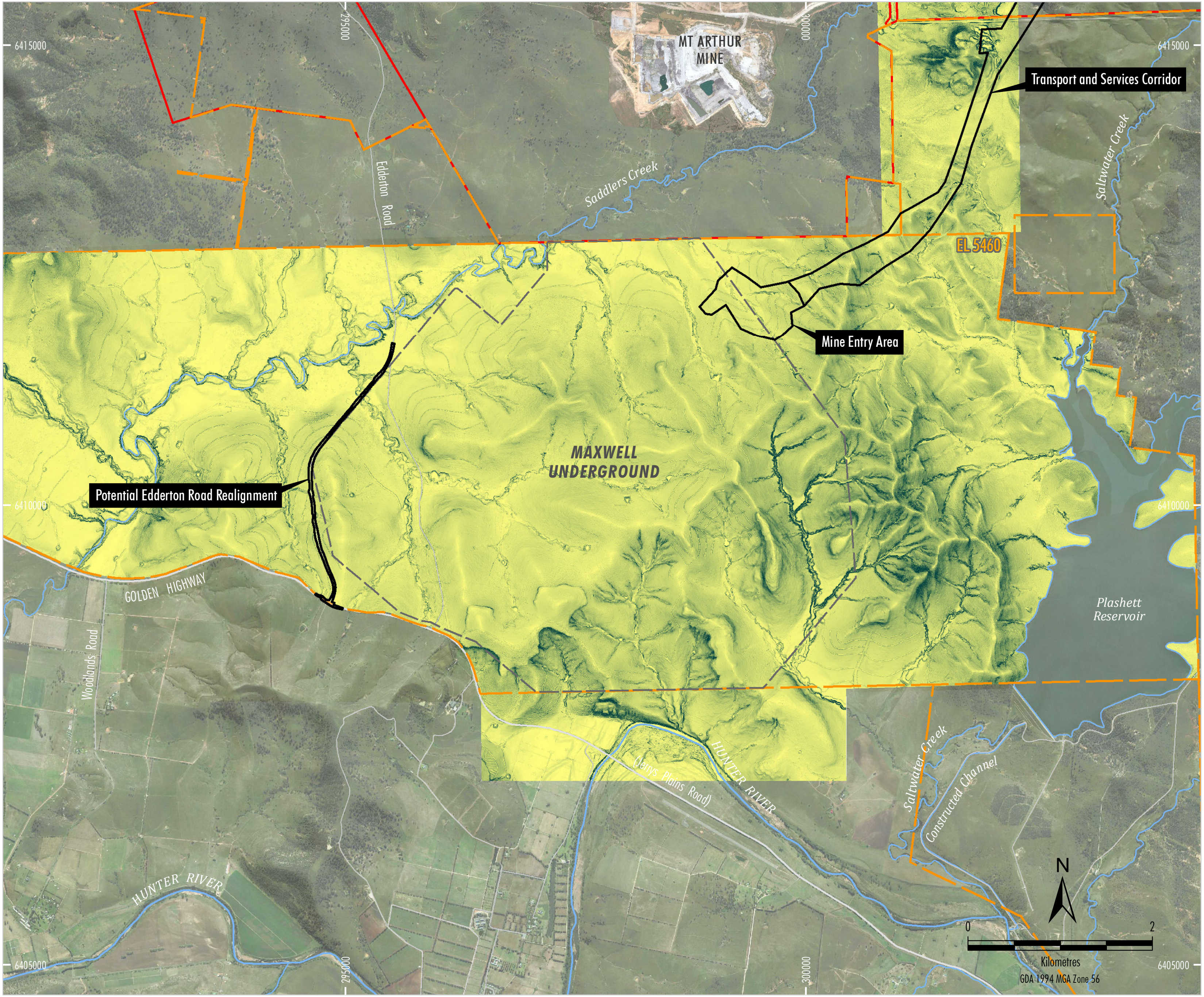
LEGEND
Exploration Licence Boundary
Mining and Coal Lease Boundary
Indicative Extent of Underground Development
Indicative Surface Development Area
Land and Soil Capability
3 Class 3
4 Class 4
5 Class 5
6 Class 6

Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019); SLR (2019)
Orthophoto Mosaic: 2018, 2016, 2011

MALABAR COAL
MAXWELL PROJECT
Land and Soil Capability

Figure 05-9

SHM-18-03 Maxwell_EIS_App AIS_207B



LEGEND
- Exploration Licence Boundary
- Mining and Coal Lease Boundary
- Indicative Extent of Underground Development
- Indicative Surface Development Area

Slope (degrees)
- > 30
- 25
- 20
- 15
- 10
- 5
- 0

Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019); Atlass (2018)
Orthophoto Mosaic: 2018, 2016, 2011

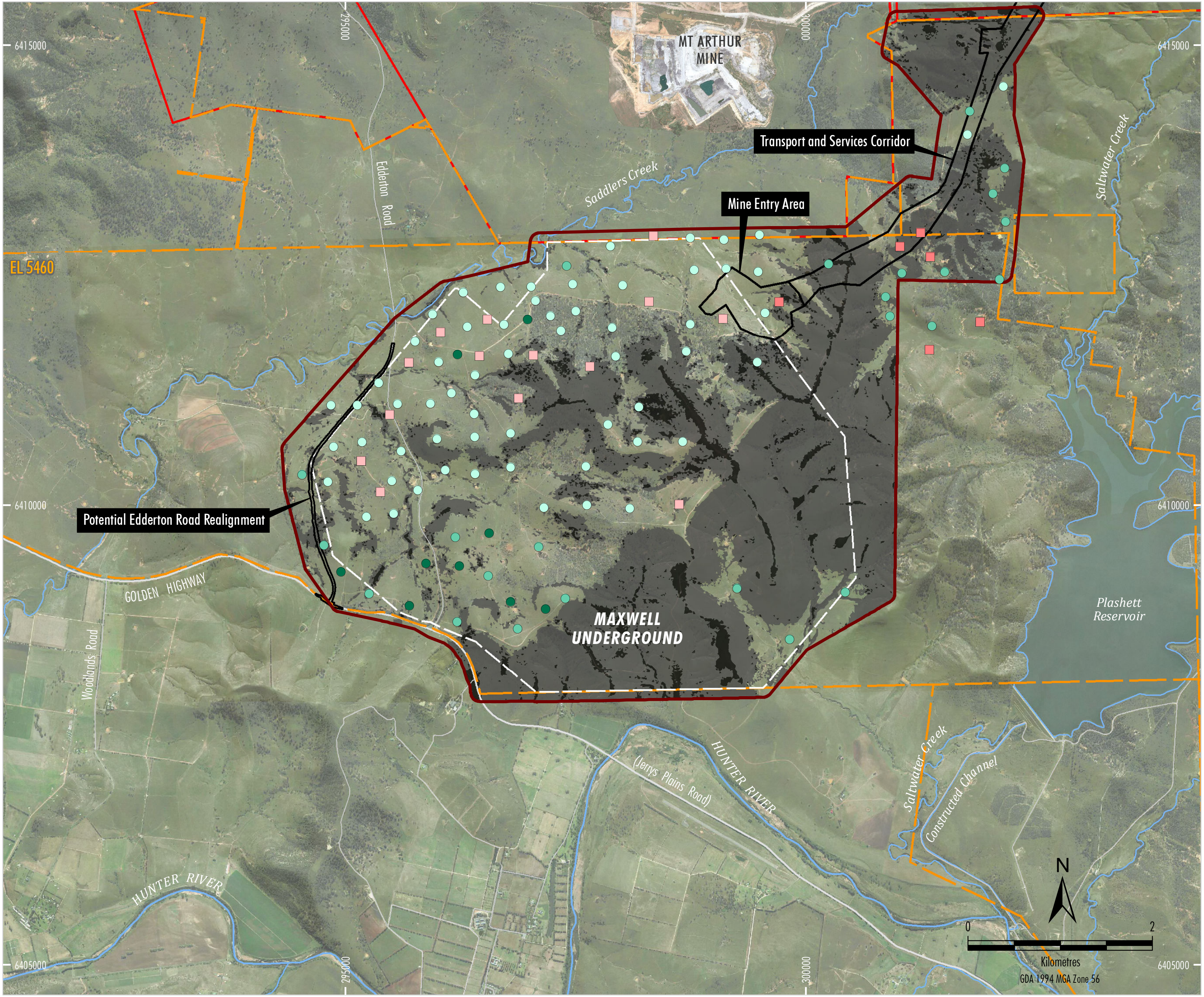
MALABAR COAL

MAXWELL PROJECT

Land Surface Slope - Maxwell Underground

Figure 05-10

SHM-18-03 Maxwell_EIS_App AIS_206B



LEGEND

- Exploration Licence Boundary
- Mining and Coal Lease Boundary
- Indicative Extent of Underground Development
- Indicative Surface Development Area
- BSAL Assessment Area
- BSAL Exclusion Zone - Slope >10%
- BSAL Exclusion Zone - < 20 ha Contiguous

SLR Sampled Locations

- Detailed Site (January 2019)
- Detailed Site (May 2018)
- Detailed Site (Laboratory Analysed) (2015)
- Check Site (May 2018)
- Check Site (2015)

Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019); SLR (2015 - 2019) Orthophoto Mosaic: 2018, 2016, 2011

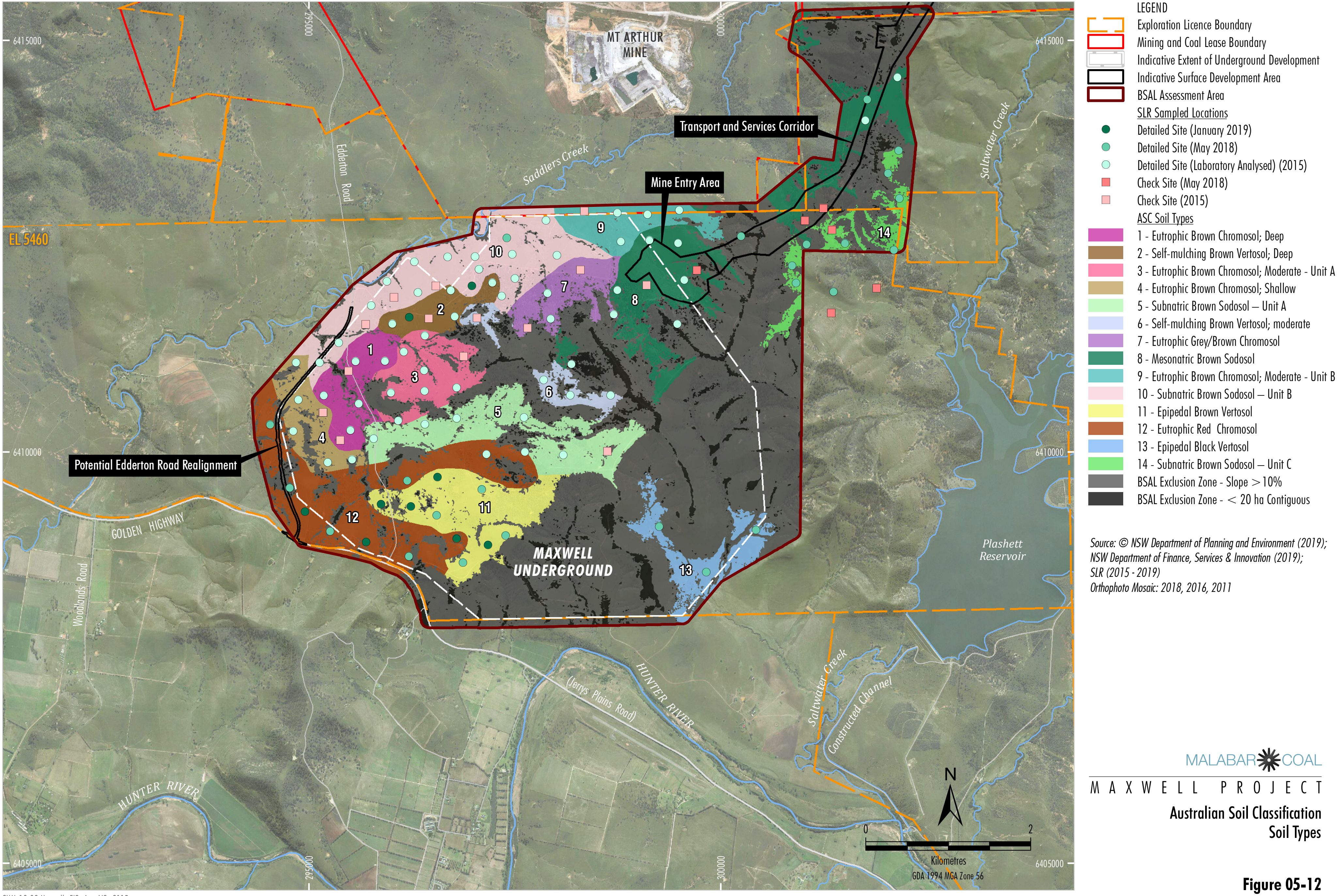
MALABAR COAL

MAXWELL PROJECT

BSAL Assessment Area from SLR (2019a)

Figure 05-11

SHM-18-03 Maxwell_EIS_App AIS_209D



Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019); SLR (2015 - 2019) Orthophoto Mosaic: 2018, 2016, 2011

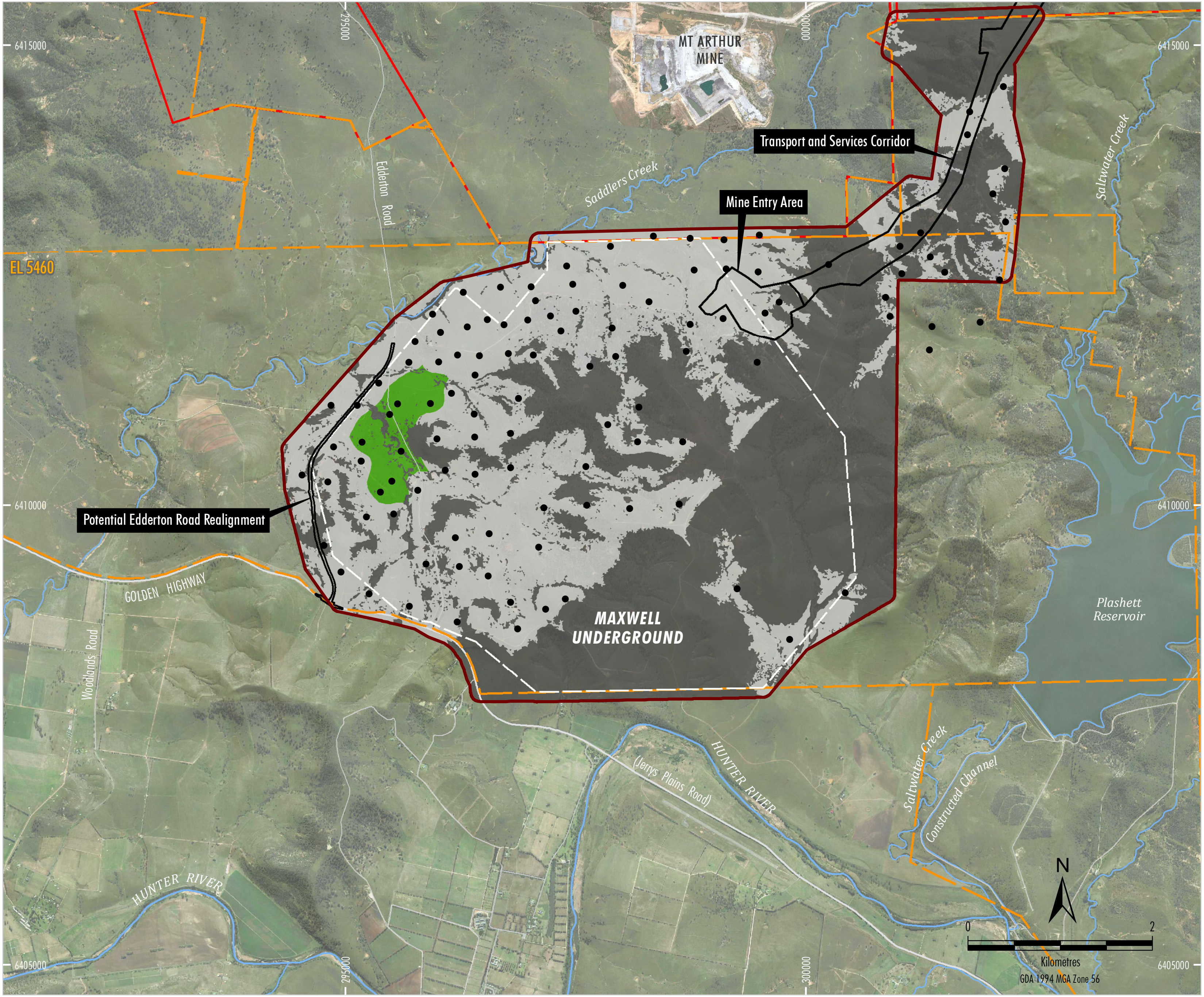
MALABAR COAL

M A X W E L L   P R O J E C T

Australian Soil Classification Soil Types

Figure 05-12

SHM-18-03 Maxwell_EIS_App AIS_211B



LEGEND

- Exploration Licence Boundary
- Mining and Coal Lease Boundary
- Indicative Extent of Underground Development
- Indicative Surface Development Area
- BSAL Assessment Area
- Verified BSAL
- Verified Non-BSAL
- Exclusion Zone
- Sample Location

Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019); SLR (2015 - 2019) Orthophoto Mosaic: 2018, 2016, 2011

MALABAR COAL

MAXWELL PROJECT

Verified Biophysical Strategic Agricultural Land

Figure 05-13

SHM-18-03 Maxwell_EIS_App AIS_210B

Table 05-3 ASC Soil Types and Areas within the Project Area and a 100 m Buffer (SLR 2019a)

Soil Landscape Unit	BSAL status	Inherent Soil Fertility	Area (ha)
Eutrophic Brown Chromosol (Deep)	Verified BSAL	Moderately high	72
Eutrophic Brown Chromosol (Moderate – Unit A)	Verified Non-BSAL	Moderately high	76
Eutrophic Brown Chromosol (Moderate – Unit B)	Verified Non-BSAL	Moderately high	71
Eutrophic Brown Chromosol (Shallow)	Verified Non-BSAL	Moderately high	57
Epipedal Black Vertosol	Verified Non-BSAL	High	71
Epipedal Brown Vertosol	Verified Non-BSAL	Moderately high	136
Eutrophic Grey/Brown Chromosol	Verified Non-BSAL	Moderately high	62
Eutrophic Red Chromosol	Verified Non-BSAL	Moderately high	222
Mesonatric Brown Sodosol	Verified Non-BSAL	Moderately low	228
Self-mulching Brown Vertosol (Deep)	Verified Non-BSAL	High	49
Self-mulching Brown Vertosol (Moderate)	Verified Non-BSAL	High	33
Subnatric Brown Sodosol (Unit A)	Verified Non-BSAL	Moderately low	143
Subnatric Brown Sodosol (Unit B)	Verified Non-BSAL	Moderately low	231
Subnatric Brown Sodosol (Unit C)	Verified Non-BSAL	Moderately low	56
		Total mapped soil area	**1507**
Greater than 10% slope or less than 20 ha contiguous area			1708
		Total excluded area	**1708**
		Total assessed area	**3215**

05.4 Groundwater Resources and Use

The Project is located in the Hunter Coalfield in the northern part of the Permo-Triassic Sydney Basin, which forms the southern portion of the Sydney-Gunnedah-Bowen Basin (Department of Mineral Resources 1988).

The geology of the Project Area and surrounds has been described by AGE (2012, 2015) and HydroSimulations (2019).

A conceptual model of the existing groundwater regime was developed by HydroSimulations (2019), based on the geology and a review of the available baseline groundwater data and relevant water sharing plans under the *Water Management Act 2000*. The three main groundwater systems identified by HydroSimulations (2019) are:

- alluvium associated with the Hunter River;
- alluvium associated with Saddlers Creek and regolith; and
- Permian strata that host the coal measures.

The Project would target coal seams within the Wittingham Coal Measures, which form a geological subgroup of the Permian coal measures. The coal seams generally dip gently to the south-west and are separated by interburden comprising siltstone, sandstone, claystone and tuff.

The Hunter River alluvium is the most productive aquifer in the region and comprises surficial silts and clays overlying basal sands and gravels up to 20 m depth. The basal sands and gravels are thickest along the alignment of the Hunter River, thinning out along the edges of the extent of mapped alluvium. The thick sequences of permeable sands and gravels in the Hunter River alluvium are considered ‘highly productive’ in accordance with the AIP. The edge of the Hunter River alluvium primarily consists of silts and clays that are largely unsaturated and considered ‘less productive’ (HydroSimulations 2019).

The stratigraphy of the alluvium along Saddlers Creek varies along the reach due to changes in the depositional environment. HydroSimulations (2019) summarise the stratigraphy of the Saddlers Creek alluvium as follows:

- Basal sands and gravels associated with a higher energy fluvial system occur at the lower reaches of the creek, at the confluence with the Hunter River.
- Further upslope, away from the Hunter River, the stratigraphy comprises surficial clays/silt overlying a heterogeneous distribution of sands and gravels.
- Within the upper reaches of the creek, the stratigraphy largely comprises clays and sandy clays.

The Saddlers Creek alluvium is mapped as 'highly productive' (NSW Department of Industry – Water [DoI – Water] 2018). However, analysis of the unconsolidated alluvial sediments in the vicinity of the Maxwell Underground found that these do not satisfy the AIP requirements for 'highly productive' groundwater because (HydroSimulations 2019):

- The average total dissolved solids in the Saddlers Creek alluvial sediments is greater than the 1,500 milligrams per litre (mg/L) criteria in the AIP (recorded concentrations average 3,400 mg/L).
- Results recorded during a previous bore census suggest the long-term yield from the bores/wells in the Saddlers Creek alluvium is less than 5 litres per second.
- Few registered bores exist in the unconsolidated alluvial sediments of Saddlers Creek, likely due to its lower yield and poorer water quality.

Malabar undertook a bore census for the Project in 2018 (Environment and Natural Resource Solutions 2019). Landowners in the vicinity of the Project were invited to participate in the bore census by a Malabar representative. Through this consultation, the landowners of four properties agreed to participate in the Bore Census. Landowners of two properties (including Coolmore Stud) indicated that they did not want to participate in the Bore Census on the basis that their property did not use water extracted from groundwater bores. Landholders of eight properties (including Godolphin Woodlands Stud) either elected not to participate in the Bore Census or did not respond to the request to participate in the bore census.

Most of the groundwater usage in the area is from the Hunter River alluvium. Comparatively few registered bores exist in the Permian porous rock aquifer, likely due to its lower yield and poorer water quality.

The Saddlers Creek alluvium is not commonly targeted for water supply. Two bores used for stock and domestic purposes are located within the alluvium (Bowfield House Well and Bowfield Well). These bores are on land owned by Malabar (the Bowfield property).

Excluding bores on land owned by Malabar, there are 147 registered bores within 10 km of the Project. The listed purpose of these bores is distributed as follows:

- Domestic/stock – 44 bores;
- Irrigation – 25 bores;
- Bores used for municipal water supply – 1 bore;
- Industrial or dewatering bores (including for mining purposes) – 4 bores;
- Monitoring or test bores – 54 bores; and
- Bores with no listed purpose – 19 bores.

The bores used for irrigation typically have completed depths ranging from approximately 7 to 20 m.

06 ADJACENT EQUINE AND VITICULTURE INDUSTRY RESOURCE ANALYSIS

DP&I (2012b) defines a CIC as a cluster that meets the following criteria:

- There is a concentration of enterprises that provides clear development and marketing advantages and is based on an agricultural product;
- The productive industries are interrelated;
- It consists of a unique combination of factors such as location, infrastructure, heritage and natural resources;
- It is of national and/or international importance;
- It is an iconic industry that contributes to the region's identity; and
- It is potentially substantially impacted by coal seam gas or mining proposals.

There is no Equine CIC or Viticulture CIC land mapped within the Project Area in the Mining SEPP. However, there are confirmed areas of both Equine and Viticulture CICs found adjacent to the Project Area (Figure 06-1) and consideration of these CICs has been undertaken via review of literature and other publicly available data.

06.1 Adjacent Equine Industry Analysis

06.1.1 Overview of the Equine Industry in the Hunter Valley

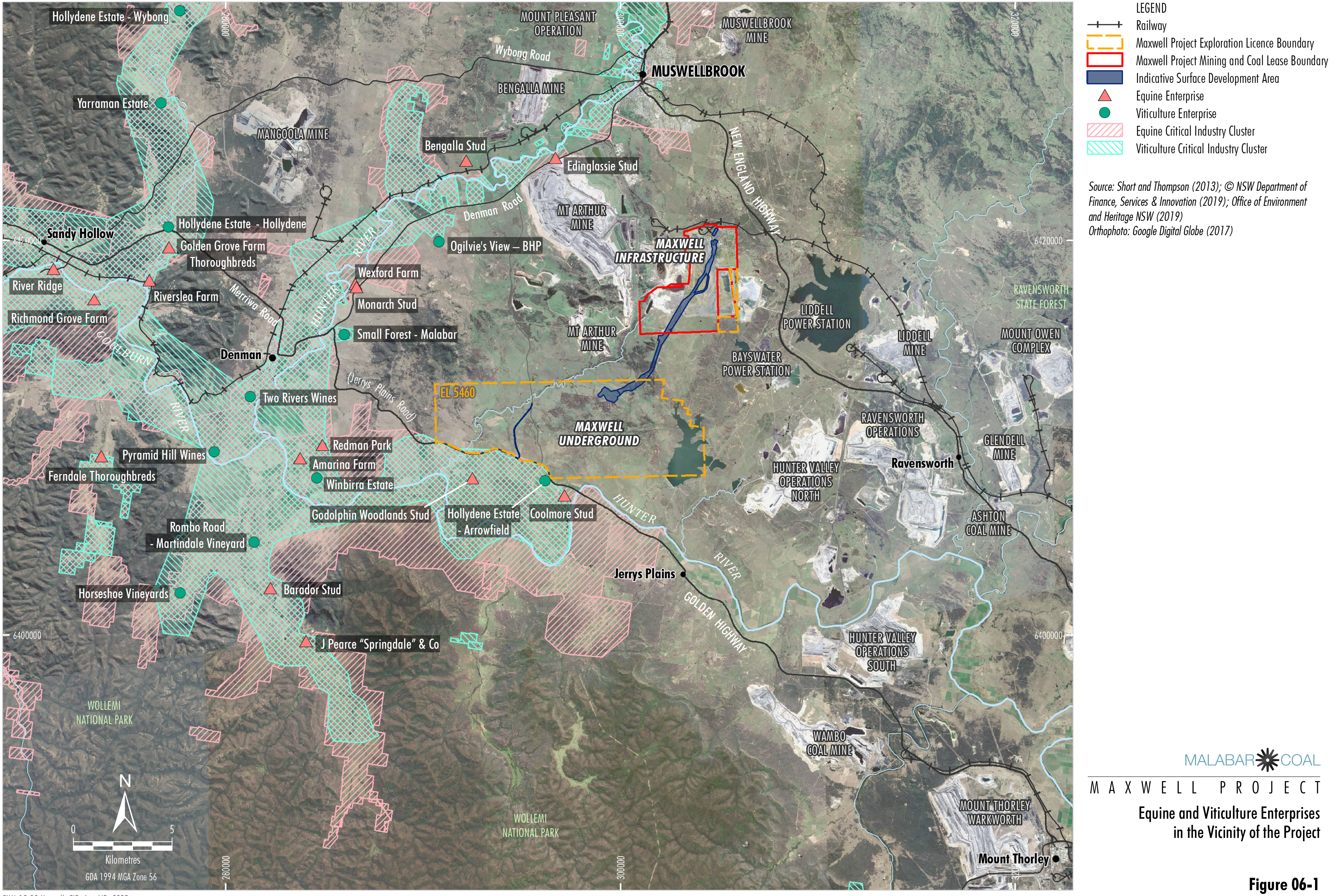
The Equine CIC has been mapped as covering 254,900 ha of land within the Upper Hunter (DPI 2014). It is comprised of a number of stud and broodmare farms supported by specialised veterinary services, stock agents and farriers located in two broad corridors stretching from Jerrys Plains in the south to the area surrounding Scone in the north and the Bylong Valley in the west (DP&E 2015). Primarily, the focus of the industry is on thoroughbred horses for the racing industry, although the industry includes horse agistment and horse breeding for other purposes. The industry is considered an important component of the cultural identity of the region, particularly in the Upper Hunter (DP&E 2015).

DPI (2013b) lists the following features of the Upper Hunter region that make it suitable to support a world class equine industry:

- Temperate climate with low risk of pests and disease;
- Clean air and attractive surrounding landscapes that appeal to clients and investors;
- Ready access to quality lucerne hay and grain supplies;
- Ready access to beef cattle enterprises and facilities to support pasture management;
- Ready access to international airports, racing and training facilities and support services;
- Well drained alluvial soils and highly productive pastures for lactating mares and their foals;
- Adjoining slopes for developing strong boned yearlings and for running dry mares; and
- Reliable water sources for equine needs and irrigation (>900 mm rainfall or within 2 km of the regulated river systems and closely associated with alluvial groundwater).

The equine industry in the Hunter Valley produces around half of all thoroughbred horses in Australia, and around 70% of Australia's thoroughbred horse exports. The industry is estimated to generate around $300 million in income to the region each year, including horse exports estimated at over $100 million. The industry is also a significant local employer, directly providing jobs for around 1,100 people, and is a significant contributor to the regional economy with over 85% of all operating costs being spent in the region (DP&E 2015).

TOC



Source: Short and Thompson (2013); © NSW Department of Finance, Services & Innovation (2019); Office of Environment and Heritage NSW (2019)
Orthophoto: Google Digital Globe (2017)

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M A X W E L L   P R O J E C T

Equine and Viticulture Enterprises in the Vicinity of the Project

Figure 06-1

SHM-18-03 Maxwell_EIS_App AIS_203B

Thoroughbred Breeders Australia and Racing Australia maintain detailed breeding statistics and provide qualitative estimates of the value of the thoroughbred breeding industry. The Racing Season 2015/2016 Fact Book (Racing Australia 2016) lists total Australian Sales in 2015/16 at $530 million and places Australia as the second largest thoroughbred producer globally, behind the USA, accounting for 14% of the global breeding mares. Racing Australia reported on sales results for thoroughbreds in Australia for the 2016/17 financial year, totalling $587 million (Racing Australia 2017).

The Australian Stockhorse Association is based in Scone and also contributes to the equine industry in the Upper Hunter. DPI (2013b) estimates that 97% of Australian stockhorses are either based in the Hunter or have Hunter bloodlines. The region also supports polo clubs, major horse events and a range of supporting services and infrastructure, including (DPI 2013b):

- A specialist equine hospital at Scone (largest in the southern hemisphere);
- The world class Hunter Valley Equine Research Centre at Scone;
- Experienced veterinarians, farriers, equine dentists, breeders, managers and support staff;
- Equine education and training facilities at Scone TAFE and Tocal Agricultural College;
- A complex network of specialist horse transport and feed companies, specialist breeding, rearing, training, spelling and competition facilities and events;
- Access to cost effective feed, including hay and grains from the local growers;
- Transport network for ready access to regional grain and hay supplies, specialist transport services and ready access to domestic and international airports to transport investors, shuttle stallions and export yearling horses; and
- A reliable high-volume source of high quality water to irrigate pastures, provide for livestock needs, clean facilities and maintain attractive surroundings.

In addition to infrastructure and support services, the physical landscape is considered important to the thoroughbred horse breeding industry in the Upper Hunter region. The combination of “uncleared, naturally vegetated and complexly eroded steep hills as a backdrop, cleared steep to undulating grassy side slopes, and the manicured patchwork of intensively used lower slopes and river flats, with their grid-work of post and rail fenced paddocks, natural riparian landscapes of the Hunter River course, cultural vegetation, houses and other buildings, creates a landscape for the studs that is both distinctive and of substantial intrinsic scenic quality” (Lamb, 2013).

Lamb (2013) concluded that “Landscape values are engineered at considerable expense by individual studs, designed to demonstrate high standards of thoroughbred racehorse production and management in a manicured and cultured landscape. Extensive consideration is given to the size and character of paddocks and fencing, grouping of farm infrastructure and buildings, interconnection of fenced spaces, impressions given by entranceways and landscaped areas, and to maintaining open views in all directions”.

06.1.2 Equine Enterprises near the Project Area

Two premier thoroughbred studs in Australia, Coolmore and Godolphin Woodlands Studs, are located in close proximity to the Project on the southern side of the Golden Highway (Figure 06-1). These enterprises have been identified and mapped as part of the Equine CIC (DP&I 2012b). Both studs are considered to play an important role in the Hunter thoroughbred industry (DP&E 2015).

The Godolphin Woodlands Stud is primarily a broodmare operation with facilities for foals and yearlings. It has a heritage listed historic homestead and accommodation for staff (DP&E 2015). Godolphin Australia Pty Ltd (Godolphin) is owned by His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the United Arab Emirates and Ruler of Dubai (Godolphin 2018).

Coolmore Australia, a Swiss registered company, purchased the Coolmore Stud in 1991. The property had been operating as farming, grazing and thoroughbred breeding operation since 1912. The Coolmore Stud is a fully integrated thoroughbred breeding operation; stallions service mares from other farms within the Hunter thoroughbred industry and are also shuttled to service mares overseas. The Coolmore Stud includes its own veterinary hospital and laboratory and has facilities for mares, foals and yearlings. It also has a small airstrip, a number of historic homesteads and accommodation for employees. During the breeding season, the Coolmore Stud employs up to 150 people, with up to 90 people residing on the property (DP&E 2015).

Marsden Jacob Associates (2016), commissioned by the horse studs, described Coolmore Australia and Godolphin Woodlands (formerly Darley Australia) Studs as Australia's largest thoroughbred breeding studs, with the combined stallion fees comprising 50% of the service fees in the Hunter Valley. Short and Thompson (2013a) described Coolmore and Godolphin Woodlands Studs as central to the functioning of the Equine CIC due to physical scale and market share and believe that any impacts on their business operations will impact all other related and support services in the CIC. This view was supported by the DP&E (2015) who describe the Coolmore and Godolphin Woodlands Studs as essential to the equine industry in the Upper Hunter.

Water for both Coolmore and Godolphin Woodlands Studs is drawn primarily from the Hunter Regulated River Water Source. The Godolphin Woodlands Stud has access of up to approximately 3,764 ML per annum from the Hunter River (Water Access Licences [WAL] 1034, 1033, 1321, 789, 1271, 1020, 1215) and the Coolmore Stud has access of up to 5,290 ML per annum from the Hunter River (WALs 11175, 13797, 616, 1311). Water access is predominantly via general security, with smaller volumes available via supplementary and domestic and stock categories (WaterNSW 2018). Ross Watson, an agronomist commissioned by Coolmore Australia, states that the Coolmore Stud is the largest area of irrigated pasture on a single property in the Hunter Region, and the largest area of pasture serviced by travelling irrigation systems in the southern hemisphere (Watson 2015).

06.1.3 Issues Raised in Relation to Previous Open Cut Mining Applications

The Drayton South Coal Project was a proposed open cut coal mine situated within EL 5460. Concerns relating to impacts on the Equine CIC, and the Coolmore and Godolphin Woodlands Studs in particular, were critical in the refusal of the Drayton South Coal Project proposal by the Planning Assessment Commission (PAC). The PAC Determination Report (PAC 2017) concluded that key potential impacts on the operation of Coolmore and Godolphin Woodlands Studs that would have arisen from an open cut mine in such close proximity as the proposed Drayton South Coal Project would have included:

- impacts on air quality associated with dust from open cut operations;
- blast noise and vibration; and
- reputational risk.

06.2 Adjacent Viticulture Industry Analysis

06.2.1 Overview of the Viticulture Industry in the Hunter Valley

The wine industry (viticulture and wine making) is recognised by DP&I (2012b) as a significant enterprise in the Upper Hunter and has a base in the Singleton and Muswellbrook LGAs. The area mapped as Viticulture CIC covers approximately 59,842 ha of the region (DPI 2014). It is noted that recent data (Table 04-2) indicate that the area under vine for grape production reduced by over 40% between 2008 and 2017. The area of vineyards in the Hunter Valley represents 7% of vineyards in NSW and 2% of vineyards in Australia (Wine Australia 2019).

Muswellbrook Shire Council (2015, 2018) describes the Upper Hunter viticulture industry as one of Australia's most well known wine regions that is renowned internationally. Viticulture establishments in the Muswellbrook LGA include Hollydene Estate Wines, James Estate Wines, Small Forest and Two Rivers (Muswellbrook Shire Council 2018). The Small Forest viticulture enterprise occupies land owned by Malabar (outside of the Project Area).

The value of the Hunter Valley viticulture industry also extends to tourism, contributing to tourism revenue in 2010 in the Hunter Valley of $256 million (Muswellbrook Shire Council 2015). Hunter Valley viticulture and tourism industries combined contribute $1.8 billion per annum into the NSW economy. The combined viticulture and tourism industries in the entire Hunter Valley was reported to employ over 7,000 people with an additional 10,000 indirectly employed (Muswellbrook Shire Council 2015).

06.2.2 Viticulture Enterprises near the Project Area

United Pastoral Pty Limited trading as Hollydene Estate operates a vineyard to the south of the Project Area (Figure 06-1). The land and facilities were purchased by Coolmore Australia in 2013 and subsequently leased to Hollydene Estate.

Hollydene Estate operates the vineyard, winery, cellar door and restaurant.

Hollydene Estate has development approval for the construction of tourist cabins and function centres in addition to refurbishment of the cellar door and restaurant (DP&E 2015).

In June 2019, Hollydene Estate Wines entered into a long-term lease with Malabar allowing Hollydene Estate to occupy the Llanillo homestead proximal to its existing business.

Short and Thompson (2013b) reported Hollydene Estate had approximately 80 ha under vine and produced approximately 2,000 cases of a wide range of red and white wines annually. Since that time, vines have been removed to facilitate development of the Coolmore Stud consistent with a trend to the removal of vines within the Hunter.

Water for the vines is drawn largely from the Hunter Regulated River Water Source with up to 95 ML per annum available as general security entitlement (WAL 12987) and 1 ML per annum available as domestic and stock entitlement (WAL 31159).

07 LITERATURE REVIEW OF MINE SUBSIDENCE IMPACTS ON AGRICULTURAL LANDSCAPES

07.1 Review of Impacts of Mine Subsidence on Agricultural Landscapes

A literature review was undertaken to describe the documented impacts of planned mine subsidence on agricultural production. Particular attention was given to papers that presented measured impacts in agricultural regions with landscapes (topography and soils) and climatic regimes similar to those in the vicinity of the Project Area.

07.2 Physical Effects of Planned Mine Subsidence

This section describes the key features of mine subsidence with a particular focus on impacts that may affect agricultural activities and production.

The primary and secondary impacts of mine subsidence are well studied and described by multiple authors (e.g. Bell & Genske 2001; Bell *et al*. 2000; Palamara *et al.* 2006). Following extraction of the selected coal seam, subsidence can form a shallow depression (i.e. trough), generally within days of mining, settling over weeks to months (Bell *et al*. 2000).

With alteration to surface topography it follows that surface runoff patterns and soil moisture patterns may also be altered. Areas of increased surface slope can increase erosion risk, especially along areas of concentrated water flow, including pre-existing drainage lines. Likewise, areas of decreased slope may retain water and form temporary ponds following rainfall. In areas with shallow water tables, ponding from groundwater can also occur.

Depending on the nature of the underground mine, surface cracking can result from subsidence. Surface cracks generally appear in tensile zones parallel to longwall edges or at the longwall ends. Bedrock with fractures and joints can also influence the pattern of cracking. As the extraction face progresses, transient cracks can develop, opening and closing as the area moves from tensile to compressive phases. Larger cracks that may require remediation are usually located around the perimeters of the longwall. Large, isolated cracks can also develop along steep slopes.

Cracking at the surface or subsurface can alter or create new flow paths altering surface and groundwater flow. Cracking can also provide erosion initiation points. The amount of change in surface and subsurface water flows will be dependent on the overlying strata and nature of the subsidence (Booth 2006; Sidle *et al*. 2000). In a landscape which is undulating and of high relief, subsidence impacts may be harder to recognise, whereas in flatter landscapes of low relief and higher water tables, the impacts of subsidence can be more obvious (Asadi *et al*. 2004).

07.3 Impacts on Agricultural Landscapes and Production

Worldwide there have been a number of studies that have sought to quantify the impacts of mine subsidence on agricultural landscapes and production. There has been an ongoing program of research undertaken by the Illinois Mine Subsidence Research Program (e.g. Darmody *et al*. 1989; Darmody 1995; Darmody 1998), and these studies conclude that soil erosion and surface ponding are key factors that may impact productivity. The Illinois Mine Subsidence Research Program studies landscapes which are very flat with rich agricultural soil. Soil erosion has been found to be negligible with surface ponding considered the most important potential impact to productivity. However, land forming mitigation through ditch creation (drainage) or fill have been shown to successfully ameliorate any negative impacts.

In Australia, Beltana No. 1 Underground Mine in the lower Hunter Valley and Kestrel Mine in central Queensland have been subject to several studies that sought to quantify the impact of longwall mine subsidence on agricultural crop and pasture production and soil parameters (Trotter and Frazier 2009; Thompson *et al.* 2010; Frazier *et al*. 2010; Frazier 2015).

07.3.1 Beltana No. 1 Underground Mine

Beltana No. 1 Underground Mine has been the subject of several key studies to examine the impacts of subsidence on agricultural/viticultural production (Trotter and Frazier 2009; Thompson *et al.* 2010).

Beltana No. 1 Underground Mine is located approximately 16 km south-west of Singleton in the Hunter Valley, NSW (approximately 35 km to the south-east of the Project). Agricultural land use consists of cattle grazing (native and improved pasture), lucerne cropping, viticulture and olive farming (Frazier *et al.* 2010). The landform is gentle to undulating, with vineyards and other cropping located mainly on alluvium and toe-slopes. Soils include alluvial soils, yellow podzols and chocolate soils with the alluvial soils occupying lower parts of the landscape (Kovac and Lawrie 1991). The climate is warm-temperate with hot wet summers and cool mild winters. For Singleton, the mean maximum temperature is 30°C in December to January and 18°C in June to July. The mean annual rainfall is 722 mm. Following extraction of the coal seam, subsidence of up to 2 m was measured (Thompson *et al.* 2010) with associated changes in surface slope and cracking recorded.

Trotter and Frazier (2009) studied the impact of subsidence on irrigated lucerne and native pasture production above the Beltana No. 1 Underground Mine. They sampled total biomass using traditional field sampling methods, proximal crop sensing and remote sensing methods. In addition, soils were sampled via cores and EM38 soil conductivity surveys. Sampling was conducted across longwall panels and in control areas to cover a range of likely impacts. No significant impacts in production or soil characteristics were found that could be associated with longwall mine subsidence.

Thompson *et al*. (2010) conducted a detailed study of the impact of longwall mine subsidence on wine grape production from 2003 to 2008. Sampling included key grape and vine parameters to capture quality and quantity parameters at scales from individual vines to the vineyard block and vineyard region scale. Sampling was undertaken prior to subsidence and following subsidence and across longwall panels to examine changes in potential impacts over time or across the vineyard. Key changes in yield were found to be more associated with changes in seasonal climatic conditions rather than subsidence and they concluded that any impacts were likely to be highly localised rather than affecting productivity more broadly.

MSEC (2019) details the mining conditions at the Beltana No. 1 Underground Mine and suggests that this mine and resulting surface impacts represent a reasonable indication of surface impacts and surface cracking in particular that may occur at the proposed Project. Cracking at Beltana No. 1 Underground Mine was mapped in detail with a total cracking length of 494 m over a total area of 17.7 square metres (m^2) found. Most cracks were less than 25 mm in width (62%), 26% of cracks were between 25-50 mm and 12% of cracks were between 50-100 mm. Out of a total survey area of 112,476 m^2 cracking was found to affect 0.02% of the total area. Pit excavations showed that cracks were shallow and generally less than 0.5 m in depth, with some wider cracks reaching below 1 m in depth.

07.3.2 Kestrel Mine

The Kestrel Mine has also been subject to several studies that aimed to quantify the impact of subsidence on agricultural production.

The Kestrel Mine is located 50 km north-east of Emerald in central Queensland. The site is very gently to gently sloping with maximum gradients of 5%. The vertosol topsoil varies in depth from 0.5 to 2 m and is underlain by a highly dispersible sub-soil which is prone to erosion. Numerous erosion control measures including contour banks and grassed waterways were implemented prior to any mining activity (Trotter and Frazier 2009).

The agricultural land use at the site is primarily pastoral and cropping. Kestrel leases the property ‘Gordon Downs’ to the Northern Australian Pastoral Company as a background grazing property. There are areas of permanent pastures, both improved and unimproved and forage crops which were used for grazing purposes. The area has also been used for cereal crop production.

The climate of the area has characteristics intermediate between those of tropical and temperate climatic types. It is also transitional between humid and semi-arid, and is regarded as subhumid (Winders, Barlow and Morrison 1985). The mean annual rainfall for the area is 536 mm (data obtained for Emerald, Queensland). The area experiences an average of 60 days of rain per year, with the highest recorded annual rainfall being 883 mm and the lowest recorded annual rainfall being 284 mm. The mean maximum daily temperature for the area is 30°C and the mean minimum daily temperature for the area is 16°C (data obtained for Emerald, Queensland). The area experiences extremes in temperature, with the highest temperature of 47°C and low temperatures of 10°C.

Hinchliffe *et al.* (2003) studied the impact of longwall mine subsidence on wheat and soybean crops at the Kestrel Mine in 2000 and 2001. They compared subsided areas with unsubsided areas using measures of plant germination and yield as well as soil parameters. There was no apparent difference in crop or soil parameters that implied a negative impact from longwall mine subsidence. They concluded that while impacts such as soil cracking and change in slope are apparent, these impacts are highly localised and ameliorated through normal agricultural management practices.

Further study over the site was undertaken across the 2007 and 2008 seasons (Trotter and Frazier 2009). Sampling was undertaken to assess forage sorghum, sown pasture and soil parameters at subsided and unsubsided (control) sites. Field sampling examined plant biomass, species composition, plant height, soil electrical conductivity, soil pH and soil moisture. Techniques commonly used in precision agriculture including EM38 conductivity survey, hand/machine mounted crop sensors and satellite remote sensing were used to provide a broader, landscape view. The study concluded there were no negative impacts on plant or soil parameters that could be attributed to subsidence.

Frazier (2015) examined an established pasture paddock over the Kestrel Mine. The paddock had been subject to several years of conservation grazing practices that aimed to re-establish Queensland Bluegrass (*Dichanthium sericeum*). This study targeted several longwall areas to determine if patterns of impact with time could be found; that is, if there was a recovery following subsidence or any impacts that compound over time. Samples were taken for plant cover and diversity using field samples and satellite imagery. No significant negative impact was found across any of the zones above any of the longwall panels in comparison to a control area. Further it was found that conservative grazing practices had substantially increased the presence of Bluegrass.

07.3.3 Blakefield South Mine

Blakefield South Mine longwalls 1 to 5 were extracted beneath South Bulga longwalls in the Whybrow Seam and hence represents multi-seam conditions similar to the Project (MSEC 2019). Detailed crack mapping found that most cracks (79%) were less than 100 mm with the majority of these cracks being less than 50 mm. The largest crack found was 500 mm. Within the study site of 5.1 km^2 it is estimated that less than 0.09% of the total area was affected by cracking. Compressive heaving and steps were also observed with typical step height of less than 50 mm. A maximum step of 800 mm was found as a result of localised vertical ground shear.

07.3.4 Narrabri Mine

Longwalls at the existing Narrabri Mine underlie agricultural land comprising grazing, dryland crops, contour banks and ephemeral streams.

Whitehaven Coal has prepared End of Panel Reports for LW101 to LW105 at the existing Narrabri Mine describing subsidence impacts, including surface cracking and monitoring results following the completion of mining each longwall (Whitehaven Coal 2013, 2014, 2015a, 2015b, 2016).

With respect to impacts to agricultural production, the End of Panel Reports describe:

- The only area affected by subsidence, with regards to agricultural suitability, was where water ponded at an ephemeral creek. The ponded water is currently pumped downstream when required. The ephemeral nature of the creek system is such that any ponding that does occur is for relatively short periods only, and on this basis, has negligible effect on agricultural use or agricultural suitability.
- Contour banks, or parts thereof, were undermined during the extraction of LW101 to 105. The subsidence impacts to the contour banks did not affect their structural stability or functionality.
- Ploughing of the land overlying Longwall 103 was undertaken during the extraction of LW103, however, the ploughing was limited due to poor climatic conditions.
- Several farm dams have been undermined during extraction of LW101 to LW105. No structural damage to these dams has been noted at any site following subsidence.

07.3.5 Conclusions from Literature Review

Planned mine subsidence has an impact on the surface landscape with lowering of the surface above the underground mining areas. Secondary impacts, including surface cracking, altered surface flow patterns with potential ponding or increased erosion risk, can be predicted with a high degree of certainty at the paddock scale.

Several studies from within Australia and worldwide have demonstrated that localised impacts occur as a result of underground coal mining, such as those caused by an individual crack. However, none of the studies have shown widespread impacts that have significantly reduced agricultural productivity over the short or long-term during or following mining. Further, common agricultural maintenance practices such as cultivation, ripping or minor land forming (e.g. restoring contour banks or small channel formation) have proven effective in managing short-term impacts.

08 IMPACT ASSESSMENT

08.1 Nature of Proposed Mining Activities

The Project proposes to use underground mining methods: bord and pillar mining with partial pillar extraction in the Whynot Seam; and longwall mining in the Woodlands Hill, Arrowfield and Bowfield Seams. Within the Maxwell Underground area, subsidence is the primary factor that may affect agricultural productivity. Section 08.2 discusses the potential impacts of subsidence on agricultural productivity.

Smaller areas of agricultural land would be removed from agricultural production for the life of the Project for infrastructure development such as the mine entry area and transport and services corridor (Figure 01-2). Potential biodiversity offset areas with a total area of nominally 716 ha are also planned for establishment on Malabar-owned land, within and outside the Project Area. Within the Maxwell Infrastructure area, approximately 473 ha of land is being rehabilitated to a grazing land use. Section 08.3 discusses the potential cumulative impacts of surface development, the potential biodiversity offset areas and ongoing rehabilitation activities on agricultural productivity.

By specifically using underground mining techniques, the Project is designed to minimise visual, noise and dust impacts within the region, and also allows the continued use of agricultural land above the underground mining area.

08.2 Predicted Surface Subsidence

The extent and nature of subsidence is related to: extracted panel thickness; panel/pillar width; depth of cover; overlying geology and surface topography; and proximity to other workings (MSEC 2019). MSEC (2019) modelled the extent and nature of subsidence associated with the Project and assessed related secondary impacts on other land resources. This section provides a summary of the findings presented in MSEC (2019).

MSEC (2019) modelled the likely magnitude of surface subsidence (horizontal and vertical movement along with associated stresses and strains) and assessed the likely associated consequences on the landscape and land use. The data modelling outcomes and impact predictions were calibrated via observations from previous mining that were considered to have similar characteristics and potential impacts as those of the Project, for example the Beltana No. 1 Underground Mine and Blakefield South Mine.

As the Project proposes multi-seam mining, subsidence parameters were consolidated into a summary table that considered the cumulative predictions following the completion of all mining in Table 08-1. Figure 08-1 shows a comparison of the pre-mining topographic surface and the final predicted topographic surface once all mining and subsidence has been completed.

The extent of subsidence impacts would be monitored during the life of the Project to confirm that subsidence impacts are within predictions.

Table 08-1 Maximum Predicted Total Conventional Subsidence Parameters (MSEC 2019)

Seam	Maximum predicted vertical cumulative subsidence (m)	Maximum predicted cumulative tilt (mm/m)	Maximum predicted cumulative hogging curvature (km^{-1})	Maximum predicted cumulative sagging curvature (km^{-1})
Whynot Seam	0.4	15	0.5	1.0
Woodlands Hill Seam	3.2	45	2.0	1.5
Arrowfield Seam	5.4	50	2.0	2.0
Bowfield Seam	5.6	50	2.0	2.0

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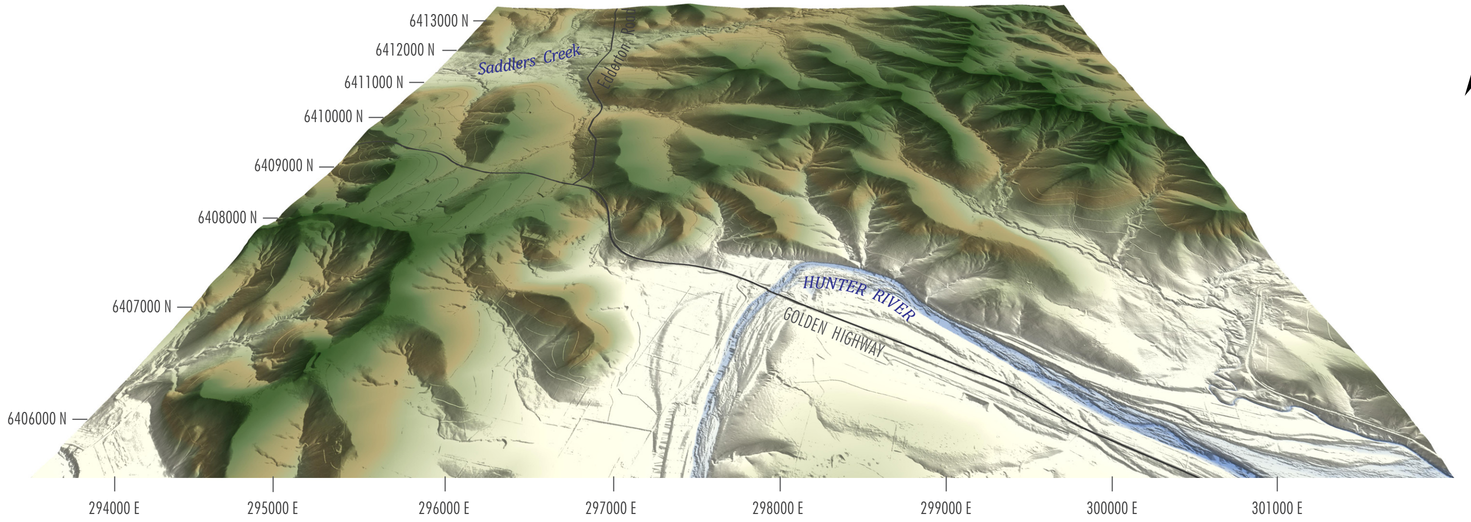
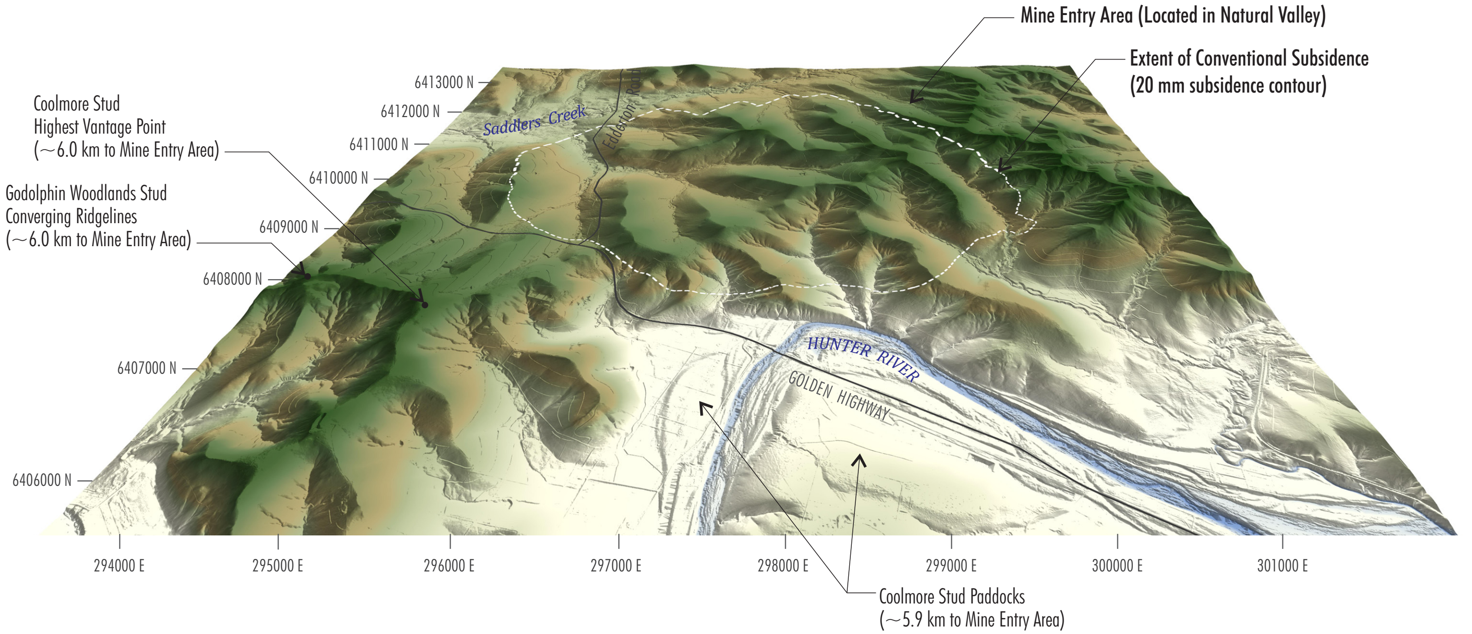


Pre-mining Surface Topography



Predicted Subsided Surface Topography - Changes Hard to Recognise Visually

LEGEND

Elevation (m AHD)

275
250
225
200
175
150
125
100
75

Source: Fluvial Systems (2019)

MALABAR COAL

M A X W E L L   P R O J E C T

Pre-mining and Post-mining Surface Topography

Figure 08-1

SHM-18-03 Maxwell_EIS_App AIS_005C

08.2.1 Surface Cracking

Underground mining can result in surface cracking, heaving, buckling, humping and stepping of the land surface (MSEC 2019). The amount of surface impact depends upon a number of factors including: mine geometry; depth of cover; overburden geology; bedrock joints; near surface geological features; and soil thickness and condition.

MSEC (2019) predicts that cracking in the flatter areas above the underground mining areas would typically be between 25-50 mm in approximately 50% of cases, between 50-100 mm in approximately 30% of cases, between 100-150 mm in approximately 15% of cases, and greater than 150 mm in approximately 5% of cases. Multiple cracks resulting in deformations over widths of several metres could occur in less than 1% of cases.

Cracking along steeper slopes is expected to be greater, typically in the order of 50-100 mm in 60% of cases, 100-200 mm in approximately 25% of cases, between 200-300 mm in approximately 10% of cases and greater than 300 mm in 5% of cases. Multiple cracks resulting in deformations over widths of several metres could occur in less than 1% of cases.

There is a sill in the Whynot Seam above the south-western ends of the longwall panels in the Woodlands Hill, Arrowfield and Bowfield Seams. It is possible that localised irregular movements could occur where this sill spans the longwalls, however it is expected that any cracking would be less than 50 mm.

The land use above the Maxwell Underground area is primarily cattle grazing with associated infrastructure. While active subsidence occurs, there are safety risks to cattle and personnel that can be mitigated. Access by cattle, other livestock and unauthorised personnel to areas of active subsidence should be restricted (e.g. via temporary fencing) until the area is inspected and deemed safe.

Management and remediation strategies for cracking include:

- visual monitoring of the surface following subsidence to identify larger cracks that could lead to safety, access or erosion issues;
- ripping or tyning of larger surface cracks where soils and slopes allow;
- infilling with soil or other suitable materials or erosion protection works and revegetation of some larger cracks that don't self-heal;
- development of site-specific management plans for areas that require broader remediation; and
- restricting access by livestock and unauthorised personnel to areas of active subsidence.

08.2.2 Surface Drainage

The topography within the Maxwell Underground area can be largely described as moderate to steeply sloping, with slopes greater than 10 degrees in the south-east and gentler slopes generally between 5 to 10 degrees in the north-west (Figure 05-10). In the south-eastern portion of the Maxwell Underground area, water sheds generally to the south, flowing directly to the Hunter River or to Saltwater Creek. In the north-west, water sheds to the north-west into Saddlers Creek. There are some areas with slope less than 5 degrees along some of the drainage lines in the north and north-west of the Maxwell Underground area.

Fluvial Systems (2019) mapped 30 unnamed streams (drainage lines) within the Maxwell Underground area and surrounds. All streams were identified as intermittent or ephemeral watercourses that flow only after periods of sustained rainfall. Strahler stream classification identifies these drainage lines as generally first or second order watercourses with small sections of third order watercourses. These ephemeral drainage lines manifest as open depressions across the landscape, generally with a shallow incised channel and occasional small ponds. Many farm dams have been constructed along these drainage lines.

The streams comprised six natural geomorphic types: Headwater; Floodplain pockets, Fine-grained; Cut and fill; Planform controlled, Low sinuosity; Planform controlled, Meandering; and one artificial type: Contour drain. The majority of streams were Headwater streams and these were judged to be geomorphologically resilient because of their setting in confined valleys (i.e. no alluvial floodplains were present) (Fluvial Systems 2019).

Drainage lines within the Maxwell Underground area would be subject to the full range of predicted subsidence, progressively as each seam is mined. Changed surface topography following subsidence would either decrease or increase the local slope in and around drainage lines. Where slope is decreased, generally upstream of chain pillars, stream power would decrease and localised depressions and ponding may occur. Fluvial Systems (2019) modelled the potential impacts of subsidence on the drainage system in terms of alignment, slope, stream power and local depressions and found only minor changes to alignment, slope and stream power. Further, Fluvial Systems (2019) suggests that as the majority of streams are of the Headwater geomorphic type, these stream types are geomorphically resilient, and any changes that occur are expected to recover quickly.

Management and remediation strategies for stream realignment include:

- visual monitoring of drainage lines following subsidence to identify regions of larger topographic change that could lead to realignment; and
- if needed, development of site-specific management plans to either ameliorate the landscape through minor works or enhance the altered landscape to benefit the ongoing agricultural management.

There is potential for subsidence-related ponding of up to approximately 2 ha to occur adjacent to existing drainage lines (Fluvial Systems 2019). This would be primarily outside of areas of verified BSAL.

Fluvial Systems (2019) considers that increased ponding across the landscape would act to trap sediment and increase the persistence of hydrologic refugia. An increased capacity of the catchment to trap sediment would help to offset the historically higher-than-natural rates of sediment generation in the catchment due to historical land clearance and management.

Management and remediation strategies for increased ponding include:

- visual monitoring of drainage lines following subsidence to identify regions of larger topographic change that could lead to ponding or other water capture issues;
- site specific management plans to either ameliorate the landscape through minor works or enhance the altered landscape to benefit the ongoing agricultural management; and
- minor works to re-establish drainage lines adversely impacted by ponding, where needed (alternately, areas of increased ponding may be developed to provide further water sources within the property, e.g. dam banks may be developed to increase pond size).

Cracking across drainage line channel beds is also possible, especially at the three isolated locations where exposed rock slabs were identified (MSEC 2019). MSEC (2019) notes that experience at other mines in the region shows that although some drainage line channel cracking has been noted at South Bulga Mine and Beltana No. 1 Underground Mine, there were no observable diversions of surface flow into the cracks once remediation had been undertaken.

Management and remediation strategies for cracking include:

- visual monitoring of drainage lines following subsidence to identify regions of larger topographic change and significant cracking issues; and
- crack remediation through infilling with local soil or other suitable material, and regrading of the local slope.

Subsidence management and remediation would occur progressively as areas are mined in each seam.

Both the Hunter River and Saddlers Creek are outside of primary subsidence impacts. MSEC (2019) predicted that any subsidence at either the Hunter River or Saddlers Creek would be less than 5 mm.

The Hunter River is over 500 m away from the underground mining area at the closest point. MSEC (2019) predicts no significant impacts on the main channel (less than 5 mm subsidence) or the floodplain or underlying alluvium (less than 20 mm subsidence). MSEC (2019) predicts no adverse impacts from the Project on the Hunter River and associated floodplain.

Saddlers Creek is approximately 240 m away from the underground mining area at its closest point to the underground mining area. The creek is expected to experience negligible subsidence, less than 5 mm (MSEC 2019).

08.2.3 Changes in Agricultural Productivity

For the period of active subsidence and remediation it may be necessary to remove small areas from agricultural production to ensure the safety of people and livestock. During this time, it is recommended that high levels of ground cover vegetation are maintained and cultivation avoided to improve surface soil stability and minimise erosion risk.

In general, it is expected that subsidence impacts to agricultural land use in the Project Area would be short-term, with minimal to no impacts to production, including over areas identified as BSAL or other highly productive soil areas.

In addition, it is expected that subsidence as a result of the Project would not result in changes to LSC Class.

08.3 Changes in Availability and Productivity of Land for Agricultural Use

Changes in land available for agricultural use would result from:

- development of surface infrastructure in support of the Project that would remove some areas temporarily from agricultural land use;
- rehabilitation of the Project surface development areas to a combination of agricultural and woodland land uses;
- conservation of the potential biodiversity offset areas that would reduce the agricultural productivity of these areas; and
- continued rehabilitation of previous mining areas at the Maxwell Infrastructure and the return of these area to agricultural use.

Each of these changes is addressed below.

08.3.1 Project Surface Development Areas and Post-Mining Land Use

The Project would involve the development of surface infrastructure, including the mine entry area and transport and services corridor (containing the site access road and a covered, overland conveyor), as well as an extension of the existing product stockpiles. In addition, Edderton Road may be realigned. In total, approximately 161 ha of agricultural land within the surface development area would be developed for surface infrastructure for the life of the Project (this excludes previous open cut mining areas at the Maxwell Infrastructure area). No BSAL would be impacted by the surface development area.

Small areas associated with monitoring, exploration and remediation would be temporarily removed from agricultural production. The Project may involve minimal temporary disturbance (<1 ha) associated with monitoring, exploration and remediation activities.

The majority of land required for surface infrastructure development would be on LSC Class 4 or greater (Table 08-2). Post-mining, approximately 123 ha of land within the surface development area (excluding the Maxwell Infrastructure area) would be returned to grazing land, with an LSC Class similar to the pre-mining LSC Class. Approximately 39 ha of land within the surface development area (excluding the Maxwell Infrastructure area) would be rehabilitated to woodland.

Rehabilitation procedures for the areas developed for Project surface infrastructure are further outlined in the EIS.

Table 08-2 Summary of LSC Class/Agricultural Land Use in the Project Surface Development Areas

Land Classification	Class 3 (ha)	Class 4 (ha)	Class 5 (ha)	Class 6 (ha)	Other Land Use	
					Infrastructure/ Previous Mining Areas (ha)	Woodland (ha)
Mine Entry Area, Transport and Services Corridor and Product Stockpile Extension						
Existing Land Use	24.3	68.5	26.4	32.6	155.0	1.3
Post-mining Land Use	14.0	92.1	42.0		16.5*	143.5
Existing Edderton Road Alignment and potential Edderton Road Realignment						
Existing Land Use	0.8	5.9	1.0	1.8	6.6 (Existing Edderton Road)	-
Post-mining Land Use	1.8	4.1	0	0.7	9.5 (Realigned Edderton Road)	-

* Land used for power line infrastructure in support of the Maxwell Solar Project in the long-term.

08.3.2 Potential Biodiversity Offset Areas

Within the Malabar-owned Plashett property, potential biodiversity offset areas, totalling 716 ha, may be conserved to offset biodiversity impacts associated with the Project. Biodiversity offset areas would be managed in accordance with a Biodiversity Stewardship Site Agreement. The key objective for the long-term security of offsets would be provided by entering into an in-perpetuity agreement with the NSW Biodiversity Conservation Trust that would safeguard the long-term restoration and protection of the areas. The creation and function of biodiversity offset areas would likely result in a reduction in current agricultural production within the areas.

This assessment conservatively assumes that no grazing would occur within potential biodiversity offset areas, although it is noted that "strategic grazing of stock" is allowable within Biodiversity Stewardship Sites under the *Biodiversity Conservation Act 2016* (as a management activity that could be undertaken to improve vegetation integrity and threatened species habitat).

Malabar provided 2rog Consulting with nominal potential biodiversity offset areas, although it is understood that the boundaries of these areas may be subject to refinement. The agricultural resources within each potential biodiversity offset area are shown in Table 08-3. Land capability ranges from very low to moderately low productivity and is considered suitable for grazing only. High intensity land use such as cropping would pose a land degradation threat to these classes.

Table 08-3 Potential Biodiversity Offset Area Summary

Land Classification	Potential Biodiversity Offset Area 1	Potential Biodiversity Offset Area 2	Potential Biodiversity Offset Area 3
Nominal area (ha)	495	148	73
Soil type	Mostly kurasol, natic, small areas of vertisol, and sodosol	Predominantly vertosol, small amount of sodosol	Predominantly vertosol with small amounts of sodosol and kurasol
LSC Class	Primarily 4, 5 and 6	Primarily 3, 4 and 6	Primarily 4 and 6
Pasture type	Native unimproved, moderate fertility	Native unimproved, moderate fertility	Native unimproved, moderate fertility

08.3.3 Maxwell Infrastructure Pasture Rehabilitation

Rehabilitation at the Maxwell Infrastructure area involves largely returning previous mining disturbance areas associated with the former Drayton Mine (including overburden emplacement areas) to an undulating landscape consistent with the surrounding natural topography, with conditions suitable to support grassland/pasture and woodland communities.

With the exception of the area proposed for the Maxwell Solar Project, the final land use for rehabilitated areas would be grassland with low intensity cattle grazing and adjoining woodland corridors.

Pasture rehabilitation areas are being and would continue to be managed to establish and maintain groundcover (90-100%) such that bare areas are minimised and tracks are stabilised. The pasture is managed so that it is not dominated by one species and maintains a sward of diverse perennial species targeted for successful grazing. This includes targets for no single species to represent more than 40% of the cover, with at least 5 species present and at least 80% of species present being targeted species. To improve the success of the grazing enterprise, stock would be provided with water with an electrical conductivity < 4,000 microSiemens per centimetre (µS/cm) and shade would be available in every grazing paddock. An adequate level of pasture cover will be maintained to support livestock. Management would also include feral animal programs, as well as annual weed assessment and treatment cycles.

A total area of approximately 473 ha of previous mining disturbance areas not required for the Project or Maxwell Solar Project would continue to be rehabilitated to grassland and used for agricultural production. The Mining Operations Plan has stated that the area will be rehabilitated to grassland and woodland communities with an LSC ranging from Class 4 to Class 7. Post-mining, an additional 32 ha of land within the Maxwell Infrastructure area that would be used for the Project would be returned to grazing land use.

08.3.4 Summary of Changes to Agricultural Land Availability

A summary of the land areas subject to the above changes is provided in Table 08-4.

Table 08-4 Summary of Changes to Agricultural Land Availability

Mining Period	Surface Development Area (ha)	Potential Biodiversity Offset Areas (ha)	Rehabilitated land at the Maxwell Infrastructure (ha)	Net change in grazing land (ha)
Mine establishment and operation	-161.3	-716.0	+473.0	-404.3
Post-mining	+122.6	-716.0	+505.1 (including an additional 32.1 ha post-mining)	-88.3

Returned to grazing land use during the life of the Project
Returned to grazing land use following decommissioning and rehabilitation at Project completion
Conserved for biodiversity purposes in-perpetuity (may allow for sporadic and light grazing)

To estimate the potential loss of agricultural production as a result of changes to agricultural land availability, the area of land and inherent land capability were considered. The approach undertaken included the following steps:

- Consider the area of the agricultural resources in each area i.e. soil types, LSC Classes, agricultural suitability class and pasture type within each area;
- Convert agricultural resource information into dry sheep equivalents (DSE) per hectare (for this assessment an average DSE of 2.8 per hectare has been assumed using estimated carrying capacity for Upper Hunter/Gloucester Native Unimproved Moderate Fertility from Blackwood *et al.* [2006]);
- Convert DSE to dry and breeding cattle equivalents using (Blackwood *et al*. 2006):
  - 1 Dry cow = 8 DSE;
  - 1 Breeding cow (average of dry and lactating) = 18.6 DSE (Table 08-5); and
- Estimate the percent cattle production reduction at the Project Area and LGA scale (for completeness, both the estimated breeding cow and dry cow impacts were calculated (Table 08-6)).

Table 08-5 Net Change to Cattle Production Capacity (Per Annum) during Operations and Post-mining

Mining period	Net change to available agricultural land (ha)	DSE	Dry cows	Breeding cows
Project construction and operations	-404.3	-1,132	-142	-61
Post-mining	-88.3	-247	-31	-13

Table 08-6 Conservative maximum Impact of the Project on Dry and Breeding Cows Production Capacity at the Property, Local and Regional Scales

Region	Estimated cattle numbers	Change in cattle numbers			
		Dry Cows during Project construction and operations	Dry Cows Post-mining	Breeding Cows during Project construction and operations	Breeding Cows Post-mining
Hunter Central Rivers NRM region	457,656*	0.031%	0.007%	0.013%	0.003%
Muswellbrook LGA	35,750**	0.397%	0.087%	0.17%	0.036%
Property (adopting previous lease conditions for Plashett)	1,370	10.3%	2.26%	4.45%	0.95%

*MLA Cattle Numbers by Natural Resource Management Region as at June 2016 (accessed 17/12/2018)
**ABS Agricultural Commodities 2016/17 accessed 17/12/2018

Based on data from the Singleton Saleyard (12 December 2018), yearling steers between 280-380 kilograms (kg) were yarded at a price of 220 cents per kg. In the very unlikely scenario that during the mine establishment and operation period all dry cows (142) produced a yearling steer of 380 kg the gross income foregone would be $118,712 per annum. A more likely but still conservative scenario is all breeding cows (61) produced a yearling steer of 330 kg with a gross income foregone of $44,286 per annum. While estimation of cattle fecundity, growth rates and market prices are all highly variable these values give an upper range for potential reductions in income.

The potential maximum impact of the Project on cattle production can be considered against regional and on-site property production levels. At the scale of the Muswellbrook LGA the potential loss of cattle production is less than 0.4% (Table 08-6) during operations. At the scale of the Project Area properties, the potential maximum loss of production ranges from approximately 4.4% to 10.3% during operations for dry and breeding cows, respectively, and less than 2.3% post-mining.

Barnett (2012) considered that the typical production on the Bowfield and Plashett properties could be significantly increased (from 1,140 head to 1,998 head) with the introduction of improved property and animal management approaches. Further, Fluvial Systems (2019) and Muswellbrook Shire Council (as an attachment to the SEARs) note that the Project Area and Saddlers Creek sub-catchment are generally in a degraded condition and that more conservative agricultural practices may help to reduce degradation and improve long-term agricultural productivity. Thus, an alternative approach to land management could be used to offset any potential short-term productivity loss, improve overall land condition and improve agricultural productivity in the long-term. These management approaches may include:

- improvement to degraded areas, primarily through temporary destocking;
- fencing of main creek line and riparian areas to improve channel bank condition, reduce erosion and also provide opportunities for light grazing in dry conditions (this approach would also require creation of stock watering points away from creek lines);
- transition from continuous to periodic stocking (i.e. resting paddocks in sequence to promote pasture growth and recovery of soil structure);
- improved soil fertility through fertility management approaches; and
- improved pasture and fodder crop production, particularly on areas of higher fertility and LSC Class 3, including areas of BSAL.

08.4 Groundwater

The three main groundwater systems identified by HydroSimulations (2019) are:

- alluvium associated with the Hunter River;
- alluvium associated with Saddlers Creek and regolith; and
- Permian strata that host the coal measures.

The AIP (NSW Government 2012) establishes minimal impact considerations for ‘highly productive groundwater’ and ‘less productive groundwater’. Highly productive groundwater is defined in the AIP as a groundwater source that is declared in the NSW *Water Management (General) Regulation 2018* and will be based on the following criteria:

- has total dissolved solids of less than 1,500 mg/L; and
- contains water supply works that can yield water at a rate greater than 5 litres per second.

The alluvial sediments associated with the Hunter Regulated River Alluvial Water Source (Upstream Glennies Creek Management Zone) are considered ‘highly productive’ in accordance with the AIP (HydroSimulations 2019). The Saddlers Creek alluvium is mapped as ‘highly productive’ (DoI – Water 2018). However, analysis of the unconsolidated alluvial sediments associated with Saddlers Creek found that these do not satisfy the AIP requirements for ‘highly productive’ groundwater, although they will be assessed against highly productive minimal impact criteria in this impact assessment (HydroSimulations 2019).

Numerical modelling of potential drawdown due to the Project has been undertaken by HydroSimulations (2019) for the Groundwater Assessment. The results of the modelling show:

- minimal impact as defined in the AIP (i.e. less than 2 m drawdown) is predicted in the ‘highly productive’ Hunter River alluvium;
- minimal impact (i.e. less than 2 m drawdown) is predicted at all privately-owned bores in ‘highly productive’ aquifers; and
- the Project is anticipated to have negligible adverse impact on groundwater quality.

A Groundwater Management Plan would be developed and implemented for the Project, and would define a groundwater monitoring strategy, groundwater level triggers, and a trigger action response plan. Malabar would implement a groundwater monitoring program, including 'make good provisions' for any material Project-related water bore drawdown should any impacts be observed during monitoring and ongoing re-evaluation of the groundwater model.

HydroSimulations (2019) predicts that the groundwater impacts of the Project would not directly impact the Equine or Viticulture CICs through reduced access or availability to groundwater resources, because:

- there would be negligible drawdown in the alluvial aquifer associated with the Hunter River and the estimated incidental groundwater take would be licensed in the Hunter Regulated River Alluvial Water Source;
- there would be no measurable impact on water quality in the Hunter River alluvial aquifer or the Hunter River; and
- Malabar currently holds sufficient licences for the predicted maximum licensable take from the Hunter Regulated River Water Source.

08.5 Surface Water

The Maxwell Underground area is drained by a network of ephemeral streams that join with Saddlers Creek or Saltwater Creek tributaries of the Hunter River. The Maxwell Underground area contains numerous ephemeral ponds along the internal stream network and 18 farm dams that may be affected by subsidence. Fluvial Systems (2019) concludes that the impacts of subsidence-related ponding on the drainage network may act to trap sediment moving downstream.

The Project water management system would operate to control poorer quality runoff (e.g. mine-affected water) in on-site water storages, such as mine water dams. WRM (2019) has considered the potential impacts of the Project on surface water and concluded:

- Nil subsidence consequences to the Hunter River and Saddlers Creek are predicted as the Project mine layout has been designed to avoid these watercourses.
- All drainage lines within the Maxwell Underground area have intermittent flow. Subsidence impacts to drainage lines would be remediated as required to prevent erosion (e.g. through the installation of rock control grade structures or use of large wood structures).
- Negligible impacts to surface water flows and quality in the Hunter River are predicted as a result of Project subsidence.

An extensive water monitoring program would be maintained for the Project to monitor surface water quantity and quality in the Hunter River and Saddlers Creek.

Further details of the surface water assessment and proposed measures to minimise the potential impacts of the Project on surface water users is provided in the Surface Water Assessment for the Project (WRM 2019).

08.6 Potential Impacts on Built Infrastructure

Key surface infrastructure above the Maxwell Underground, includes:

- farm dams (18 in total that may be affected by subsidence);
- unsealed tracks;
- land contouring;
- cattle yards and fencing;
- Edderton Road; and
- an 11 kV power line.

With the exception of Edderton Road and the 11 kV power line, all of the built features that may be affected by subsidence from the Project are owned by Malabar. It could be expected that phases of tensile and compressive strain associated with subsidence may result in damage to dams, tracks, land contouring, yards and fences.

Fluvial Systems (2019) has assessed potential impacts on surface water storage and erosion and predict minimal impacts that would be manageable via minor works if required (Section 08.2).

Surface infrastructure, such as roads, fences, yards, buildings, should be inspected prior to and following subsidence and repaired if necessary.

Impacts are expected to be minor and readily ameliorated through a program of pre-subsidence inspection and works if required, followed by post-subsidence assessment and remedial works if required. It is likely that some current infrastructure would be upgraded as part of mine development.

Impacts to Edderton Road and the 11 kV power line would be managed through specific Built Feature Management Plans. Experience throughout the Hunter Valley indicates that Built Feature Management Plans for infrastructure such as Edderton Road and the low voltage power lines are readily manageable with only minor, temporary impacts.

The Golden Highway and associated bridge across Hunter River are outside the Project Area and are unlikely to be impacted (MSEC 2019). However, these significant infrastructure features should be subject to monitoring and, if impacted, managed as part of a Built Feature Management Plan.

08.7 Neighbouring Agricultural Impacts

The Project has been designed specifically as an underground mine to minimise impacts on neighbouring properties that relate to visual impact, dust and noise.

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, equine and viticulture enterprises.

08.7.1 Visibility and Visual Sensitivity

VPA (2019) assessed the visual impact of the Project on surrounding properties, including nearby equine enterprises (Coolmore and Godolphin Woodlands Studs) and viticulture enterprise (Hollydene Estate). VPA (2019) found that views of the Project would be largely screened at these properties by the topography to the north of the Golden Highway.

There would be no views of the Project from the majority of viewpoints on the Coolmore and Godolphin Woodlands Studs. At the highest vantage points on the Coolmore and Godolphin Woodlands Studs, a section of the transport and services corridor and covered overland conveyor would be potentially visible as it crosses ridgelines north-east of the mine entry area. These components of the Project would be between 7.5 km and 7.7 km from the viewer and would take up a very small portion of the primary view (<1%), which significantly reduces discernible components (Figure 08-2 to Figure 08-5). The assessed visual impact at these vantage points is low (VPA 2019).

SHM-18-03 Maxwell_EIS_App AIS_001A

LEGEND

Visual Simulation

Source: VPA (2019)

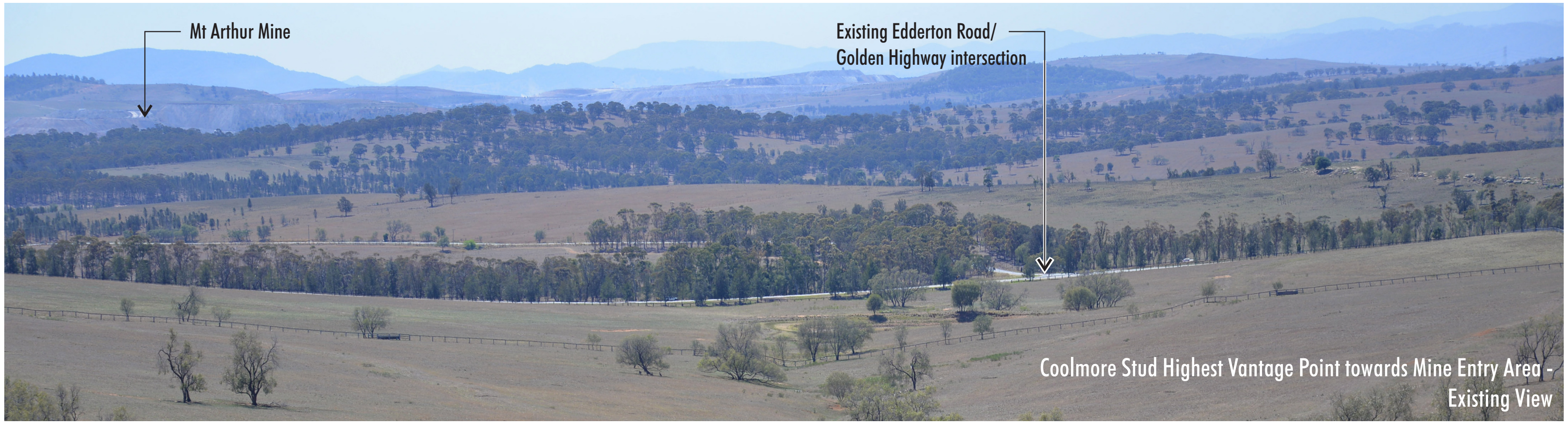
MALABAR COAL

M A X W E L L   P R O J E C T

Visual Simulation –
Coolmore Stud Highest Vantage Point

Figure 08-2

TOC



LEGEND
Visual Simulation

Source: VPA (2019)

MALABAR COAL

MAXWELL PROJECT

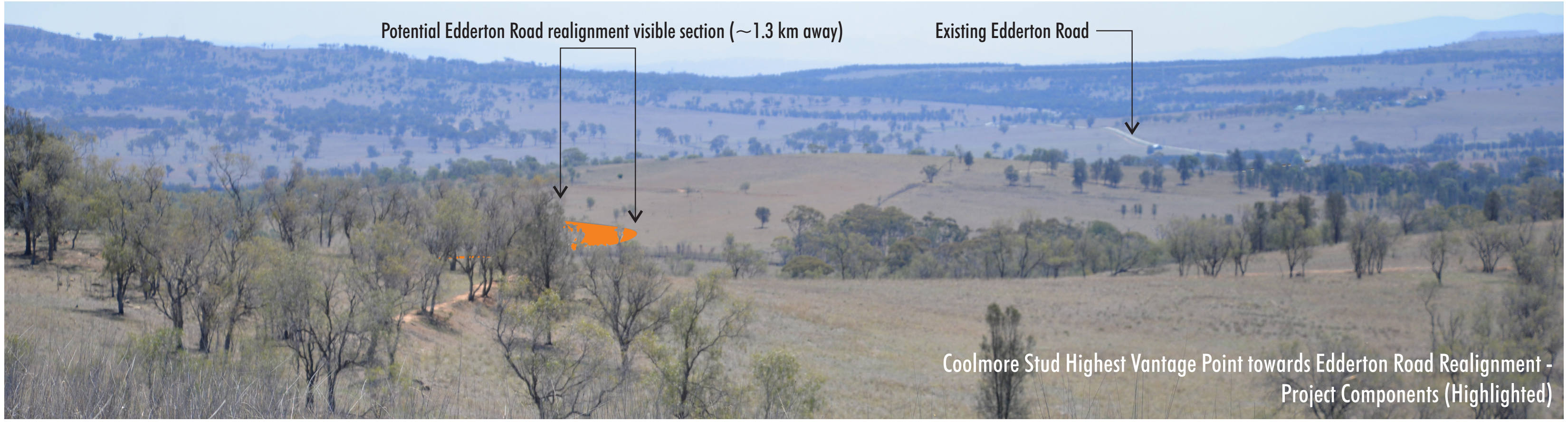
Visual Simulation –
Coolmore Stud Highest Vantage Point
Towards Mine Entry Area

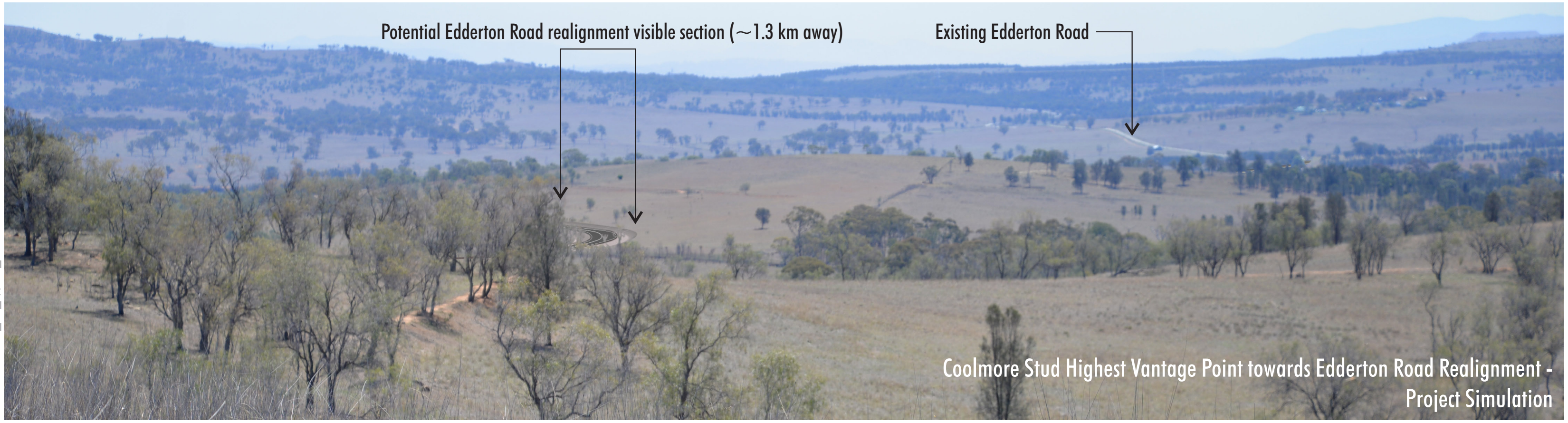
Figure 08-3

SHM-18-03 Maxwell_EIS_App AIS_002B

LEGEND
Visual Simulation

Source: VPA (2019)





SHM-18-03 Maxwell_EIS_App AIS_003B

MALABAR COAL

M A X W E L L   P R O J E C T

Visual Simulation –
Coolmore Stud Highest Vantage Point
Towards Potential Edderton Road Realignment

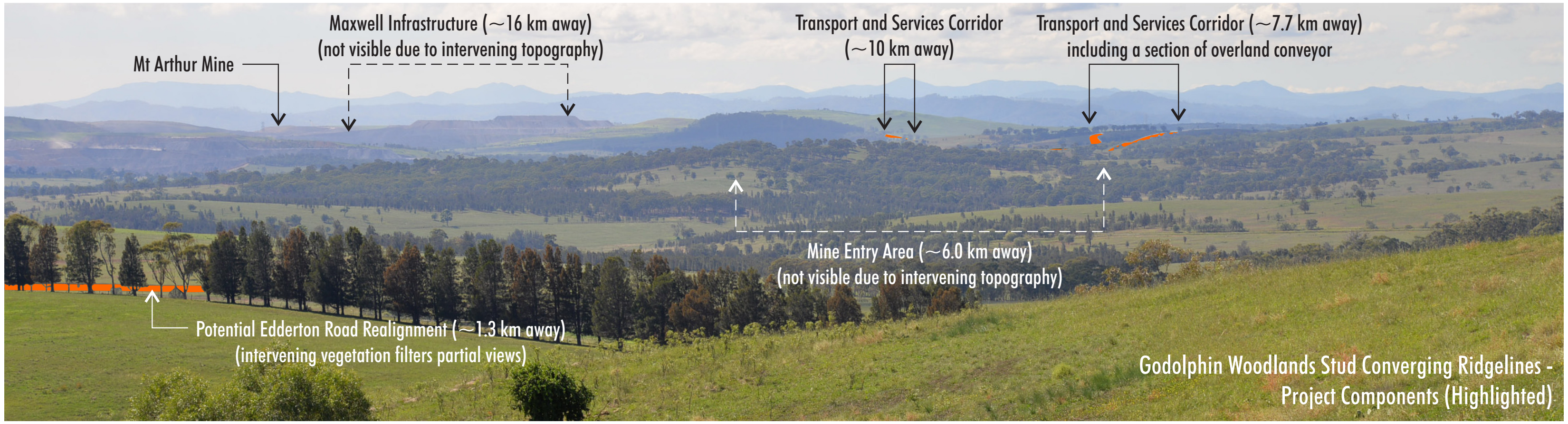
Figure 08-4

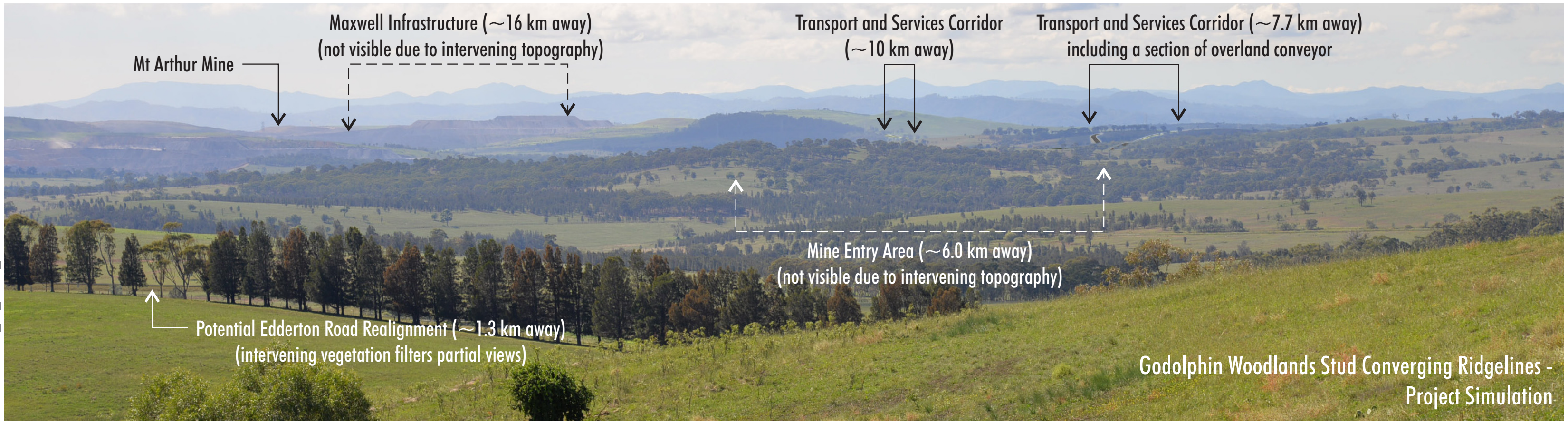
TOC

LEGEND

Visual Simulation

Source: VPA (2019)





SHM-18-03 Maxwell_EIS_App AIS_004B

MALABAR COAL

MAXWELL PROJECT

Visual Simulation – Godolphin Woodlands Stud Converging Ridgelines

Figure 08-5

There would be no views of the Project from Hollydene Estate (VPA 2019).

08.7.2 Air Quality

An assessment of potential changes in dust (or particulate matter) levels was undertaken by Todoroski Air Sciences (2019). The assessment considered both predicted incremental changes due to the Project and cumulative impacts, based upon recent and comprehensive weather and dust monitoring data and conservative estimates of dust emissions.

Todoroski Air Sciences (2019) found that, consistent with expectations from an underground mine, the Project is unlikely to result in any adverse dust or other air quality impacts.

08.7.3 Noise

An assessment of predicted noise levels from the Project and potential changes in acoustic amenity was undertaken by Wilkinson Murray (2019).

Wilkinson Murray (2019) found that noise contributions from the Project at Hollydene Estate, Coolmore Stud and Godolphin Woodlands Stud are predicted to be less than or equal to 27 A-weighted decibels (dBA). In consideration of monitored noise levels, these noise contributions would be indistinguishable from background noise.

The predicted noise levels for the Project at northern residential receivers near the Maxwell Infrastructure would generally be similar to or less than the noise levels during operation of the former Drayton Mine (Wilkinson Murray 2019).

There would be no exceedances of the relevant criteria predicted due to rail noise on the Antiene Rail Spur before and after closure of the Mt Arthur Mine. Project rail movements would result in an indiscernible increase in noise along the Main Northern Railway (less than 0.5 decibels).

08.7.4 Road Transport

TTPP (2019) examined the likely road transport implications of the Project. TTPP (2019) found that no specific measures or upgrades to the existing road network were required and the Project would not impact significantly on the capacity, safety or efficiency of the current road network.

Potential subsidence impacts on Edderton Road would be managed while maintaining Edderton Road open for through traffic, through either: (i) subsidence management and normal road maintenance along the existing alignment; or (ii) the realignment of the road around the Maxwell Underground area. TTPP (2019) estimated these management options would result in only minor changes in changes in travel time (less than 3 minutes).

In the event that Edderton Road is realigned, the new alignment of Edderton Road and new intersection with the Golden Highway would be designed and constructed in accordance with Austroads Guide to Road Design requirements and in consultation with Muswellbrook Shire Council and NSW Roads and Maritime Services (RMS) as relevant. TTPP (2019) concluded that the layout of the new intersection is safer than that of the existing intersection of Edderton Road and the Golden Highway, as it allows turning vehicles to slow clear of the through traffic on the Golden Highway.

08.8 Consideration of Potential Equine CIC and Viticulture CIC Impacts

While the Equine and Viticulture CICs are not located within the Project Area, their location to the south of the Project warrants consideration of potential impacts.

The PAC Determination Report for the Drayton South Coal Project (PAC 2017) considered potential impacts to the Equine CIC, most notably Coolmore and Godolphin Woodlands Studs, may occur via:

- impacts on air quality associated with dust from open cut operations;
- blast noise and vibration; and
- reputational risk.

In contrast to Drayton South Coal Project, the proposed Maxwell Project is an underground mine that would significantly reduce or eliminate any potential impacts on air quality or from blast noise (Todoroski Air Sciences 2019, Wilkinson Murray 2019). The Project would also be largely unnoticeable from the Coolmore and Godolphin Woodlands Studs or vineyard premises (Hollydene Estate), or anywhere along the Golden Highway (VPA 2019).

The area subject to potential subsidence to the north of the studs and vineyards is moderately undulating and any subsidence would be hard to recognise visually (Asadi *et al*. 2004). It is predicted that subsidence would not directly affect the Coolmore and Godolphin Woodlands Studs or Hollydene Estate.

Concerns raised by Coolmore Australia and Godolphin in relation to potential impacts on equine health in relation to previous proposals have related to potential dust impacts, vibration impacts and noise impacts. For this Project, it is noted that:

- Changes in particulate matter concentrations in the air at Coolmore and Godolphin Woodlands Studs would be negligible and unmeasurable (i.e. less than 0.1 micrograms per cubic metre of $PM_{2.5}$ averaged over any 24 hour period) (Todoroski Air Sciences 2019).
- Changes in dust deposition on pastures at Coolmore and Godolphin Woodlands Studs would also be negligible and unmeasurable (i.e. less than 0.05 grams per square metre per month) (Todoroski Air Sciences 2019).
- Noise contributions from the Project at the Coolmore and Godolphin Woodlands Studs would be indistinguishable from background noise (Wilkinson Murray 2019).
- There would be no noticeable vibration as a result of the Project at the Coolmore and Godolphin Woodlands Studs (Wilkinson Murray 2019).

On the basis of the above, no material risks to equine health at Coolmore and Godolphin Woodlands Stud have been identified.

A summary of impact considerations in regard to CICs is presented in Table 08-7.

Table 08-7 Consideration of CIC Impact Criteria

Criteria from clause 17H(4)(b) of the Mining SEPP	Impact assessment
Any impacts on the land through surface area disturbance and subsidence	The Project does not coincide with any areas of Equine or Viticulture CIC (MSEC 2019).
Reduced access to, or impacts on, water resources and agricultural resources	There would no direct or subsidence impacts on agricultural resources used by the Equine or Viticulture CIC (this AIS). The Project would not have any significant impacts on water resources used by nearby equine and viticulture enterprises (surface water extraction from the regulated Hunter River) (HydroSimulations 2019).
Reduced access to support services and infrastructure	The Project would not have any material impact on support services or infrastructure, as there would be no property acquisitions or other impacts likely to isolate any CIC property from, or lead to the closure of a CIC support service such as an equine veterinarian or winery (this AIS).
Reduced access to transport routes	The Project would have no significant impact on road transport capacity, safety or efficiency (TTPP 2019). Potential subsidence impacts on Edderton Road would be managed to maintain access, either through subsidence management and normal road maintenance or realignment of Edderton Road around the underground mining area. As there would be limited overlap between Project-related traffic and key transport routes used by equine and viticulture enterprises, there would be no material reduced access to transport routes (this AIS).
Loss of scenic and landscape values	The Project would not have any material impact on scenic or landscape values in consideration of the scale of the surface development and its location (VPA 2019).

08.9 Summary of Agricultural Impact Assessment

Evidence from modelling and assessment undertaken for the Project (Fluvial Systems 2019, HydroSimulations 2019, MSEC 2019, SLR 2019a, SLR 2019b, Todoroski Air Sciences 2019, TTPP 2019, VPA 2019, Wilkinson Murray 2019) and from assessment of similar projects in Australia and worldwide, show that there is likely to be insignificant impacts to agricultural resources and agricultural production as a result of the Project, given appropriate management and rehabilitation (Table 08-8).

It is expected that the Project consent conditions would require an Extraction Plan that incorporates a Land Management Plan, Built Features Management Plans and a Rehabilitation Management Plan. With appropriate development and implementation of these plans it is expected that there would be no significant long-term impact on the agricultural resources within the Project Area.

08.10 Potential Socio-Economic Impacts

Development of the Project is likely to have negligible impact on agricultural productivity within the Project Area. The Project proposes underground mining to minimise surface impacts and agricultural land uses can be maintained during the life of the Project, with relatively small areas of active subsidence temporarily excluded from grazing to maintain staff and livestock safety. A relatively small net area of agricultural land and hence production will be required for surface infrastructure for the life of the Project and for biodiversity offsets in-perpetuity. These areas are significantly offset by the return of rehabilitated pasture areas in the Maxwell Infrastructure area. The conservative predicted net impact during the Project is likely to be less than 61 breeding cows, representing or <0.2% of cattle production in the Muswellbrook LGA (Table 08-6). This reduces to less than 13 breeding cows following final decommissioning and rehabilitation, representing <0.04% of cattle production in the Muswellbrook LGA.

These potential impacts could be offset through an alternative approach to land management on the remainder of Malabar-owned land to improve overall land condition and agricultural productivity in the long-term (Section 08.3.4).

With no material change or potential improvement in agricultural production from the Project Area (with the implementation of appropriate management measures), it follows there would be negligible or even beneficial outcomes for the regional agricultural industry and related services and employment.

The Project is specifically designed as an underground mine to have minimal impact on the surface environment. Surface infrastructure would not be visible from the Golden Highway and would result in low visual impacts from Edderton Road (VPA 2019). The Project would not have any material impact on scenic or landscape values in consideration of the scale of the surface development and its location (VPA 2019). Therefore, the Project is likely to have an insignificant or negligible impact on visual amenity for tourism in the region.

08.11 Consideration of Critical Mass Thresholds

With no material change or potential improvement in agricultural production from the Project Area (with the implementation of appropriate management measures), it follows there would be negligible or even beneficial 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.

08.12 Consideration of Cumulative Impacts

The assessment of potential impacts on the availability and productivity of agricultural land includes the establishment of Malabar's Maxwell Solar Project on land at the Maxwell Infrastructure.

With no material change or potential improvement in agricultural production from the Project Area (with the implementation of appropriate management measures), there could be beneficial outcomes for the regional agricultural industry as outlined above. Therefore, the Project would not materially contribute to potential cumulative impacts on the regional agricultural industry.

Table 08-8 Summary of Agricultural Impact Assessment

Agricultural Resource, Practice or Infrastructure	Potential Impact	Management or Mitigation	Consequence to Agricultural Productivity
Resource			
Soil	Subsidence impacting soil quality through: ponding and soil degradation. Loss of agricultural soil through infrastructure development. Minimal ponding expected along existing creek lines.	Land management planning and action to minimise erosion through retention of high levels of ground cover, avoiding cultivation, repairing residual soil cracks and managing areas of poor drainage. Land management actions to ameliorate erosion should it occur. Rehabilitation upon closure to reinstate previous or other agreed land use.	No significant impact
BSAL	Subsidence impacting BSAL through erosion or degradation. Temporary loss of access to BSAL during active subsidence. Negligible surface ponding within areas of verified BSAL (Fluvial Systems 2019).	Land management planning and action to minimise erosion through retention of high levels of ground cover, minimising cultivation, repairing residual soil cracks and managing areas of poor drainage. Land management actions to ameliorate erosion/degradation should it occur. Remediation of subsidence impacts.	No significant impact

Agricultural Resource, Practice or Infrastructure	Potential Impact	Management or Mitigation	Consequence to Agricultural Productivity
Surface Water **Drainage lines**	Altered topography/catchment through subsidence (catchment area will remain almost the same for all watercourses). Ponding along creek lines. Altered dam storage or damage to dam wall or floor. Channel cracking.	Draining or incorporation of ponded areas into land management. Inspect dams before and after subsidence to monitor for damage or change to productivity. Reduce water level in larger dams prior to active subsidence. Dam repairs or augmentation made as required. Inspect channels before and after subsidence. Channel restoration works made as required. Licensing of surface water take.	No significant impact
Groundwater	Negligible impacts predicted to 'highly productive' groundwater.	Licensing of groundwater take. Groundwater and surface water monitoring with regular review of monitoring results against predictions.	No significant impact
Weeds	Weeds decrease agricultural productivity (no significant risk anticipated with appropriate management).	Weed management procedures included in Land Management Plan 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

Agricultural Resource, Practice or Infrastructure	Potential Impact	Management or Mitigation	Consequence to Agricultural Productivity
Practice			
Grazing	Small areas temporarily unavailable to grazing in active subsidence zone. Temporary loss of pasture areas: ponding and soil degradation. Loss of up to 877.3 ha of grazing land for surface infrastructure and potential biodiversity offsets during operations. Loss of up to 754.7 ha of grazing land for potential biodiversity offsets and other woodland areas for post-mining period.	Temporary restrictions on access for livestock and unauthorised personnel. Land management planning and action to minimise erosion through retention of high levels of ground cover, minimising cultivation, repairing residual soil cracks and managing areas of poor drainage. Manage all available properties and grazing resources including the Maxwell Infrastructure pasture rehabilitation areas to minimise potential production losses and return of previous surface development areas to pasture.	No significant impact
Fodder cropping	Fodder cropping areas temporarily unavailable in the area of current mining. Temporary loss of cropping area: ponding; and soil degradation.	Temporary restrictions on access. Land management planning and action to minimise erosion through retention of high levels of ground cover, minimising cultivation, repairing residual soil cracks and managing areas of poor drainage.	No significant impact
Infrastructure			
Fences and gates	Damage to fences and gates.	Monitor and repair as required.	No significant impact
Dams	Loss of dam storage volume. Damage to dam wall or floor.	Inspect dams before and after subsidence to monitor for damage or change to productivity. Reduce water level in larger dams prior to active subsidence. Dam repairs or augmentation made as required.	No significant impact
Contour banks and other erosion control works	Damage to banks or alteration to function.	Monitor post subsidence to determine any impacts. Repair banks if required.	No significant impact

Agricultural Resource, Practice or Infrastructure	Potential Impact	Management or Mitigation	Consequence to Agricultural Productivity
Neighbouring Agricultural Impacts			
Visual Sensitivity	Low impacts on visual amenity.	Mitigated through Project design (e.g. adoption of underground mining methodology and placement of mine entry area in an area screened from major viewpoints).	No significant impact
Air Quality	No adverse air quality impacts at privately-owned properties used for agricultural production.	Mitigated through Project design (e.g. adoption of underground mining methodology and placement of mine entry area).	No significant impact
Noise	No material noise impacts at privately-owned properties used for agricultural production.	Mitigated through Project design (e.g. adoption of underground mining methodology and placement of mine entry area).	No significant impact
Road Transport	No significant impact on the capacity, safety or efficiency of the current road network as a result of the Project. Minor changes in changes in travel time (less than 3 minutes) along Edderton Road.	Management of Edderton Road during the life of the Project to maintain serviceability in consultation with Muswellbrook Shire Council and RMS.	No significant impact

09 LAND USE CONFLICT RISK ASSESSMENT (LUCRA)

09.1 Assessing Potential Land Use Conflict in Rural Landscapes

Land use conflicts occur when there is a perceived impact on rights, values or amenity of one land use on another. In rural areas, these conflicts are common between agriculture and residential uses, however, land use conflict can also arise with developments in mining, infrastructure, forestry, fishing, aquaculture and other primary industries.

The most common potential issues are rural amenity and environmental protection issues. Amenity issues include impacts to the visual amenity, acoustic environment (e.g. from operations of large machinery) and air quality, including dust, odour, pesticides, and smoke. Environmental protection land use issues can include clearing of native vegetation, land degradation and increased sediment into rivers, reduced water quality in waterways due to stock access and runoff from operations. Other direct impacts of land use on neighbouring land causing conflict include straying stock, trespass, changes in stormwater flow or water access, and changes to the management of pests, weeds and stock diseases.

The DPI has developed the LUCRA, a risk-based assessment to help identify and assess potential land use conflict between neighbouring land uses.

There are four key steps for undertaking a LUCRA:

1. Gather information about a potential land use change and associated activities;
2. Evaluate the risk level of each activity;
3. Identify risk reduction management strategies; and
4. Record LUCRA results.

Sections 01 to 06 of this AIS present detailed information on the nature of the Project and contextual information of the regional setting and hence address Step 1 of the LUCRA approach. The following sections present Steps 2-4 of the LUCRA approach.

09.2 Identification of Surrounding Properties

LUCRA was undertaken on each of the properties and land uses in the vicinity of the Project (Figure 05-1, Figure 05-2) (Table 09-1). Each of the surrounding properties were assessed using the LUCRA Guideline (2011). Risk assessment was undertaken using the Risk Matrix (Table 09-2), a Probability Table (Table 09-3) and a Consequence Assessment (Table 09-4). Priority is given to identifying controls for those risks with a ranking score of 10 or higher.

Land use types were grouped and assessed under the:

1. Equine CIC.
2. Viticulture CIC.
3. Mining and power generation industry.

Impacts on residential areas to the north of the Maxwell Infrastructure are considered in the Social Impact Assessment (Appendix L of the EIS).

It is considered that Malabar's Bowfield property extends sufficiently west of the Project to provide a buffer to other properties further west.

Table 09-1 Properties Surrounding the Project and Land Uses

Property	Current Land Use	Reference within this Section
Coolmore Stud (Coolmore Australia)	Equine	Section 09.4.1
Godolphin Woodlands Stud (Godolphin)	Equine	Section 09.4.1
Hollydene Estate (Coolmore Australia)	Viticulture and tourism (cellar door)	Section 09.4.2
Mt Arthur Mine (BHP)	Mining (open cut) and cattle grazing (on buffer lands)	Section 09.4.3
Plashett Reservoir	Off-river water storage for operations at Bayswater Power Station and water supply to the Jerrys Plains township	Section 09.4.3
Bayswater Power Station and Liddell Power Station (AGL)	Power generation and cattle grazing (on buffer lands)	Section 09.4.3

09.3 LUCRA Method

Each identified land use was assessed for potential conflict risks. Risks were identified using the assessment results present in Section 08. Each identified risk was assigned a Risk Probability and Risk Consequence rating (Table 09-3,Table 09-4). The Probability and Consequence ratings for each risk were then used to create a Risk Ranking Matrix (Table 09-2) and the relative Risk Ranking assigned. Risks were identified for each stage of the Project.

Once the initial risks had been identified and ranked for each of the surrounding land uses, risk mitigation measures were recorded and an adjusted Risk Ranking assigned. Results for each LUCRA assessment are provided in Section 09.4.

Table 09-2 Risk Ranking Matrix (DPI 2011)

Probability	A	B	C	D	E
Consequence					
1	25	24	22	19	15
2	23	21	18	14	10
3	20	17	13	9	6
4	16	12	8	5	3
5	11	7	4	2	1

Table 09-3 Probability Table (DPI 2011)

Level	Descriptor	Description
A	Almost certain	Common or repeating occurrence
B	Likely	Known to occur, or ‘it has happened’
C	Possible	Could occur, or ‘I’ve heard of it happening’
D	Unlikely	Could occur in some circumstances, but not likely to occur
E	Rare	Practically impossible

Table 09-4 Measure of Consequence

Level: 1	Descriptor: Severe
Description	• Severe and/or permanent damage to the environment • Irreversible • Severe impact on the community • Neighbours are in prolonged dispute and legal action involved
Example/ Implication	• Harm or death to animals, fish, birds or plants • Long-term damage to soil or water • Odours so offensive some people are evacuated or leave voluntarily • Many public complaints and serious damage to reputation • Contravenes *Protection of the Environment Operations Act 1997* (POEO Act) and conditions under licences and permits. Almost certain prosecution under the POEO Act
Level: 2	**Descriptor: Major**
Description	• Serious and/or long-term impact on the environment • Long-term management implications • Serious impact on the community • Neighbours are in serious dispute
Example/ Implication	• Water, soil or air impacted, possibly in the long-term • Harm to animals, fish or birds or plants • Public complaints. Neighbour disputes occur. Impacts pass quickly • Contravenes conditions of licences, permits and the POEO Act • Likely prosecution
Level:3	**Descriptor: Moderate**
Description	• Moderate and/or medium-term impact to the environment and community • Some ongoing management implications • Neighbour disputes occur
Example/ Implication	• Water, soil or air impacted, probably in the short-term • No serious harm to animals, fish, birds or plants • Public largely unaware and few complaints • May contravene the conditions of licences and the POEO Act • Unlikely to result in prosecution
Level: 4	**Descriptor: Minor**
Description	• Minor and/or short-term impact to the environment and community • Can be effectively managed as part of normal operations • Infrequent disputes between neighbours
Example/ Implication	• Theoretically could affect the environment or people but no impacts noticed • No complaints • Does not affect the legal compliance status
Level: 5	**Descriptor: Negligible**
Description	• Very minor impact to the environment and community • Can be effectively managed as part of normal operations • Neighbour disputes unlikely
Example/ Implication	• No measurable or identifiable impact on the environment • No measurable impact on the community or impact is generally acceptable

09.4 LUCRA Risk Evaluation and Mitigation Assessment Results

Outcomes of the LUCRA are presented in this section as a series of tables for the Equine CIC (Table 09-5), for the Viticulture CIC (Table 09-6), and for the mining and power generation industry (Table 09-7).

09.4.1 LUCRA Equine CIC: Coolmore and Godolphin Woodlands Studs

Table 09-5 describes the unmitigated potential impacts from the Project on the nearby equine enterprises, within the Equine CIC. Risks range from level 2 (Unlikely/Negligible) to level 13 (Possible/Moderate).

The revised risk ratings considering management and mitigation (Table 09-5) show that with appropriate management risks can be reduced to below level 8 (Possible/Minor). The Project is specifically designed to minimise impacts on surrounding land users with the underground design reducing likely impacts on amenity, noise and dust to insignificant or negligible levels.

09.4.2 LUCRA Viticulture CIC: Hollydene Estate

Table 09-6 describes the unmitigated potential impacts from the mine on the nearby Viticulture CIC enterprise (Hollydene Estate). Risks range from level 1 (Rare/Negligible) to level 13 (Possible/Moderate).

The revised risk ratings considering management and mitigation (Table 09-6) show that with appropriate management risks can be reduced to below level 8 (Possible/Minor). The Project is specifically designed to minimise impacts on surrounding land users with the underground design reducing likely impacts on amenity, noise and dust to insignificant or negligible levels. Visual amenity assessment has shown that there are no views of surface infrastructure from Hollydene Estate.

09.4.3 LUCRA Mining and Power Generation Industry: Mt Arthur Mine (BHP), Plashett Reservoir, Bayswater Power Station and Liddell Power Station (AGL)

Table 09-7 describes the unmitigated potential impacts from the Project on the nearby mining and power generation industry. Risks were all considered below level 4 (Possible/Negligible).

The revised risk ratings considering management and mitigation (Table 09-7) show that with appropriate management risks can be reduced to below level 2 (Unlikely/Negligible).

09.5 Summary

In conclusion, application of LUCRA has identified a number of potential land use conflict risks for the Project on surrounding properties which represent a number of industries including equine and viticulture enterprises within the Equine and Viticulture CICs and surrounding mining and power generation operations. LUCRA has been used to identify strategies to minimise the risk of each of these potential conflicts and should be considered as part of the management of the site for the life of the Project. It is considered that potential conflicts can be adequately mitigated through the management strategies proposed.

Table 09-5 Initial Risk Evaluation and Management Strategy for the Equine CIC

Activity	Identified Potential Conflict (Unmitigated)	Unmitigated Risk Rating	Management Strategy (Method of Control)	Revised Risk Rating	Performance Target
Surface development	Activities associated with mine construction and operations negatively affect customer perception of the horse studs result in reduced income/viability/contributions to the Equine CIC.	9. Unlikely/ Moderate	Primarily controlled through Project design, in particular the commitment to develop the Project solely as an underground mining operation; locating surface infrastructure in a natural valley, away from sensitive receptors; limiting the requirement to develop new infrastructure through the use of the existing Maxwell Infrastructure; and reduction in heights of surface infrastructure to restrict view to sensitive receptors. Further mitigated through ongoing engagement with the neighbouring equine enterprises to provide Project information and work through concerns.	5. Unlikely/ Minor	Zero unmitigated complaints/ Complaint response within 24 hours.
Interaction with water resources	Impact on the availability or quality of water available to the Equine CIC.	5. Unlikely/ Minor	Integrated groundwater, surface water and biodiversity impact assessments; acquisition of sufficient water licences; groundwater and surface water monitoring programs.	2. Unlikely/ Negligible	No measurable impact on water quality or water availability at Equine CICs attributable to the Project.
Generation of noise or dust from surface activities	Impacts on the acoustic environment or air quality of the Equine CIC (not expected to be identifiable or measurable).	2. Unlikely/ Negligible	Primarily controlled through Project design. Monitoring programs to be implemented to confirm predictions.	2. Unlikely/ Negligible	No measurable impact on acoustic amenity or air quality at Equine CICs attributable to the Project.
Interactions between Malabar and neighbouring landholders	Poor consultation or engagement with neighbouring equine enterprises results in poor social outcomes.	13. Possible/ Moderate	Maintain consultation and engagement with neighbouring equine enterprises within the Equine CIC. Clear complaints response protocol.	8. Possible/ Minor	Zero unmitigated complaints/ Complaint response within 24 hours.
Management of subsidence impacts on Edderton Road	Possible minor disruptions during road maintenance activities or construction of the new alignment.	8. Possible/ Minor	Clear communication to Coolmore and Godolphin Woodlands Stud personnel of upcoming activities on Edderton Road.	4. Possible/ Negligible	No unforeseen delays on Edderton Road.
Project vehicle movements on and off-site	Increased biosecurity risks (weeds, plants and animals) as a result of vehicles moving on-site and from external regions.	8. Possible/ Minor	Where vehicles have been off road, washdown of vehicles and mechanical equipment to minimise seed transport off the site. Weed management program, including mechanical removal of identified weeds and/or the application of approved herbicides.	5. Unlikely/ Minor	Monitoring under a Biodiversity Management Plan reveals no additional risks.

Table 09-6 Initial Risk Evaluation and Management Strategy for the Viticulture CIC

Activity	Identified Potential Conflict (Unmitigated)	Unmitigated Risk Rating	Management Strategy (Method of Control)	Revised Risk Rating	Performance Target
Surface development	Activities associated with mine construction and operations negatively affect customer perception of the Hollydene Estate result in reduced income/viability/contributions to the Viticulture CIC.	1. Rare/ Negligible	Primarily controlled through Project design, in particular the commitment to develop the Project solely as an underground mining operation; locating surface infrastructure in a natural valley, away from sensitive receptors; limiting the requirement to develop new infrastructure through the use of the existing Maxwell Infrastructure; and reduction in heights of surface infrastructure to restrict view to sensitive receptors. Further mitigated through ongoing engagement with Hollydene Estate to provide Project information and work through concerns.	1. Rare/ Negligible	Zero unmitigated complaints/ Complaint response within 24 hours.
Interaction with water resources	Impact on the availability or quality of water available to the Viticulture CIC.	5. Unlikely/ Minor	Integrated groundwater, surface water and biodiversity impact assessments; acquisition of sufficient water licences; groundwater and surface water monitoring programs.	2. Unlikely/ Negligible	No measurable impact on water quality or water availability at Viticulture CICs attributable to the Project.
Generation of noise or dust from surface activities	Impacts on the acoustic environment or air quality of the Viticulture CIC (not expected to be identifiable or measurable).	2. Unlikely/ Negligible	Primarily controlled through Project design. Monitoring programs to be implemented to confirm predictions.	2. Unlikely/ Negligible	No measurable impact on acoustic amenity or air quality at Viticulture CICs attributable to the Project.
Interactions between Malabar and neighbouring landholders	Poor consultation or engagement with neighbouring viticulture enterprises results in poor social outcomes.	13. Possible/ Moderate	Maintain consultation and engagement with Hollydene Estate. Clear complaints response protocol.	8. Possible/ Minor	Zero unmitigated complaints/ Complaint response within 24 hours.
Management of subsidence impacts on Edderton Road	Possible minor disruptions during road maintenance activities or construction of the new alignment.	4. Possible/ Negligible	Clear communication to Hollydene Estate personnel of upcoming activities on Edderton Road.	4. Possible/ Negligible	No unforeseen delays on Edderton Road.
Project vehicle movements on and off-site	Increased biosecurity risks (weeds, plants and animals) as a result of vehicles moving on-site and from external regions.	8. Possible/ Minor	Where vehicles have been off road, washdown of vehicles and mechanical equipment to minimise seed transport off the site. Weed management program, including mechanical removal of identified weeds and/or the application of approved herbicides.	5. Unlikely/ Minor	Monitoring under a Biodiversity Management Plan reveals no additional risks.

Table 09-7 Initial Risk Evaluation and Management Strategy for Surrounding Mining and Power Generation Industry

Activity	Identified Potential Conflict (Unmitigated)	Unmitigated Risk Rating	Management Strategy (Method of Control)	Revised Risk Rating	Performance Target
Underground mining activities generating subsidence	Far-field subsidence impacts on infrastructure.	1. Rare/ Negligible	Subsidence Monitoring Program.	1. Rare/ Negligible	Infrastructure remains safe and serviceable.
Interaction with water resources	Impact on the availability or quality of water available to the mining and power generation industry.	2. Unlikely/ Negligible	Integrated groundwater, surface water and biodiversity impact assessment, acquisition of sufficient water licences, groundwater and surface water monitoring programs.	2. Unlikely/ Negligible	Zero unmitigated complaints.
Project vehicle movements on and off-site	Increased biosecurity risks (weeds, plants and animals) as a result of vehicles moving on-site and from external regions.	4. Possible/ Negligible	Where vehicles have been off road, washdown of vehicles and mechanical equipment to minimise seed transport off the site. Weed management program, including mechanical removal of identified weeds and/or the application of approved herbicides.	2. Unlikely/ Negligible	Monitoring under a Biodiversity Management Plan reveals no additional risks.

10 CONCLUSIONS AND RECOMMENDATIONS

Detailed assessment of potential impacts of the Project has forecast no significant impact on agricultural production and BSAL, or the adjacent Equine and Viticulture CICs.

The Project Area outside the existing mining and coal lease areas at Maxwell Infrastructure is moderately agriculturally productive. Cattle grazing is the dominant land use with some small areas of opportunistic fodder cropping. A small area of BSAL (72 ha) occurs within the western part of the Maxwell Underground area and is bisected by Edderton Road (SLR 2019a).

MSEC (2019) modelled the potential subsidence based on the underground mining layout and undertook an impact assessment for the potential consequences of subsidence in the area. MSEC (2019) also drew upon experience from measured subsidence and associated impacts from other mines in Australia, especially those from nearby mines. Expected subsidence from underground activities across the underground mining area would vary from; nil in certain areas, to a maximum of 5.6 metres in areas where the underground mining in all four seams occur (MSEC 2019). Subsidence, and remediation of observed impacts, would occur progressively in areas as each seam is mined.

Fluvial Systems (2019) modelled the potential impacts of subsidence on the landscape, focussing on surface drainage and streams. They found little to no risk of detrimental impacts to channel alignment or morphology providing appropriate land management practices were put in place. Further they highlighted that the predicted increase to surface water ponding along creek lines may be beneficial for sediment retention and may increase the persistence of hydrologic refugia.

Agricultural land in the Project Area was found to be generally of moderate to low land capability (SLR 2019b). Subsidence is likely to limit agricultural productivity over small areas for relatively short periods of time. Likely impacts such as cracking, ponding and increased erosion risk can be effectively restored through a set of routine agricultural land management practices such as ploughing and minor earth works. No areas of BSAL would be impacted by surface infrastructure development (SLR 2019a). Based on the modelling, specialist assessments and experience from nearby mines, there would be little to no risk of detrimental consequences from subsidence to agricultural resources if appropriate land management and rehabilitation is undertaken.

Given the nature of the production systems and the nature of the impacts predicted for the Project, it is likely that agricultural production can continue above the Maxwell Underground throughout the life of the Project, with access to small areas being restricted temporarily during subsidence and any associated remediation activities.

Potential reductions in available agricultural land as a result of surface infrastructure development (approximately 161 ha) and the establishment of the potential biodiversity offset areas (approximately 716 ha) for the Project are partly offset by the opening of rehabilitated pasture areas within the Maxwell Infrastructure Area (approximately 473 ha). A conservative assessment of potential lost productivity considering the current or recent management regime and inherent land capability shows a potential reduction of cattle carrying capacity in the order of 61 breeding cows in total during the life of the Project. Following cessation of mining and the appropriate decommissioning and rehabilitation of surface infrastructure areas to grazing land use, the potential impact is approximately 13 breeding cows. With improved agricultural management practices (land and livestock), these potential impacts could be completely ameliorated or production could even be increased with negligible impact on agricultural production at the property, site or regional scale. The Project rehabilitation management plan provides details of the planned approach to rehabilitate these areas to similar LSC Classes upon completion of mining.

Groundwater assessment and modelling by HydroSimulations (2019) found that any potential impacts to the 'highly productive' Hunter River alluvium would be within the 'Level 1' minimal impact thresholds as defined by the AIP.

Specialist studies concerning noise, dust, traffic and visual amenity found no significant impact on neighbouring properties or land users (Wilkinson Murray 2019, Todoroski Air Sciences 2019, TTPP 2019, VPA 2019). There are no views of the mine entry area from the equine and viticulture properties to the south of the Project, with only very limited views of the transport and services corridor from the most elevated positions on these properties. There would be no views of the infrastructure at the mine entry area or transport and services corridor from viewpoints on the Golden Highway. Therefore, there is not anticipated to be any material land use conflict between the Project and nearby Equine and Viticulture CICs.

This report represents the Agricultural Impact Statement 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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Attachment A - Refined BSAL Verification Assessment

MAXWELL PROJECT

Malabar Coal Limited
Refined Biophysical Strategic Agricultural Land Verification Assessment

SLR Ref: 630.12463.001
Version No: Revision 0
March 2019

SLR

Maxwell Project

Malabar Coal Limited

Refined Biophysical Strategic Agricultural Land Verification Assessment

PREPARED BY:

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
10 Kings Road New Lambton NSW 2305 Australia

(PO Box 447 New Lambton NSW 2305 Australia)
T: 61 2 4037 3200 F: 61 2 4037 3201
E: newcastleau@slrconsulting.com www.slrconsulting.com

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EXECUTIVE SUMMARY

Maxwell Ventures (Management) Pty Ltd, a wholly owned subsidiary of Malabar Coal Limited (Malabar), is seeking consent to develop an underground coal mining operation, referred to as the Maxwell Project (the Project).

A conditional Gateway Certificate for the Project was issued on 20 December 2018 under Part 4AA, Division 4 of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*. This document provides a refined assessment of the presence of Biophysical Strategic Agricultural Land (BSAL) within the Gateway Certificate Area in consideration of the conditions of the Gateway Certificate.

The presence of BSAL within the Gateway Certificate Area has been assessed based on surveys completed by SLR in 2015, 2018 and 2019. The assessment has been conducted in accordance with the *Interim protocol for site verification and mapping of biophysical strategic agricultural land* (Office of Environment & Heritage and Department of Primary Industries – Office of Agricultural Sustainability and Food Security, 2013).

Fourteen soil units have been identified across the Gateway Certificate Area. Of these soil units, only one soil unit was verified as BSAL. This area of BSAL is approximately 72 hectares, however some of this soil unit has been disturbed by the existing Edderton Road, which bisects this soil unit. The entire area of verified BSAL is located outside of the proposed surface development areas for the Project.

1 INTRODUCTION

Maxwell Ventures (Management) Pty Ltd, a wholly owned subsidiary of Malabar Coal Limited (Malabar), is seeking consent to develop an underground coal mining operation, referred to as the Maxwell Project (the Project).

The Project is located in the Upper Hunter Valley of New South Wales (NSW), east-southeast of Denman and south-southwest of Muswellbrook.

Underground mining is proposed within Exploration Licence (EL) 5460.

Malabar also owns the existing infrastructure within Coal Lease (CL) 229, Mining Lease (ML) 1531 and CL 395 (known as the Maxwell Infrastructure). The Project would include the use of the substantial existing Maxwell Infrastructure, along with the development of some new infrastructure.

A conditional Gateway Certificate for the Project was issued on 20 December 2018 under Part 4AA, Division 4 of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*.

This document provides a refined Biophysical Strategic Agricultural Land (BSAL) Verification Assessment of the Gateway Certificate Area to address the conditions of the Gateway Certificate. The works have been completed in accordance with the *Interim protocol for site verification and mapping of biophysical strategic agricultural land* (Office of Environment & Heritage (OEH) and Department of Primary Industries – Office of Agricultural Sustainability and Food Security (DPI-OASFS), 2013) (Interim Protocol). **Appendix A** presents a reconciliation of how the comments in the report by the Mining & Petroleum Gateway Panel have been considered and addressed in this document.

This document presents the combined results of surveys and assessments:

- completed in 2015 in support of a Gateway Certificate Application for the Drayton South Coal Project (SLR, 2015) (covering 1,458 hectares);
- completed in May 2018 in support of the Gateway Certificate Application for the Project (SLR, 2018) (covering 1,757 hectares); and
- supplemented by additional work completed in January 2019 (within the previously surveyed areas).

This document forms part of an Environmental Impact Statement (EIS) which has been prepared to accompany a Development Application for the Project in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act, 1979*.

1.1 Study Area

To provide for the refined BSAL Verification Assessment, the Gateway Certificate Area plus a 100 metre buffer, a total area of 3,215 hectares has been assessed and is referred to as the "Study Area" (**Figure 1**).

1.2 Legislation and Standards

1.2.1 Interim Protocol for Site Verification and Mapping of BSAL

In April 2013, the Interim Protocol (DPI-OASFS, 2013) was released by the NSW Government. The Interim Protocol outlines the process for seeking verification of whether or not land mapped as BSAL meets the established BSAL criteria. The *State Environment Planning Policy (Mining, Petroleum Production and Extractive Industries) Amendment 2013* (the 2013 Mining SEPP amendment) requires certain types of developments to verify whether the proposed site is on BSAL.

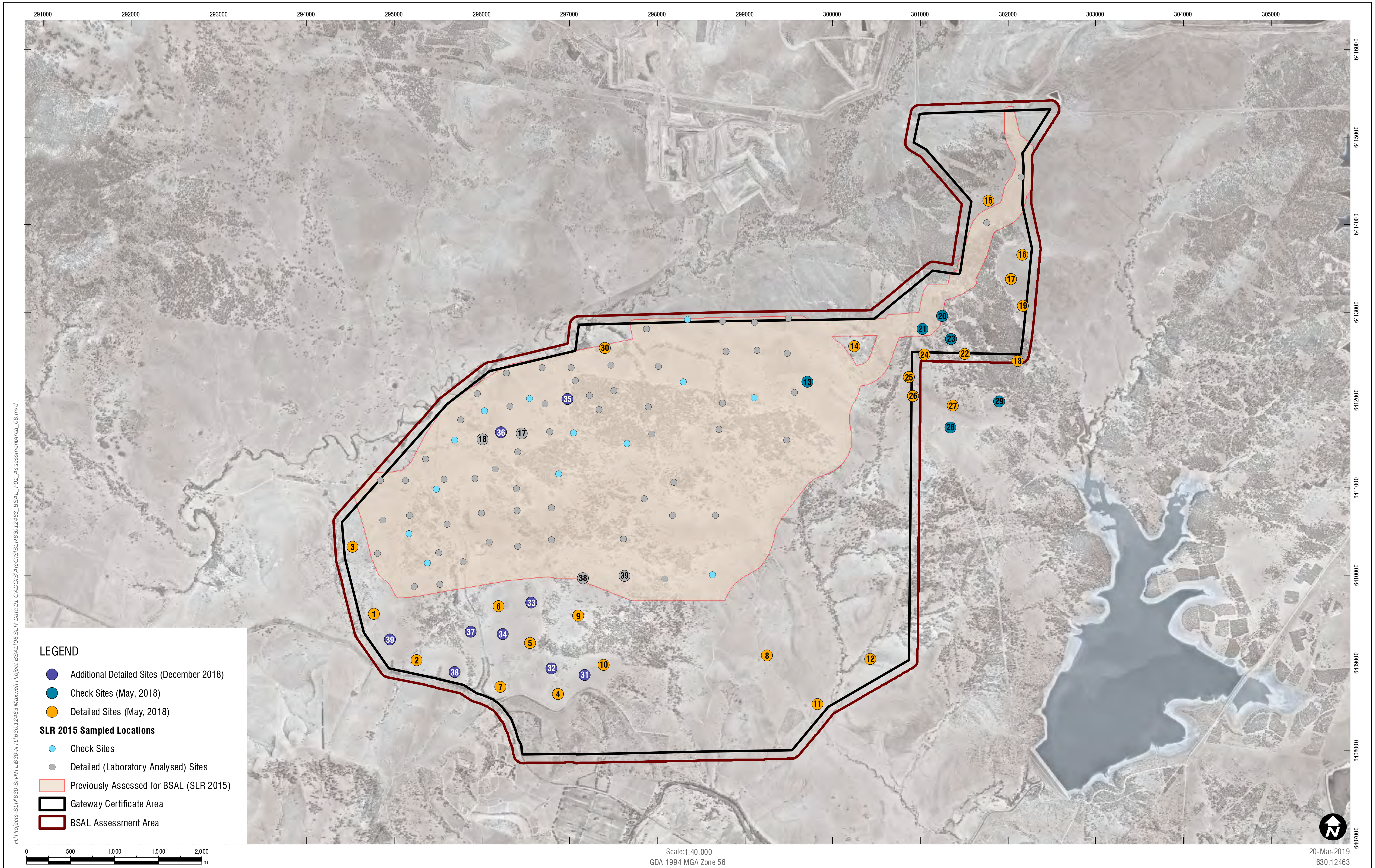
The purpose of the Interim Protocol is to assist proponents and landholders to understand what is required to identify the existence of BSAL. It outlines the technical requirements for the on-site identification and mapping of BSAL.

1.2.2 Assessment Standards

The key standards for this assessment include:

- Interim Protocol;
- Australian Soil Classification (ASC) system (Isbell, 2002);
- Guidelines for Surveying Soil and Land Resources (National Committee on Soil and Terrain (NCST), 2008); and
- Australian Soil and Land Survey Field Handbook (NCST, 2009).

All figures shown in the main report are at 1:40,000 scale. In order to meet the requirements of the Interim Protocol, figures at 1:25,000 scale are shown in **Appendix B**.



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BSAL Assessment Area

FIGURE 1

2 METHODOLOGY

The site verification methodology for the Study Area has been undertaken consistent with the process described within the Interim Protocol; including the following steps:

1. Identify the project area (termed Study Area in this report) which will be assessed for BSAL;
2. Confirm access to a reliable water supply;
3. Choose the appropriate approach to map the soils information;
4. Undertake a risk assessment; and
5. Undertake field Soil Surveys and BSAL Assessment.

Each of these steps is described in further detail in the following subsections.

2.1 Step 1: Identify the Project Area which will be Assessed for BSAL

The Interim Protocol requires that *"the assessment area should include the entire project area and include at least a 100 metre buffer to take into account minor changes in design, surrounding disturbance and minor expansion. If BSAL is part of a larger contiguous mass of BSAL then the boundary of this area must also be identified."*

The Study Area for the BSAL Verification Assessment is shown in **Figure 1**. The Study Area includes a 100 metre buffer surrounding the Gateway Certificate Application Area.

2.2 Step 2: Confirm Access to a Reliable Water Supply

The Interim Protocol requires that *"BSAL lands must have access to a 'reliable water supply'",* which includes rainfall of 350 millimetres (mm) or more per annum in 9 out of 10 years.

The Project is located in the Upper Hunter. The Interim Protocol confirms that all of the area in the Upper Hunter has access to a "reliable water supply".

2.3 Step 3: Choose the Appropriate Approach to Map the Soils Information

The Interim Protocol states *"access to the project area will define the level of investigation that the proponent can undertake. If the proponent has access to the land then the BSAL verification requirements for on-site soils assessment as described in sections 6 and 9 of the Interim Protocol should be met. If the proponent does not have access then the proponent should develop a model of soils distribution guided by sections 6 and 9 based on landscape characteristics using the information listed in Section 5 of the Interim Protocol."*

Some assessment sites were relocated away from drainage lines and possible archaeological disturbance with the revised locations selected to be still representative of the surrounding soil unit for mapping and assessment purposes.

114 hectares in the north and north-west of the Study Area were correlated with contour data and adjoining soil type information (a Sodosol and a Chromosol) due to these areas being on land not owned by Malabar.

2.4 Step 4: Risk Assessment

The Interim Protocol states *“the proponent should undertake a risk assessment as this will influence the density of soil sampling required as explained in Section 9.6.1. The proposed activity on parts or all of the project area may be of low risk to agriculture and so may only require a sampling density of 1:100 000. Alternatively other areas may be at higher risk of impact and so should have a sampling density of 1:25 000.”*

Based on the advice of the Mining & Petroleum Gateway Panel, an inspection density of 1:25,000 has been adopted across the Study Area.

2.5 Step 5: Field Soil Survey and BSAL Assessment

The field surveys for the BSAL Verification Assessment were undertaken:

- in 2015 by John Lawrie (Certified Professional Soil Scientist (CPSS) 2) with assistance from SLR staff;
- in May 2018 by SLR’s Principal Soil Scientist Clayton Richards (CPSS 2) and SLR’s Associate Agronomist, Murray Fraser; and
- in January 2019 by SLR’s Associate Agronomist, Murray Fraser supervised by Rod Masters (CPSS 2).

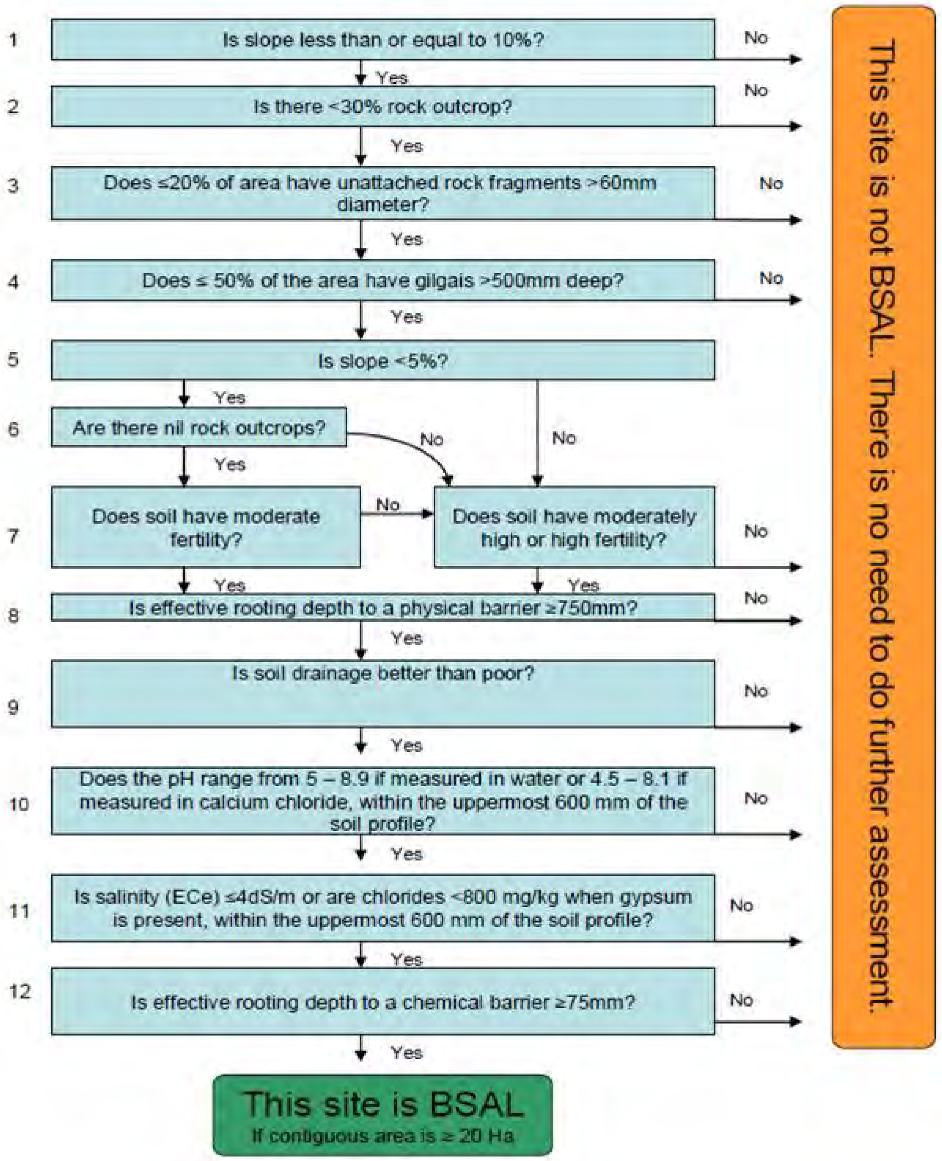
2.6 Field Soil Survey Methodology

For soil to be classified as BSAL it must meet the criteria outlined in the flow chart shown in **Diagram 1**. If any criterion is not met (except for those outlined in step 5 or step 6), the site is not BSAL and there is no need to continue the assessment.

Section 6 of the Interim Protocol states *“slope is the upward or downward incline of the land surface, measured in per cent. BSAL soils must have a slope of less than or equal to 10 per cent. If any criteria are not met, the site is not BSAL and there is no need to continue the assessment”*.

The design of the soil survey program was developed by following a process of applying the BSAL methodology as a desktop exercise in the first instance to identify any areas that could not meet the criteria (termed exclusion zones). The field survey program was then developed to target the areas that could potentially meet BSAL criteria.

Diagram 1 BSAL Criteria Flow Diagram

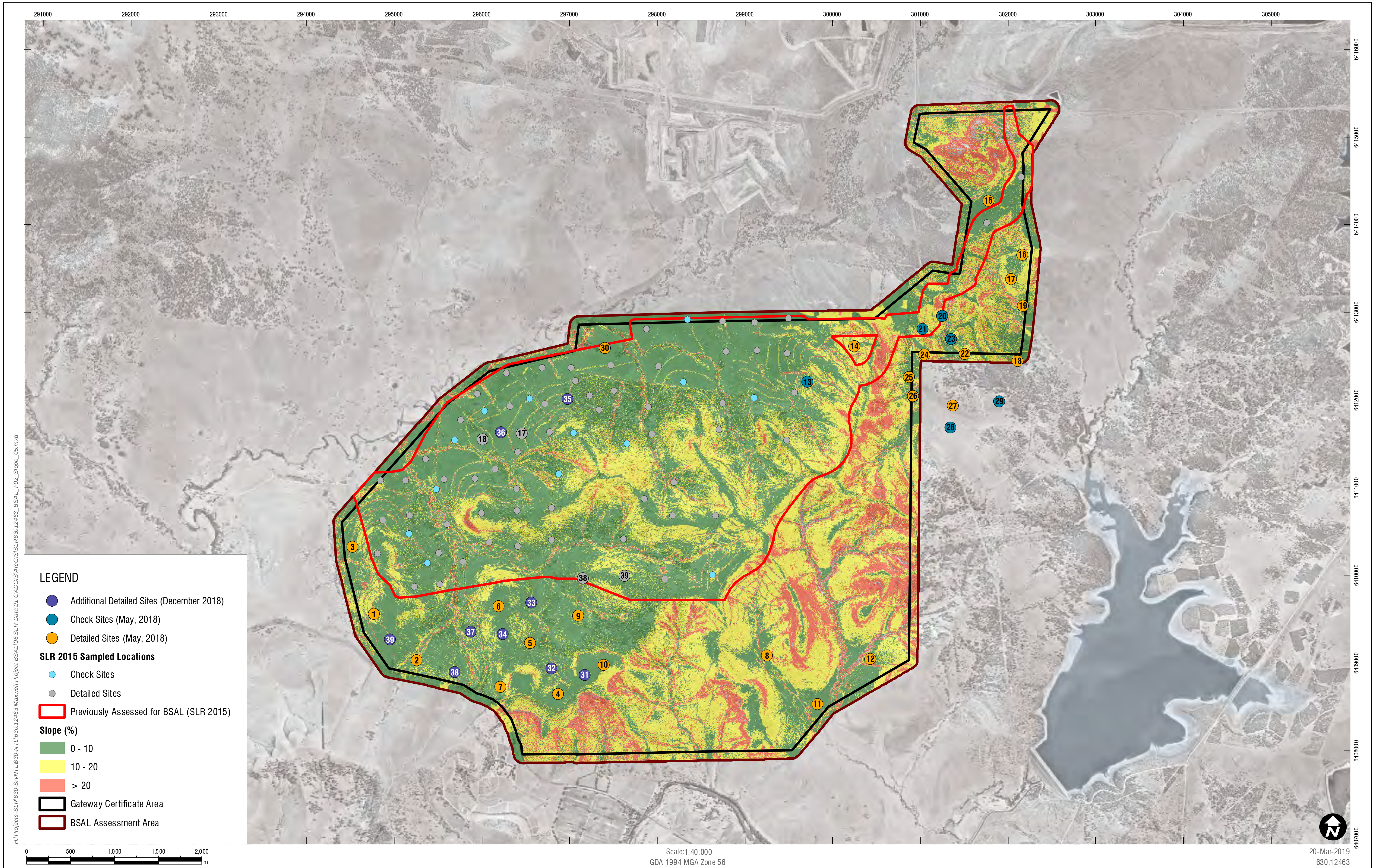


Note: In applying step 12 it was assumed that the effective rooting depth to a chemical barrier of ≥75 mm was incorrect as stated in Diagram 1, and instead a value of ≥750 mm was adopted as stated in Section 6.10 of the Interim Protocol.

2.6.1 Exclusion Zones

Land greater than 10% slope (**Figure 2**) within the Study Area was identified using topographical data derived from updated LIDAR data provided by Malabar that was captured in June 2018. This updated LIDAR was applied across the entire Study Area, including the SLR (2015) Study Area. Areas with greater than 10% slope were excluded from the soil survey program, along with any areas which were less than or equal to 10% slope and also less than 20 hectares in contiguous area. In total, 1,708 hectares of the Study Area was determined not to meet the BSAL methodology Criteria 1, as shown in **Diagram 1** and on **Figure 3**. The Slope Analysis methodology is provided in **Appendix C**.

TOC



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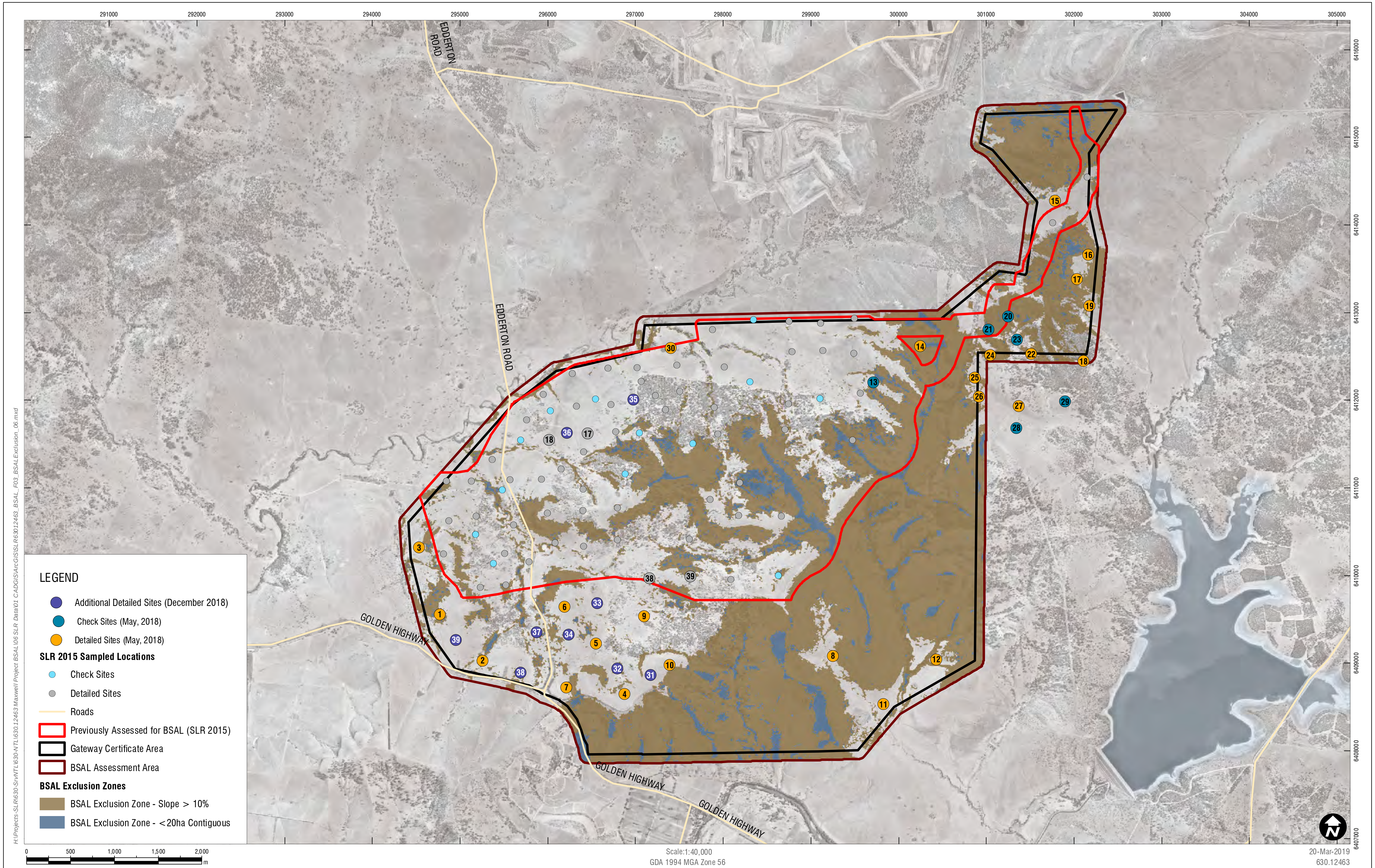
Slope Analysis

FIGURE 2



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BSAL Exclusion Areas

FIGURE 3

2.6.2 Soil Survey Density

To satisfy soil mapping requirements, the field soil survey program was undertaken for those areas outside the BSAL Exclusion Zone and comprised of 113 described sites in total, as shown on **Figure 3**. A breakdown of the soil survey density, as per Interim Protocol requirements, is provided in **Table 1**.

Table 1 Assessment of Soil Survey Density

Category	**BSAL Study Area**
Total Study Area Hectares	3,215
BSAL Exclusion Zone (Greater Than 10% Slope) Hectares	1,525
BSAL Exclusion Zone (Less Than 20 Hectares Contiguous)	183
BSAL Survey Area Hectares	**1,507**
Survey Density	**BSAL Survey Area**
1:25,000 Survey Area Hectares	1,507
Target 1:25,000 Survey Density	Minimum 65 Required Sites Actual Sites Surveyed 113
Total Number Sites	**113**
Laboratory Analysed Sites	**94***

* See Section 2.6.3 for an explanation of different soil survey observation types.

2.6.3 Soil Survey Observation Types

Soil profiles were assessed at 113 sites in accordance with the *Australian Soil and Land Survey Field Handbook* (NCST, 2009). Each soil-profile exposure was excavated by a backhoe to either a depth of 1.2 metres, to equipment refusal, or to bedrock.

Detailed soil profile morphological descriptions were prepared at all sites to record the information specified in the Interim Protocol. Information was recorded for the major parameters specified in **Table 2**.

Global Positioning System (GPS) readings was taken for all sites where soil descriptions are recorded. Vegetation type, landform and aspect were also noted. Soil exposures from pits were photographed during field operations.

Table 2 Field Assessment Parameters

Descriptor	Application
Horizon depth	Weathering characteristics, soil development
Field colour	Permeability, susceptibility to dispersion/erosion
Field texture grade	Erodibility, hydraulic conductivity, moisture retention, root penetration
Boundary distinctness and shape	Erosional/dispositional status, textural grade
Consistence force	Structural stability, dispersion, ped formation
Structure pedality grade	Soil structure, root penetration, permeability, aeration
Structure ped and size	Soil structure, root penetration, permeability, aeration
Stones – amount and size	Water holding capacity, weathering status, erosional/depositional character
Roots – amount and size	Effective rooting depth, vegetative sustainability
Ants, termites, worms etc.	Biological mixing depth

Of the 113 sites, 94 sites were detailed sites and 19 sites were check sites.

Check sites are mapping observations examined in sufficient detail to allocate the site to a specific soil type and map unit.

For detailed sites, soil was collected from each major soil horizon (soil layer). After assessment, soil pits were backfilled with the remaining soil.

Soil samples from the 94 detailed sites were utilised in the BSAL verification laboratory testing program. Samples were analysed in order to classify Australian Soil Classification (ASC) (Isbell, 2002) soil taxonomic class and enable BSAL verification.

Soil collected from each major soil horizon (soil layer) was sent to a National Association of Testing Authorities Australia (NATA) accredited laboratory (EAL Laboratories) for analysis. The selected physical and chemical laboratory analysis properties and their relevant application are listed in **Table 3**.

Table 3 Laboratory Analysis Parameters

Property	Application
Coarse Fragments (>2mm)	Soil workability; root development
Particle-Size Distribution (<2mm)	Determine fraction of clay, silt, fine sand and coarse sand; nutrient retention; exchange properties; erodibility; workability; permeability; sealing; drainage; interpretation of most other physical and chemical properties and soil qualities
Soil Reaction (pH)	Nutrient availability; nutrient fixation; toxicities (especially aluminium and manganese); liming; sodicity; correlation with other soil properties
Electrical Conductivity (EC)	Appraisal of salinity hazard in soil substrates or groundwater; total soluble salts
Cation Exchange Capacity (CEC) & Exchangeable Cations	Nutrient status; calculation of exchangeable cations including sodium, calcium, magnesium, potassium and exchangeable sodium percentage (ESP); assessment of other physical and chemical properties, especially dispersivity, shrink – swell, water movement, aeration
Munsell Colour Chart (Munsell)	Drainage, oxidation, fertility, correlation with other physical, chemical and biological properties

Soil salinity in the samples from the detailed sites was determined through measurement of the electrical conductivity (EC) of soil:water (1:5) suspensions. These values were converted to the EC of a saturated extract (ECe) based on soil texture in accordance with the Interim Protocol. The methodology and results of the conversions for all detailed sites are shown in **Appendix F**.

3 SOILS ASSESSMENT

Fourteen soil units in this Study Area were identified, each were mapped according to the dominant ASC soil type (**Figure 4**) using a combination of the soil survey and laboratory analysis results. These fourteen soil units and the observation sites associated with each are shown below in **Table 4**.

Section 9.6.2 of the Interim Protocol states "*All soil map units will have some soil variation. The dominant soil type upon which BSAL status is determined should comprise great [sic] than 70 per cent of a soil map unit*." Section 9.6.3 of the Interim Protocol further confirms "*BSAL status is determined on the dominant soil type within a soil map unit*."

A description of one detail representative site from each mapped soil unit follows in **Tables 5** to **46**, with the remaining soil profile descriptions shown in **Appendix D**. Red font is used in **Tables 5** to **46** to indicate the BSAL criteria that are not met for a particular site. Laboratory certificates of analysis are shown in **Appendix E**. Once the Gateway Certificate Area was refined by Malabar Coal, Sites 27, 28 and 29 were no longer within the Study Area, however they have been included in this assessment to ensure consistency with the laboratory analysis data presented in **Appendix E**.

Table 4 Soil Units within Study Area

Soil Unit	ASC Soil Type	Map Class	Detailed Site	Check Site	Hectares
1[#]	**Eutrophic Brown Chromosol; Deep**	**Dominant**	**21[1], 27[1], 54[1], 59[1], 75[1]**	**60[1], 72[1]**	72
2	**Self-Mulching Brown Vertosol; Deep**	**Dominant**	**11[1],18[3]**	**Nil**	49
	Eutrophic Brown Dermosol	Sub-Dominant	15[1], 16[1]	Nil	
	Eutrophic Red Chromosol		36[2]	Nil	
	Self-Mulching Red Vertosol		17[3]	Nil	
3	**Eutrophic Brown Chromosol; Moderate – Unit A**	**Dominant**	**20[1], 25[1], 26[1], 71[1]**	**19[1]**	76
	Eutrophic Red Chromosol	Sub-Dominant	24[1]	Nil	
	Eutrophic Yellow Chromosol		28[1]	Nil	
	Subnatric Brown Sodosol		70[1]	Nil	
4	**Eutrophic Brown Chromosol; Shallow**	**Dominant**	**52[1], 55[1], 56[1], 57[1], 58[1]**	**73[1]**	57
5[#]	**Subnatric Brown Sodosol – Unit A**	**Dominant**	**31[1], 40[1], 74[1]**	**41[1]**	143
	Mottled-Subnatric Brown Sodosol	Sub-Dominant	30[1]	Nil	
	Mottled-Hypernatric Grey Sodosol		29[1]	Nil	
6	**Self-Mulching Brown Vertosol; Moderate**	**Dominant**	**32[1], 33[1], 61[1]**	**Nil**	33
	Black Dermosol	Sub-Dominant	Nil	64[1]	
7	**Eutrophic Grey/Brown Chromosol**	**Dominant**	**35[1], 36[1]**	**37[1], 47[1]**	62
	Natric Yellow Kurosol	Sub-Dominant	48[1]	Nil	
8	**Mesonatric Brown Sodosol**	**Dominant**	**34[1], 43[1], 62[1]**	**44[1], 13[2]**	228
	Subnatric Brown Sodosol	Sub-Dominant	1[1], 46[1]	Nil	
	Subnatric Grey Sodosol		42[1]	Nil	
	Eutrophic Black Dermosol		2[1]	Nil	
	Self-Mulching Brown Vertosol		8[1]	Nil	
	Mottled-Subnatric Red Sodosol		14[2]	Nil	
	Eutrophic Brown Chromosol		15[2]	Nil	
9	**Eutrophic Brown Chromosol; Moderate – Unit B**	**Dominant**	**5[1], 45[1]**	**6[1]**	71
	Eutrophic Red Chromosol	Sub-Dominant	3[1]	Nil	
	Subnatric Grey Sodosol		4[1]	Nil	
10[#]	**Subnatric Brown Sodosol – Unit B**	**Dominant**	**9[1], 12[1], 13[1], 14[1], 23[1], 68[1], 76[1]**	**67[1], 69[1]**	231
	Epipedal Brown Vertosol	Sub-Dominant	30[2]	Nil	
	Mesonatric Brown Sodosol		35[2]	Nil	
	Subnatric Red Sodosol		53[1]	Nil	
	Mesonatric Red Sodosol		63[1]	66[1]	
	Subnatric Black Sodosol		65[1]	Nil	
	Eutrophic Brown Chromosol		10[1]	Nil	
	Eutrophic Brown Dermosol		7[1]	Nil	
	Hypercalcic Calcarosol		22[1], 49[1]	Nil	

Soil Unit	ASC Soil Type	Map Class	Detailed Site	Check Site	Hectares
11[#]	**Epipedal Brown Vertosol**	**Dominant**	**4[4], 5[2], 9[2], 33[2], 34[2]**	**Nil**	136
	Epipedal Red Vertosol	Sub-Dominant	37[2]	Nil	
	Eutrophic Brown Chromosol		10[4]	Nil	
	Subnatric Brown Sodosol		31[2]	Nil	
12[#]	**Eutrophic Red Chromosol**	**Dominant**	**38[1], 39[1], 3[2], 6[2], 38[2], 39[2]**	**Nil**	222
	Eutrophic Red Dermosol	Sub-Dominant	1[2]	Nil	
	Eutrophic Brown Chromosol		7[2]	Nil	
	Subnatric Red Sodosol		2[4]	Nil	
	Hypernatric Brown Sodosol		32[2]	Nil	
13	**Epipedal Black Vertosol**	**Dominant**	**8[2], 12[2]**	Nil	71
	Eutrophic Grey Dermosol	Sub-Dominant	11[2]	Nil	
14	**Subnatric Brown Sodosol – Unit C**	**Dominant**	**16[2], 17[2], 25[2], 27[2]**	**20[2], 21[2], 28[2]**	56
	Mottled-Subnatric Brown Sodosol	Sub-Dominant	22[2]	Nil	
	Subnatric Grey Sodosol		26[2]	Nil	
	Red Sodosol		Nil	23[2], 29[2]	
	Mottled-Mesonatric Brown Sodosol		18[2]	Nil	
	Eutrophic Brown Dermosol		19[2]	Nil	
	Eutrophic Brown Chromosol		24[2]	Nil	
				Soil Units Subtotal	**1,507**
Exclusion	**Greater than 10% slope or less than 20 hectares contiguous area**				**1,708**
				Total	**3,215**

These soil units are bisected by Edderton Road. It is expected that the soil resource would have been significantly impacted in the area of development, however the area of Edderton Road has been conservatively retained in the total soil unit area.

1 Sites surveyed by SLR in 2015.

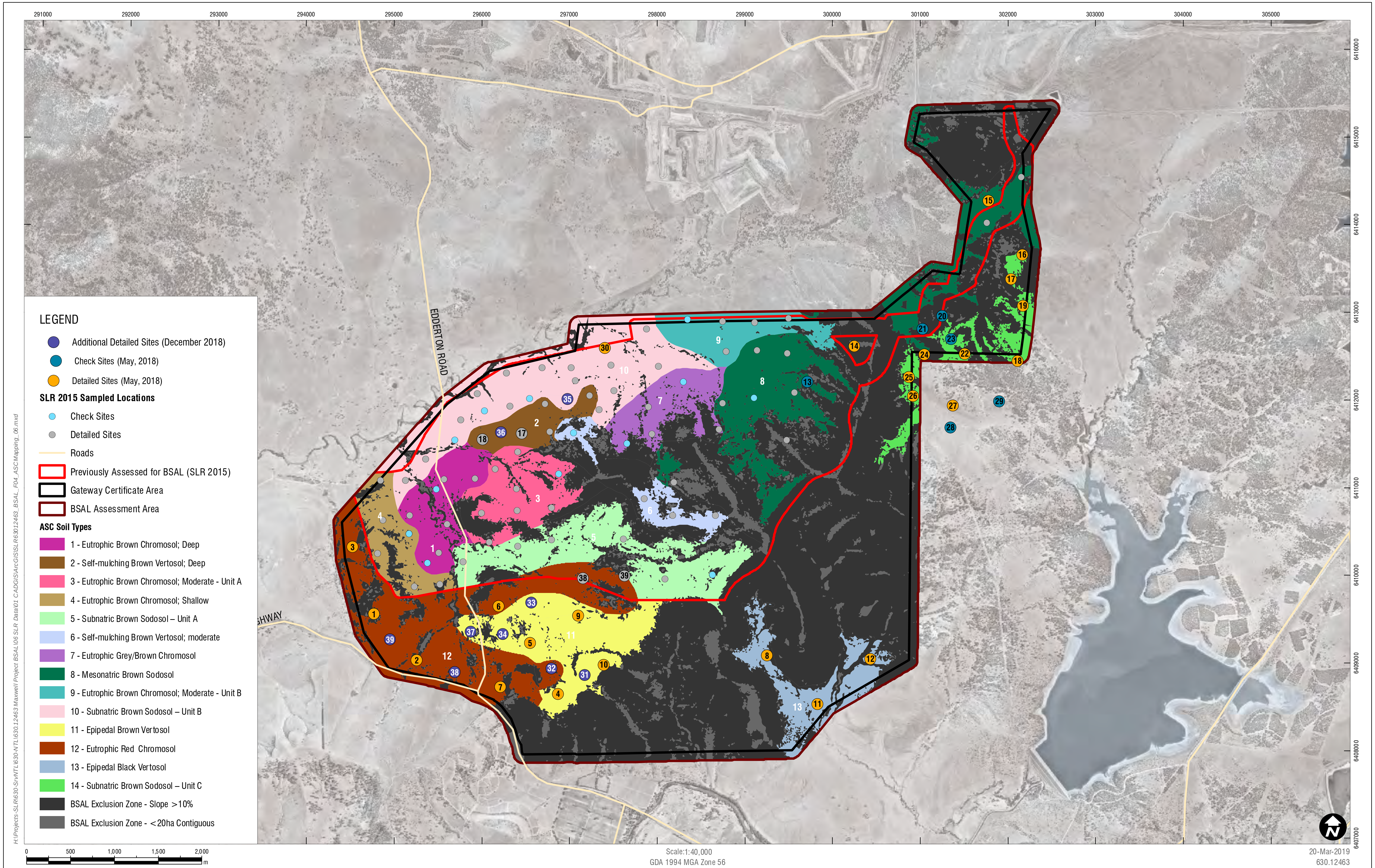
2 Sites surveyed by SLR in 2018/2019.

3 Additional laboratory analysis was undertaken at SLR (2015) Sites 17 and 18 by SLR in 2018 and 2019, respectively.

4 Additional work undertaken in 2019 included detailed analyses of Sites 2, 4 and 10, previously check sites in SLR (2018).

These soil profile descriptions are also shown in **Appendix D**.

The only change in the soil unit mapping from SLR (2018) is a change in the boundary between Soil Unit 2 (Self-Mulching Brown Vertosol; Deep) and Soil Unit 10 (Subnatric Brown Sodosol – Unit B) to reflect that the new Site 35 (Mesonatric Brown Sodosol) should be associated with Soil Unit 10.



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ASC Soil Types

FIGURE 4

Soil Unit 1: Eutrophic Brown Chromosol; Deep

Site 21 – Eutrophic Brown Chromosol

Table 5 Summary: Eutrophic Brown Chromosol (Site 21)

Overview

Landscape Site 21

ASC Name	Eutrophic Brown Chromosol
Representative Site	Site 21
Survey Year	2015
Other Mapped Sites 2015	27, 54, 59, 60, 72, 75
Survey Type	Detailed
Dominant Land Use	Grazing
Inherent Soil Fertility	Moderately High
Site Verified	BSAL

Table 6 Profile: Eutrophic Brown Chromosol (Site 21)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.08	Dark brown (7.5YR 3/4) clay loam, strong structure of 20-50 mm angular blocky peds with a strong consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; well drained with a clear and even boundary.
	B21 0.08 – 0.45	Brown (7.5YR 4/4) light-medium clay, strong structure of 20-50 mm subangular blocky peds with a strong consistence. Nil mottling; nil stone content; nil segregations; common fine roots; well drained with a clear and wavy boundary.
	B22 0.45 – 0.75	Strong brown (7.5YR 4/6) clay loam, strong structure of 20-100 mm subangular blocky peds with a strong consistence. Nil mottling; nil stone content; 20% < 5 mm soft calcareous segregations; few fine roots; well drained.
	BC +0.75	Weathering bedrock.

Table 7 Chemical Parameters: Eutrophic Brown Chromosol (Site 21)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.7	Neutral	1.3	Non-Sodic	0.9	Non-saline	1.4	Low
B21	8.7	Strongly Alkaline	5.8	Non-Sodic	2.4	Slightly saline	1.0	Low
B22	8.8	Strongly Alkaline	3.0	Non-Sodic	3.4	Slightly saline	2.6	Low

Soil Unit 2: Self-Mulching Brown Vertosol; Deep

Site 11 – Self-Mulching Brown Vertosol

Table 8 Summary: Self-Mulching Brown Vertosol (Site 11)

Overview

Landscape Site 11

ASC Name	Self-Mulching Brown Vertosol
Representative Site	Site 11
Survey Year	2015
Other Mapped Sites 2015	15, 16, 17, 18
Other Mapped Sites 2018/2019	17, 18, 36
Survey Type	Detailed
Dominant Land Use	Grazing
Inherent Soil Fertility	High
Site Verified	Non-BSAL – ECe

Table 9 Profile: Self-Mulching Brown Vertosol (Site 11)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Dark brown (10YR 3/3) light clay, strong structure of 10-50 mm angular blocky peds with a strong consistence. Nil mottling; nil stone content; nil segregations; abundant fine and coarse roots; well drained with a clear and wavy boundary.
	B1 0.10 – 0.40	Dark brown (10YR 3/3) light-medium clay, strong structure of 20-50 mm prismatic peds with a strong consistence. Nil mottling; 5% 5-10 mm stone content; nil segregations; common fine roots; well drained with a gradual and wavy boundary.
	B21 0.40 – 0.70	Dark brown (10YR 3/3) heavy clay, strong structure of 10-50 mm lenticular peds with a strong consistence. Nil mottling; 5% 5-10 mm stone content; nil segregations; common fine roots; moderately drained with a clear and wavy boundary.
	B22 +0.70	Yellowish-brown (10YR 5/6) heavy clay, strong structure of 100-200 mm angular blocky peds with a strong consistence. Nil mottling; nil stone content; 20% <5 mm calcareous segregations; few fine roots; moderately drained.

Table 10 Chemical Parameters: Self-Mulching Brown Vertosol (Site 11)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	7.2	Neutral	0.4	Non-Sodic	0.7	Non-Saline	2.5	Low
B1	7.8	Mildly Alkaline	3.4	Non-Sodic	0.7	Non-Saline	1.9	Low
B21	8.6	Strongly Alkaline	11.6	Sodic	4.1	Moderately Saline	0.8	Very Low
B22	8.5	Strongly Alkaline	7.5	Marginally Sodic	6.8	Moderately Saline	1.9	Low

Soil Unit 3: Eutrophic Brown Chromosol; Moderate – Unit A

Site 26 – Eutrophic Brown Chromosol

Table 11 Summary: Eutrophic Brown Chromosol (Site 26)

Overview

Landscape Site 26

ASC Name	Eutrophic Brown Chromosol
Representative Site	Site 26
Survey Year	2015
Other Mapped Sites 2015	19, 20, 24, 25, 28, 70, 71
Survey Type	Detailed
Dominant Land Use	Grazing
Inherent Soil Fertility	Moderately High
Site Verified	Non-BSAL – Soil Depth

Table 12 Profile: Eutrophic Brown Chromosol (Site 26)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Dark brown (10YR 3/3) loamy sand, single-grained structure. Nil mottling; nil stone content; nil segregations; abundant fine roots; moderately drained with a clear and wavy boundary.
	A2 0.15 – 0.45	Brown (7.5YR 4/4) sandy loam, massive structure. Nil mottling; nil stone content; nil segregations; common fine roots; imperfectly drained with a clear and wavy boundary.
	B2 0.45 – 0.65	Strong brown (7.5YR 5/6) light-medium clay, strong structure of 100-200 mm subangular blocky peds with a strong consistence. Nil mottling; 10% <5 mm stone content; nil segregations; few fine roots; well drained.
	C +0.65	Bedrock.

Table 13 Chemical Parameters: Eutrophic Brown Chromosol (Site 26)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.1	Slightly Acidic	1.0	Non-Sodic	0.9	Non-Saline	3.4	Low
A2	7.2	Neutral	1.5	Non-Sodic	0.3	Non-Saline	6.0	Balanced
B2	7.3	Neutral	0.4	Non-Sodic	0.4	Non-Saline	2.5	Low

Soil Unit 4: Eutrophic Brown Chromosol; Shallow

Site 58 – Eutrophic Brown Chromosol

Table 14 Summary: Eutrophic Brown Chromosol (Site 58)

Overview

Landscape Site 58

ASC Name	Eutrophic Brown Chromosol
Representative Site	Site 58
Survey Year	2015
Other Mapped Sites 2015	52, 55, 56, 57, 73
Survey Type	Detailed
Dominant Land Use	Grazing
Inherent Soil Fertility	Moderately High
Site Verified	Non-BSAL – Soil Depth

Table 15 Profile: Eutrophic Brown Chromosol (Site 58)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Dark brown (10YR 3/3) loam, moderate structure of 20-50 mm subangular blocky peds with a strong consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; well drained with a clear and wavy boundary.
	B2 0.10 – 0.40	Dark yellowish-brown (10YR 4/4) heavy clay, strong structure of 20-100 mm angular blocky peds with a strong consistence. Nil mottling; 5% <5 mm stone content; nil segregations; common fine roots; well drained with a clear and wavy boundary.
	BC 0.40 – 0.80	Weathering bedrock.
	C +0.80	Bedrock.

Table 16 Chemical Parameters: Eutrophic Brown Chromosol (Site 58)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.8	Neutral	0.3	Non-Sodic	0.8	Non-Saline	1.9	Low
B2	8.1	Moderately Alkaline	4.6	Non-Sodic	0.5	Non-Saline	0.8	Very Low

TOC

Soil Unit 5: Subnatric Brown Sodosol – Unit A

Site 40 – Subnatric Brown Sodosol

Table 17 Summary: Subnatric Brown Sodosol (Site 40)

Overview	
 Landscape Site 40	
ASC Name	Subnatric Brown Sodosol
Representative Site	Site 40
Survey Year	2015
Other Mapped Sites 2015	29, 30, 31, 41, 74
Survey Type	Detailed
Dominant Land Use	Woodland / Grazing
Inherent Soil Fertility	Moderately Low
Site Verified	Non-BSAL – Fertility & ECe

Table 18 Profile: Subnatric Brown Sodosol (Site 40)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Dark brown (7.5YR 3/3) loam, moderate structure of 20-50 mm platy peds with a moderate consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; moderately drained with an abrupt and even boundary.
	B21 0.10 – 0.35	Brown (7.5YR 4/4) heavy clay, strong structure of 20-50 mm angular blocky peds with a strong consistence. Nil mottling; nil stone content; nil segregations; common fine roots; moderately drained with a clear and wavy boundary.
	B22 0.35 – 0.70	Reddish-brown (5YR 4/4) heavy clay, strong structure of 20-50 mm angular blocky peds with a strong consistence. Nil mottling; nil stone content; 10% < 2mm soft calcareous segregations; few fine roots; well drained with a clear and wavy boundary.
	BC +0.70	Weathering bedrock.

Table 19 Chemical Parameters: Subnatric Brown Sodosol (Site 40)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.9	Neutral	0.4	Non-Sodic	0.5	Non-Saline	1.4	Low
B21	8.3	Moderately Alkaline	10.1	Sodic	1.5	Non-Saline	0.6	Very Low
B22	8.8	Strongly Alkaline	6.7	Marginally Sodic	5.6	Moderately Saline	1.3	Low

Soil Unit 6: Self-mulching Brown Vertosol; Moderate

Site 33 – Self-Mulching Brown Vertosol

Table 20 Summary: Self-Mulching Brown Vertosol (Site 33)

Overview

Landscape Site 33

ASC Name	Self-Mulching Brown Vertosol
Representative Site	Site 33
Survey Year	2015
Other Mapped Sites 2015	32, 61, 64
Survey Type	Detailed
Dominant Land Use	Grazing
Inherent Soil Fertility	High
Site Verified	Non-BSAL – Soil Depth

Table 21 Profile: Self-Mulching Brown Vertosol (Site 33)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Dark brown (7.5YR 3/4) light-medium clay, strong structure of 20-50 mm angular blocky peds with a strong consistence. Nil mottling; 10% 20-50 mm stone content; nil segregations; abundant fine roots; well drained with a gradual and even boundary.
	B2 0.10 – 0.60	Dark yellowish-brown (10YR 4/6) heavy clay, strong structure of 20-50 mm angular blocky peds with a strong consistence. Nil mottling; 5% 10 mm stone content; 10% nil segregations; common fine roots; well drained with a clear and wavy boundary.
	BC +0.60	Weathering bedrock.

Table 22 Chemical Parameters: Self-Mulching Brown Vertosol (Site 33)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	7.0	Neutral	2.0	Non-Sodic	0.4	Non-Saline	0.6	Very Low
B2	8.8	Strongly Alkaline	3.8	Non-Sodic	2.0	Slightly Saline	1.0	Low

Soil Unit 7: Eutrophic Grey/Brown Chromosol

Site 35 – Eutrophic Grey Chromosol

Table 23 Summary: Eutrophic Grey Chromosol (Site 35)

Overview

Landscape Site 35

ASC Name	Eutrophic Grey Chromosol
Representative Site	Site 35
Survey Year	2015
Other Mapped Sites 2015	36, 37, 47, 48
Survey Type	Detailed
Dominant Land Use	Woodland
Inherent Soil Fertility	Moderately High
Site Verified	Non-BSAL – ECe

Table 24 Profile: Eutrophic Grey Chromosol (Site 35)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Dark brown (7.5YR 3/2) clay loam, strong structure of 5-20 mm polyhedral peds with a strong consistence. Nil mottling; 5-10% 10 mm stone content; nil segregations; abundant fine roots; well drained with a clear and wavy boundary.
	A2 0.10 – 0.50	Brown (7.5YR 4/2) heavy clay, strong structure of 20-50 mm subangular blocky peds with a strong consistence. Nil mottling; 5% <5 mm stone content; nil segregations; common fine roots; well drained with a clear and wavy boundary.
	B22 +0.50	Brown (7.5YR 4/3) heavy clay, strong structure of 20-100 mm subangular blocky peds with a strong consistence. Nil mottling; 10% <5 mm stone content; 20% <5 mm soft calcareous segregations; few fine roots; moderately drained.

Table 25 Chemical Parameters: Eutrophic Grey Chromosol (Site 35)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.8	Neutral	0.3	Non-Sodic	0.7	Non-Saline	1.7	Low
A2	8.2	Moderately Alkaline	4.3	Non-Sodic	0.5	Non-Saline	1.0	Low
B22	8.8	Strongly Alkaline	3.6	Non-Sodic	4.1	Moderately Saline	1.7	Low

Soil Unit 8: Mesonatric Brown Sodosol

Site 62 – Mesonatric Brown Sodosol

Table 26 Summary: Mesonatric Brown Sodosol (Site 62)

Overview

Landscape Site 62

ASC Name	Mesonatric Brown Sodosol
Representative Site	Site 62
Survey Year	2015
Other Mapped Sites 2015	1, 2, 8, 34, 42, 43, 44, 46
Other Mapped Sites 2018/2019	13, 14, 15
Survey Type	Detailed
Dominant Land Use	Woodland & Grazing
Inherent Soil Fertility	Moderately Low
Site Verified	Non-BSAL – Fertility, Sodicity & ECe

Table 27 Profile: Mesonatric Brown Sodosol (Site 62)

Profile	Horizon / Depth (m)	Description
	A11 0.0 – 0.15	Dark greyish brown (10YR 4/2) Clay loam, weak structure of 15-30 mm subangular blocky peds with a weak consistence and rough fabric. Nil mottling; nil stone content; nil segregations; well drained with a gradual and wavy boundary.
	A21 0.15 – 0.30	Dark brown (7.5YR 3/3) bleached clay loam, strong structure of 20-50 mm angular blocky peds with a strong consistence and rough fabric. Nil mottling; nil stone content; nil segregations; moderately drained with a clear and wavy boundary.
	A22 0.30 – 0.70	Brown (7.5YR 4/3) bleached clay loam, strong structure of 100-500 mm columnar peds with a moderate consistence and rough fabric. Nil mottling; nil stone content; nil segregations; poorly drained with a clear and wavy boundary.
	B2 0.70 – 1.0	Brown (7.5YR 4/3) light-medium clay, strong structure of 50-100 mm angular blocky peds with a moderate consistence and smooth fabric. Nil mottling; nil stone content; 10% soft calcium carbonate segregations; moderately drained.

Table 28 Chemical Parameters: Mesonatric Brown Sodosol (Site 62)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A11	6.4	Slightly Acidic	1.5	Non Sodic	0.6	Non-Saline	1.3	Low
A21	7.4	Mildly Alkaline	4.7	Non Sodic	0.4	Non-Saline	1.3	Low
A22	7.4	Mildly Alkaline	6.9	Marginally Sodic	1.3	Non-Saline	0.9	Very Low
B2	8.6	Strongly Alkaline	17.3	Strongly Sodic	7.4	Moderately Saline	0.5	Very Low

Soil Unit 9: Eutrophic Brown Chromosol; Moderate – Unit B

Site 5 – Eutrophic Brown Chromosol

Table 29 Summary: Eutrophic Brown Chromosol (Site 5)

Overview	
 **Landscape Site 5**	
ASC Name	Eutrophic Brown Chromosol
Representative Site	Site 5
Survey Year	2015
Other Mapped Sites 2015	3, 4, 6, 45
Survey Type	Detailed
Dominant Land Use	Grazing
Inherent Soil Fertility	Moderately High
Site Verified	Non-BSAL – Soil Depth

Table 30 Profile: Eutrophic Brown Chromosol (Site 5)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.05	Dark brown (7.5YR 3/2) loam, moderate structure of 10-50 mm angular blocky peds with a strong consistence. Nil mottling; nil stone content; nil segregations; common fine roots; moderately drained with an abrupt and wavy boundary.
	B21 0.05 – 0.30	Dark yellowish-brown (10YR 4/4) light-medium clay, strong structure of 10-50 mm angular blocky peds with a strong consistence. Nil mottling; nil stone content; nil segregations; few fine roots; moderately drained with a gradual and wavy boundary.
	B22 0.30 – 0.50	Dark yellowish-brown (10YR 4/4) light-medium clay, strong structure of 50-100 mm angular blocky peds with a strong consistence. 15% faint grey mottling; nil stone content; 20% <5 mm soft calcareous segregations; few fine roots; imperfectly drained.
	BC +0.50	Weathering bedrock.

Table 31 Chemical Parameters: Eutrophic Brown Chromosol (Site 5)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.7	Neutral	0.3	Non-Sodic	1.0	Non-Saline	2.6	Low
B21	7.2	Neutral	3.3	Non-Sodic	0.4	Non-Saline	1.3	Low
B22	7.9	Moderately Alkaline	1.4	Non-Sodic	2.0	Slightly Saline	1.7	Low

Soil Unit 10: Subnatric Brown Sodosol – Unit B

Site 13 –Subnatric Brown Sodosol

Table 32 Summary: Subnatric Brown Sodosol (Site 13)

Overview

Landscape Site 13

ASC Name	Subnatric Brown Sodosol
Representative Site	Site 13
Survey Year	2015
Other Mapped Sites 2015	7, 9, 10, 12, 14, 22, 23, 49, 53, 63, 65, 66, 67, 68, 69, 76
Other Mapped Sites 2018/2019	30, 35
Survey Type	Detailed
Dominant Land Use	Grazing
Inherent Soil Fertility	Moderately Low
Site Verified	Non-BSAL – Fertility & ECe

Table 33 Profile: Subnatric Brown Sodosol (Site 13)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.08	Dark brown (10YR 3/3) clay loam, moderate structure of 20-50 mm subangular blocky peds with a strong consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; moderately drained with a clear and even boundary.
	B21 0.08 – 0.50	Dark brown (10YR 3/3) heavy clay, strong structure of 20-50 mm angular blocky peds with a strong consistence. Nil mottling; 10% <5 mm ironstone stone content; nil segregations; common fine roots; moderately drained with a clear and wavy boundary.
	B22 0.50 – 0.60	Strong brown (7.5YR 4/6) heavy clay, strong structure of 20-50 mm angular blocky peds with a strong consistence. Nil mottling; 5% 5-10 mm ironstone stone content; 30% <5 mm soft calcareous segregations; few fine roots; moderately drained with a clear and wavy boundary.
	B23 +0.60	Strong brown (7.5YR 4/6) heavy clay, strong structure of 50-100 mm angular blocky peds with a strong consistence. Nil mottling; 5% 5-10 mm ironstone stone content; 5% <5 mm manganiferous segregations; nil roots; moderately drained.

Table 34 Chemical Parameters: Subnatric Brown Sodosol (Site 13)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.5	Slightly Acidic	1.1	Non-Sodic	1.0	Non-Saline	1.2	Low
B21	8.2	Moderately Alkaline	8.5	Marginally Sodic	1.3	Non-Saline	0.9	Very Low
B22	8.5	Strongly Alkaline	6.4	Marginally Sodic	5.7	Moderately Saline	1.7	Low
B23	8.8	Strongly Alkaline	8.5	Marginally Sodic	6.7	Moderately Saline	1.6	Low

Soil Unit 11: Epipedal Brown Vertosol

Site 9 – Epipedal Brown Vertosol

Table 35 Summary: Epipedal Brown Vertosol (Site 9)

Overview

Landscape Site 9

ASC Name	Epipedal Brown Vertosol
Representative Site	Site 9
Survey Year	2018/19
Other Mapped Sites 2018/2019	4, 5, 10, 31, 33, 34, 37
Survey Type	Detailed
Dominant Topography	Mid Slope
Dominant Land Use	Cattle Grazing
Vegetation	White Box, Grey Box, Acacia, Red Grass
Inherent Soil Fertility	Moderately High
Slope	9%
Aspect	North
Site Verified	Non-BSAL – Sodicity & ECe

Table 36 Profile: Epipedal Brown Vertosol (Site 9)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Very dark brown (7.5YR 2.5/2) silty clay, moderately structured 10-20 mm blocky peds with strong consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and wavy boundary. Sampled 0.0 – 0.10.
	B21 0.20 – 0.40	Dark brown (7.5YR 3/3) silty clay, strongly structured 20-40 mm subangular blocky peds with strong consistence and a smooth fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with gradual and wavy boundary. Sampled 0.20 – 0.30.
	B22 0.40 – 0.75	Dark yellowish brown (10YR 3/4) medium clay, strongly structured 20-40 mm subangular blocky peds with strong consistence and a smooth fabric. 10% soft calcium nodules <10 mm. Nil mottling, nil stone content, coarse roots common. Well drained with gradual and wavy boundary. Sampled 0.40 – 0.50 and 0.65 – 0.75.
	B23 +0.75	Brown (7.5YR 4/4) heavy clay, massive with strong consistence and a smooth fabric. 10% soft calcium nodules <10 mm. Nil mottles, nil stone content, few coarse roots. Well drained, layer continues beyond sampling depth. Not sampled.

Table 37 Chemical Parameters: Epipedal Brown Vertosol (Site 9)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.4	Slightly Acidic	3.1	Non-Sodic	0.6	Non-Saline	1.5	Low
B21	8.0	Moderately Alkaline	11.6	Sodic	1.7	Non-Saline	0.8	Very Low
B22	8.6	Strongly Alkaline	19.7	Strongly Sodic	6.2	Moderately Saline	0.6	Very Low
B22	8.7	Strongly Alkaline	17.4	Strongly Sodic	5.6	Moderately Saline	1.1	Low

Soil Unit 12: Eutrophic Red Chromosol

Site 3 – Eutrophic Red Chromosol

Table 38 Summary: Eutrophic Red Chromosol (Site 3)

Overview	
	
	Landscape Site 3
ASC Name	Eutrophic Red Chromosol
Representative Site	Site 3
Survey Year	2018/19
Other Mapped Sites 2015	38, 39
Other Mapped Sites 2018/2019	1, 2, 6, 7, 32, 38, 39
Survey Type	Detailed
Dominant Topography	Mid Slope
Dominant Land Use	Cattle Grazing
Vegetation	Acacia, Casuarina, Wire Grass, Red Grass
Inherent Soil Fertility	Moderately High
Slope	8%
Aspect	South-West
Site Verified	Non-BSAL – Soil Depth & Drainage

Table 39 Profile: Eutrophic Red Chromosol (Site 3)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Dark yellowish brown (10YR 4/4) loamy sand, weak crumb structure 2-10 mm peds with weak consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.0 – 0.10.
	A2 0.15 – 0.40	Strong brown (7.5YR 4/6) loamy sand, weakly structured 5-10 mm blocky peds with weak consistence and a rough fabric. Bleached when dry. Nil mottling, nil stone content, fine roots common. Well drained with an abrupt and even boundary. Sampled 0.20 – 0.30.
	B2 0.40 – 0.65	Yellowish red (5YR 4/6) clay loam, strongly structured 20-50 mm subangular blocky peds with strong consistence and a rough fabric. 25% distinct yellow mottles; nil stone content; coarse roots common. Poorly drained with a clear and even boundary. Sampled 0.40 – 0.50.
	BC +0.65	Weathered sandstone. Not sampled.

Table 40 Chemical Parameters: Eutrophic Red Chromosol (Site 3)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.3	Slightly Acidic	3.5	Non-Sodic	0.5	Non-Saline	2.7	Moderate
A2	6.2	Slightly Acidic	3.7	Non-Sodic	0.2	Non-Saline	4.3	Balanced
B2	6.8	Neutral	4.3	Non-Sodic	0.3	Non-Saline	2.8	Moderate

Soil Unit 13: Black Vertosol

Site 12 – Epipedal Black Vertosol

Table 41 Summary: Epipedal Black Vertosol (Site 12)

Overview	
 **Landscape Site 12**	
ASC Name	Epipedal Black Vertosol
Representative Site	Site 12
Survey Year	2018/19
Other Mapped Sites 2018/2019	8, 11
Survey Type	Detailed
Dominant Topography	Lower Slope
Dominant Land Use	Cattle Grazing
Vegetation	White Box, Kurrajong, Red Grass, Wire Grass
Inherent Soil Fertility	High
Slope	8%
Aspect	West
Site Verified	Non-BSAL – pH 8.2 (1:5 $CaCl_2$) & Rock Outcrop^

^Rock outcrop photos shown at the end of **Appendix D**.

Table 42 Profile: Epipedal Black Vertosol (Site 12)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Dark brown (7.5YR 3/2) silty clay, strongly structured 10-20 mm blocky peds with strong consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and wavy boundary. Sampled 0.0 – 0.10.
	B21 0.20 – 0.50	Dark brown (7.5YR 3/2) heavy clay, strongly structured 20-50 mm subangular blocky peds with strong consistence and a smooth fabric. 20% soft calcium nodules 10-20 mm. Nil mottling, nil stone content, abundant coarse roots. Well drained with a gradual and wavy boundary. Sampled 0.20 – 0.30 and 0.40 – 0.50.
	B22 0.50 – 0.90	Very dark brown (7.5YR 2.5/3) medium clay, strongly structured 40-50 mm subangular blocky peds with strong consistence and a smooth fabric. 40% soft calcium nodules 10-20 mm. Nil mottling, nil stone content, coarse roots common. Well drained with a gradual and wavy boundary. Sampled 0.65 – 0.75.
	B23 +0.90	Very dark brown (7.5YR 2.5/3) heavy clay, massive structure. Layer continues beyond sample depth. Not sampled.

Table 43 Chemical Parameters: Epipedal Black Vertosol (Site 12)

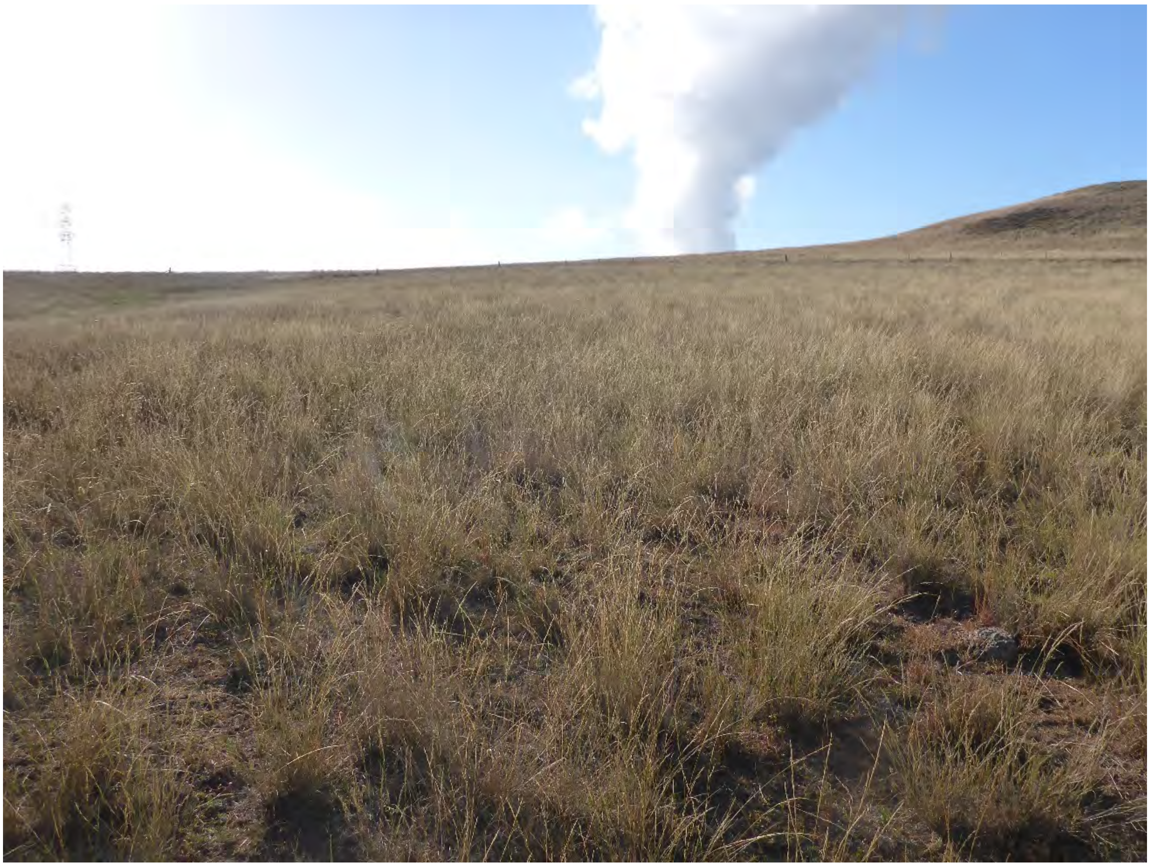
Layer	pH ($CaCl_2$)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	7.5	Mildly Alkaline	0.9	No-Sodic	1.6	Non-Saline	6.6	High
B21	7.6	Mildly Alkaline	2.1	Non-Sodic	0.9	Non-Saline	3.7	Moderate
B21	8.0	Strongly Alkaline	8.4	Marginally Sodic	2.0	Non-Saline	1.8	Low
B22	8.2	Strongly Alkaline	14.6	Strongly Sodic	3.7	Slightly Saline	1.2	Low

Soil Unit 14: Subnatric Brown Sodosol – Unit C

Site 16 – Subnatric Brown Sodosol

Table 44 Summary: Subnatric Brown Sodosol (Site 16)

Overview



Landscape Site 16

ASC Name	Subnatric Brown Sodosol
Representative Site	Site 16
Survey Year	2018/19
Other Mapped Sites 2018/2019	17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29
Survey Type	Detailed
Dominant Topography	Mid Slope
Dominant Land Use	Cattle Grazing
Vegetation	Wire Grass, Corkscrew Grass
Inherent Soil Fertility	Moderately Low
Slope	9%
Aspect	North-West
Verified	Non-BSAL – Fertility

Table 45 Profile: Subnatric Brown Sodosol (Site 16)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Dark brown (7.5YR 3/3) silty clay loam, strongly structured 10-20 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a clear and even boundary. Sampled 0.0 – 0.10.
	B21 0.15– 0.40	Dark brown (7.5YR 3/4) heavy clay, strongly structured 20-40 mm subangular blocky peds with strong consistence and a rough fabric. Nil mottles; nil stone content; coarse roots common. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30.
	B22 +0.40	Dark reddish brown (5YR 3/3) heavy clay, strongly structured 30-50 mm subangular blocky peds with strong consistence and a rough fabric. <5% soft calcium nodules 10-20 mm. Nil mottles, nil stone content, coarse roots common. Well drained with layer continuing beyond sampling depth. Sampled 0.40 – 0.50 and 0.65 – 0.75.

Table 46 Chemical Parameters: Subnatric Brown Sodosol (Site 16)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	5.7	Moderately Acidic	2.3	Non-Sodic	0.9	Non-Saline	1.4	Low
B21	7.1	Neutral	6.4	Marginally Sodic	0.5	Non-Saline	1.0	Low
B22	8.3	Moderately Alkaline	12.0	Sodic	1.6	Non-Saline	0.7	Very Low
B22	8.6	Strongly Alkaline	14.4	Strongly Sodic	1.6	Non-Saline	1.3	Low

4 BIOPHYSICAL STRATEGIC AGRICULTURAL LAND ASSESSMENT

This BSAL Verification Assessment has been conducted in accordance with the Interim Protocol.

The BSAL status was determined on the dominant soil type within each soil unit. According to the Interim Protocol, the findings of this BSAL Verification Assessment, as shown in **Table 47** and **Figure 5**, are:

- Exclusion areas of 1,525 hectares for land greater than 10% slope were identified and excluded as potential BSAL in the Study Area for this assessment.
- Exclusion areas of 183 hectares for land of slope less than 10%, but with less than 20 hectares contiguous area were identified and excluded as potential BSAL in the Study Area for this assessment.
- Soil Unit 1: Eutrophic Brown Chromosol; deep was verified BSAL. Based on the latest slope analysis, the area of this soil unit is 72 hectares. It is noted that some of this soil unit has already been disturbed by Edderton Road, which bisects this soil unit. Therefore, the area of actual BSAL remaining would be less than 72 hectares.
- There were 1,435 hectares, comprising thirteen Soil Units, verified as non-BSAL within the Study Area for this assessment.

The BSAL assessment and limitations for each soil unit and sample site is shown in **Table 48**.

Table 47 BSAL Assessment Summary

Soil Survey BSAL Assessment	Hectares
Verified BSAL	72
Verified Non-BSAL	1,435
Exclusion Area	1,708
BSAL Assessment Total	**3,215**
Verified Non-BSAL	**Hectares**
Soil Type Verified Non-BSAL	1,435
Exclusion Greater Than 10% Slope	1,525
Exclusion Less Than 20 Hectares Contiguous Area	183
Verified Non-BSAL Total	**3,143**

Table 48 BSAL Assessment

Site Number	Inspection Type	ASC Soil Type (to ASC Great Group for detailed sites)	1. Is slope < 10%?	2. Is there < 30% Rock Outcrop?	3. < 20% unattached Rock Fragments > 60mm?	4. Does < 50% have Gilgais >500mm deep?	5. Is Slope <5%?	6. Are there nil rock outcrops?	7a. Does soil have moderate fertility?	7b. Does soil have moderately high or high fertility?	8. Is ERD to a physical barrier >750mm?	9. Is drainage better than poor?	10. Is pH between 5.0 and 8.9 (water) and 4.5 and 8.1 (CaCl2)?	11. Is salinity (ECe) < 4 dS/m	12. Is ERD to a chemical barrier >750mm?	Is the Soil Unit BSAL?
Soil Unit 1 – Eutrophic Brown Chromosol; Deep																
21[1]	Detailed	Eutrophic Brown Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✓	✓	✓	✓	✓	
27[1]	Detailed	Eutrophic Brown Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✓	✓	✓	✓	✓	
54[1]	Detailed	Eutrophic Brown Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✓	✓	✓	✓	✓	
59[1]	Detailed	Eutrophic Brown Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✓	✓	✓	✓	✓	**Yes**
75[1]	Detailed	Eutrophic Brown Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✓	✓	✓	✓	✓	
60[1]	Check	Brown Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✓	✓	✓	✓	✓	
72[1]	Check	Brown Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✓	✓	✓	✓	✓	
Soil Unit 2 – Self-Mulching Brown Vertosol; Deep																
11[1]	Detailed	Self-Mulching Brown Vertosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✓	✓	✓	✗	-	
15[1]	Detailed	Eutrophic Brown Dermosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✓	✓	✓	✓	✗	
16[1]	Detailed	Eutrophic Brown Dermosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✓	✓	✓	✓	✓	
36[2]	Detailed	Eutrophic Red Chromosol	✓	✓	✓	✓	✗	✓	✓	✓	✗	✓	✓	✓	✓	**No**
17[3]	Detailed	Self-Mulching Red Vertosol	✓	✓	✓	✓	✗	✓	✓	✓	✗	✓	✗	✗	✗	
18[3]	Detailed	Self-Mulching Brown Vertosol	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	

Site Number	Inspection Type	ASC Soil Type (to ASC Great Group for detailed sites)	1. Is slope < 10%?	2. Is there < 30% Rock Outcrop?	3. < 20% unattached Rock Fragments > 60mm?	4. Does < 50% have Gilgais >500mm deep?	5. Is Slope <5%?	6. Are there nil rock outcrops?	7a. Does soil have moderate fertility?	7b. Does soil have moderately high or high fertility?	8. Is ERD to a physical barrier >750mm?	9. Is drainage better than poor?	10. Is pH between 5.0 and 8.9 (water) and 4.5 and 8.1 (CaCl2)?	11. Is salinity (ECe) < 4 dS/m	12. Is ERD to a chemical barrier >750mm?	Is the Soil Unit BSAL?
Soil Unit 3 – Eutrophic Brown Chromosol; Moderate – Unit A																
20[1]	Detailed	Eutrophic Brown Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✓	✓	✓	✗	-	No
25[1]	Detailed	Eutrophic Brown Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✗	-	-	-	-	
26[1]	Detailed	Eutrophic Brown Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✗	-	-	-	-	
71[1]	Detailed	Eutrophic Brown Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✓	✓	✗	-	-	
19[1]	Check	Brown Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✗	-	-	-	-	
24[1]	Detailed	Eutrophic Red Chromosol	✓	✓	✓	✓	✓	✓	✓	✓	✗	-	-	-	-	
28[1]	Detailed	Eutrophic Yellow Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✓	✗	-	-	-	
70[1]	Detailed	Subnatric Brown Sodosol	✓	✓	✓	✓	✗	N/A	N/A	✗	-	-	-	-	-	
Soil Unit 4 – Eutrophic Brown Chromosol; Shallow																
56[1]	Detailed	Eutrophic Brown Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✗	-	-	-	-	No
57[1]	Detailed	Eutrophic Brown Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✗	-	-	-	-	
58[1]	Detailed	Eutrophic Brown Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✗	-	-	-	-	
73[1]	Check	Brown Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✗	-	-	-	-	
55[1]	Detailed	Eutrophic Brown Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✓	✓	✓	✗	-	
52[1]	Detailed	Eutrophic Brown Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✓	✓	✓	✗	-	

Site Number	Inspection Type	ASC Soil Type (to ASC Great Group for detailed sites)	1. Is slope < 10%?	2. Is there < 30% Rock Outcrop?	3. < 20% unattached Rock Fragments > 60mm?	4. Does < 50% have Gilgais >500mm deep?	5. Is Slope <5%?	6. Are there nil rock outcrops?	7a. Does soil have moderate fertility?	7b. Does soil have moderately high or high fertility?	8. Is ERD to a physical barrier >750mm?	9. Is drainage better than poor?	10. Is pH between 5.0 and 8.9 (water) and 4.5 and 8.1 (CaCl2)?	11. Is salinity (ECe) < 4 dS/m	12. Is ERD to a chemical barrier >750mm?	Is the Soil Unit BSAL?
Soil Unit 5 – Subnatric Brown Sodosol – Unit A																
31[1]	Detailed	Subnatric Brown Sodosol	✓	✓	✓	✓	✓	✓	✗	✗	-	-	-	-	-	**No**
40[1]	Detailed	Subnatric Brown Sodosol	✓	✓	✓	✓	✗	N/A	N/A	✗	-	-	-	-	-	
74[1]	Detailed	Subnatric Brown Sodosol	✓	✓	✓	✓	✓	✓	✗	✗	-	-	-	-	-	
30[1]	Detailed	Mottled-Subnatric Brown Sodosol	✓	✓	✓	✓	✗	N/A	N/A	✗	-	-	-	-	-	
41[1]	Check	Brown Sodosol	✓	✓	✓	✓	✗	N/A	N/A	✗	-	-	-	-	-	
29[1]	Detailed	Mottled-Hypernatric Grey Sodosol	✓	✓	✓	✓	✗	N/A	N/A	✗	-	-	-	-	-	
Soil Unit 6 – Self-Mulching Brown Vertosol; Moderate																
32[1]	Detailed	Self-Mulching Brown Vertosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✗	-	-	-	-	**No**
33[1]	Detailed	Self-Mulching Brown Vertosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✗	-	-	-	-	
61[1]	Detailed	Self-Mulching Brown Vertosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✗	-	-	-	-	
64[1]	Check	Black Dermosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✗	-	-	-	-	
Soil Unit 7 – Eutrophic Grey/Brown Chromosol																
35[1]	Detailed	Eutrophic Grey Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✓	✓	✓	✗	-	**No**
36[1]	Detailed	Eutrophic Brown Chromosol	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
37[1]	Check	Brown Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✗	-	-	-	-	
47[1]	Check	Brown Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✗	-	-	-	-	
48[1]	Detailed	Natric Yellow Kurosol	✓	✓	✓	✓	✓	✓	✗	✗	-	-	-	-	-	

Site Number	Inspection Type	ASC Soil Type (to ASC Great Group for detailed sites)	1. Is slope < 10%?	2. Is there < 30% Rock Outcrop?	3. < 20% unattached Rock Fragments > 60mm?	4. Does < 50% have Gilgais >500mm deep?	5. Is Slope <5%?	6. Are there nil rock outcrops?	7a. Does soil have moderate fertility?	7b. Does soil have moderately high or high fertility?	8. Is ERD to a physical barrier >750mm?	9. Is drainage better than poor?	10. Is pH between 5.0 and 8.9 (water) and 4.5 and 8.1 (CaCl2)?	11. Is salinity (ECe) < 4 dS/m	12. Is ERD to a chemical barrier >750mm?	Is the Soil Unit BSAL?
Soil Unit 8 – Mesonatric Brown Sodosol																NLT – not lab tested
34[1]	Detailed	Mesonatric Brown Sodosol	✓	✓	✓	✓	✗	N/A	N/A	✗	-	-	-	-	-	No
43[1]	Detailed	Mesonatric Brown Sodosol	✓	✓	✓	✓	✗	N/A	N/A	✗	-	-	-	-	-	
62[1]	Detailed	Mesonatric Brown Sodosol	✓	✓	✓	✓	✗	N/A	N/A	✗	-	-	-	-	-	
1[1]	Detailed	Subnatric Brown Sodosol	✓	✓	✓	✓	✗	N/A	N/A	✗	-	-	-	-	-	
46[1]	Detailed	Subnatric Brown Sodosol	✓	✓	✓	✓	✓	✓	✗	✗	-	-	-	-	-	
44[1]	Check	Brown Sodosol	✓	✓	✓	✓	✗	N/A	N/A	✗	-	-	-	-	-	
42[1]	Detailed	Subnatric Grey Sodosol	✓	✓	✓	✓	✗	N/A	N/A	✗	-	-	-	-	-	
2[1]	Detailed	Eutrophic Black Dermosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✓	✓	✓	✗	-	
8[1]	Detailed	Self-Mulching Brown Vertosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✗	-	-	-	-	
13[2]	Check	Brown Sodosol	✓	✓	✓	✓	✗	✓	✗	✗	✗	✓	NLT	NLT	NLT	
14[2]	Detailed	Mottled-Subnatric Red Sodosol	✗	✓	✓	✓	✗	✓	✗	✗	✗	✗	✓	✗	✗	
15[2]	Detailed	Eutrophic Brown Chromosol	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	
Soil Unit 9 – Eutrophic Brown Chromosol; Moderate – Unit B																
5[1]	Detailed	Eutrophic Brown Chromosol	✓	✓	✓	✓	✓	✓	✓	✓	✗	-	-	-	-	No
45[1]	Detailed	Eutrophic Brown Chromosol	✓	✓	✓	✓	✓	✓	✓	✓	✗	-	-	-	-	
6[1]	Check	Brown Chromosol	✓	✓	✓	✓	✓	✓	✓	✓	✗	-	-	-	-	
3[1]	Detailed	Eutrophic Red Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✗	-	-	-	-	
4[1]	Detailed	Subnatric Grey Sodosol	✓	✓	✓	✓	✓	✓	✗	✗	-	-	-	-	-	

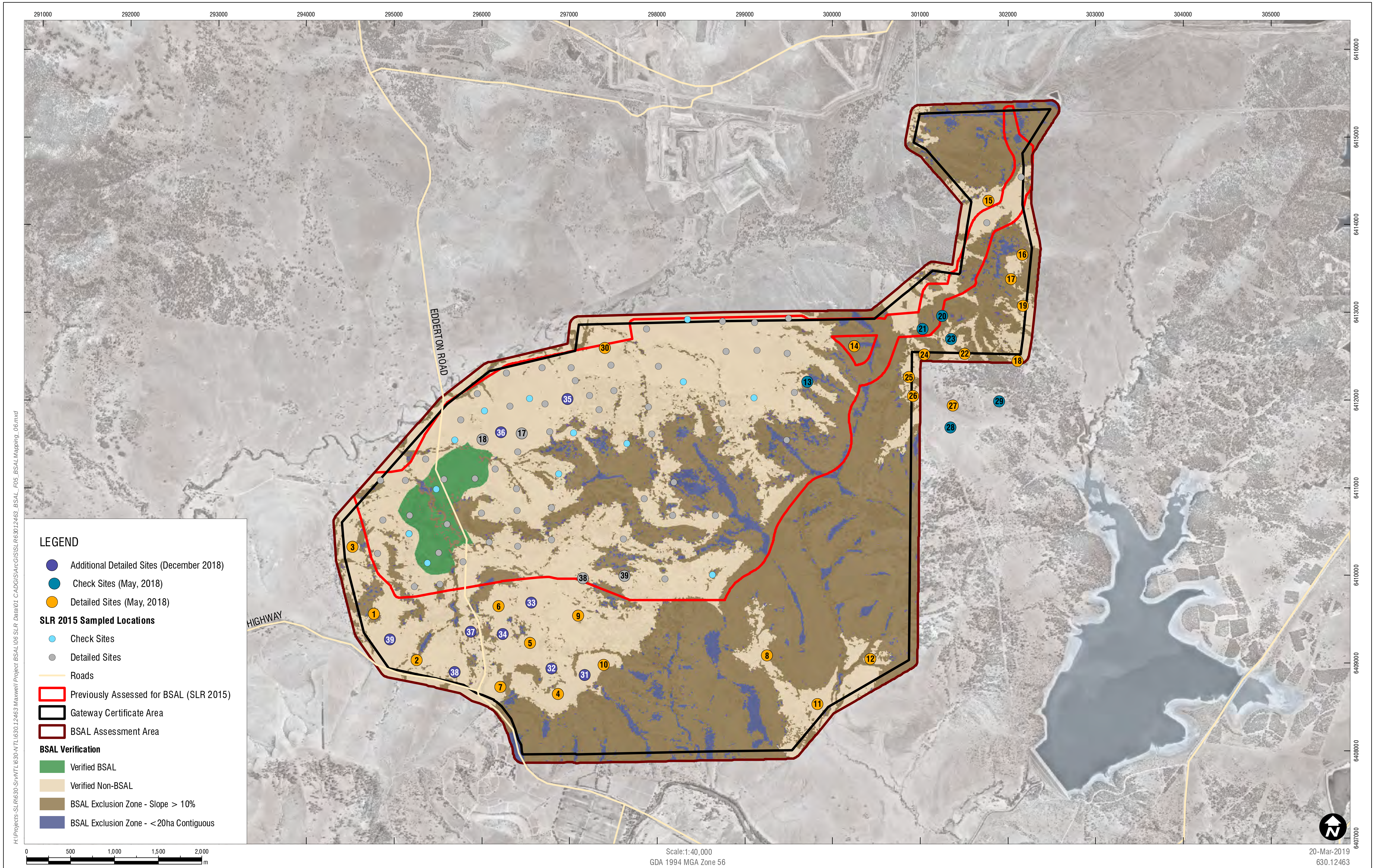
Site Number	Inspection Type	ASC Soil Type (to ASC Great Group for detailed sites)	1. Is slope < 10%?	2. Is there < 30% Rock Outcrop?	3. < 20% unattached Rock Fragments > 60mm?	4. Does < 50% have Gilgais >500mm deep?	5. Is Slope <5%?	6. Are there nil rock outcrops?	7a. Does soil have moderate fertility?	7b. Does soil have moderately high or high fertility?	8. Is ERD to a physical barrier >750mm?	9. Is drainage better than poor?	10. Is pH between 5.0 and 8.9 (water) and 4.5 and 8.1 (CaCl2)?	11. Is salinity (ECe) < 4 dS/m	12. Is ERD to a chemical barrier >750mm?	Is the Soil Unit BSAL?
Soil Unit 10 – Subnatric Brown Sodosol – Unit B																
12[1]	Detailed	Subnatric Brown Sodosol	✓	✓	✓	✓	✓	✓	×	✗	-	-	-	-	-	No
13[1]	Detailed	Subnatric Brown Sodosol	✓	✓	✓	✓	✓	✓	×	✗	-	-	-	-	-	
14[1]	Detailed	Subnatric Brown Sodosol	✓	✓	✓	✓	✓	✓	×	✗	-	-	-	-	-	
23[1]	Detailed	Subnatric Brown Sodosol	✓	✓	✓	✓	×	N/A	N/A	✗	-	-	-	-	-	
68[1]	Detailed	Subnatric Brown Sodosol	✓	✓	✓	✓	×	N/A	N/A	✗	-	-	-	-	-	
9[1]	Detailed	Mesonatric Brown Sodosol	✓	✓	✓	✓	✓	✓	×	✗	-	-	-	-	-	
76[1]	Detailed	Mesonatric Brown Sodosol	✓	✓	✓	✓	✓	✓	×	✗	-	-	-	-	-	
67[1]	Check	Brown Sodosol	✓	✓	✓	✓	✓	✓	×	✗	-	-	-	-	-	
69[1]	Check	Brown Sodosol	✓	✓	✓	✓	✓	✓	×	✗	-	-	-	-	-	
53[1]	Detailed	Subnatric Red Sodosol	✓	✓	✓	✓	✓	✓	×	✗	-	-	-	-	-	
63[1]	Detailed	Mesonatric Red Sodosol	✓	✓	✓	✓	×	N/A	N/A	✗	-	-	-	-	-	
66[1]	Check	Red Sodosol	✓	✓	✓	✓	✓	✓	×	✗	-	-	-	-	-	
65[1]	Detailed	Subnatric Black Sodosol	✓	✓	✓	✓	×	N/A	N/A	✗	-	-	-	-	-	
10[1]	Detailed	Eutrophic Brown Chromosol	✓	✓	✓	✓	×	N/A	N/A	✓	✓	✓	✓	✓	✓	
22[1]	Detailed	Paralithic Hypercalcic Calcarosol	✓	✓	✓	✓	✓	✓	×	✗	-	-	-	-	-	
7[1]	Detailed	Eutrophic Brown Dermosol	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	-	
49[1]	Detailed	Hypercalcic Calcarosol	✓	✓	✓	✓	✓	✓	×	✗	-	-	-	-	-	
30[2]	Detailed	Epipedal Brown Vertosol	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	
35[2]	Detailed	Mesonatric Brown Sodosol	✓	✓	✓	✓	×	✓	✗	✗	✗	✓	✗	✗	✗	

Site Number	Inspection Type	ASC Soil Type (to ASC Great Group for detailed sites)	1. Is slope < 10%?	2. Is there < 30% Rock Outcrop?	3. < 20% unattached Rock Fragments > 60mm?	4. Does < 50% have Gilgais >500mm deep?	5. Is Slope <5%?	6. Are there nil rock outcrops?	7a. Does soil have moderate fertility?	7b. Does soil have moderately high or high fertility?	8. Is ERD to a physical barrier >750mm?	9. Is drainage better than poor?	10. Is pH between 5.0 and 8.9 (water) and 4.5 and 8.1 (CaCl2)?	11. Is salinity (ECe) < 4 dS/m	12. Is ERD to a chemical barrier >750mm?	Is the Soil Unit BSAL?
Soil Unit 11 – Epipedal Brown Vertosol																
4[2]	Detailed	Epipedal Black Vertosol	✓	✓	✓	✓	✗	✓	✓	✓	✗	✓	✗	✗	✓	No
5[2]	Detailed	Epipedal Brown Vertosol	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	
9[2]	Detailed	Epipedal Brown Vertosol	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✗	✗	
10[2]	Detailed	Eutrophic Brown Chromosol	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	
31[2]	Detailed	Subnatric Black Sodosol	✗	✓	✓	✓	✗	✓	✗	✗	✓	✓	✗	✗	✗	
33[2]	Detailed	Epipedal Brown Vertosol	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✗	✗	✗	
34[2]	Detailed	Epipedal Brown Vertosol	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✗	✓	✓	
37[2]	Detailed	Epipedal Red Vertosol	✓	✓	✓	✓	✗	✓	✓	✓	✗	✓	✗	✗	✗	
Soil Unit 12 – Eutrophic Red Chromosol																
38[1]	Detailed	Eutrophic Red Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✗	-	-	-	-	No
39[1]	Detailed	Eutrophic Red Chromosol	✓	✓	✓	✓	✗	N/A	N/A	✓	✗	-	-	-	-	
1[2]	Detailed	Eutrophic Red Dermosol	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✗	✗	
2[2]	Detailed	Subnatric Red Sodosol	✗	✓	✓	✓	✗	✓	✗	✗	✗	✗	✓	✓	✓	
3[2]	Detailed	Eutrophic Red Chromosol	✓	✓	✓	✓	✗	✓	✓	✓	✗	✗	✓	✓	✓	
6[2]	Detailed	Eutrophic Red Chromosol	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	✓	✓	
7[2]	Detailed	Eutrophic Brown Chromosol	✗	✓	✓	✓	✗	✓	✓	✓	✗	✗	✓	✓	✓	
32[2]	Detailed	Hypernatric Brown Sodosol	✓	✓	✓	✓	✗	✓	✗	✗	✓	✗	✗	✗	✗	
38[2]	Detailed	Eutrophic Red Chromosol	✓	✓	✓	✓	✗	✓	✓	✓	✗	✓	✓	✓	✓	
39[2]	Detailed	Eutrophic Red Chromosol	✓	✓	✓	✓	✗	✓	✓	✓	✗	✓	✓	✓	✓	

Site Number	Inspection Type	ASC Soil Type (to ASC Great Group for detailed sites)	1. Is slope < 10%?	2. Is there < 30% Rock Outcrop?	3. < 20% unattached Rock Fragments > 60mm?	4. Does < 50% have Gilgais >500mm deep?	5. Is Slope <5%?	6. Are there nil rock outcrops?	7a. Does soil have moderate fertility?	7b. Does soil have moderately high or high fertility?	8. Is ERD to a physical barrier >750mm?	9. Is drainage better than poor?	10. Is pH between 5.0 and 8.9 (water) and 4.5 and 8.1 (CaCl2)?	11. Is salinity (ECe) < 4 dS/m	12. Is ERD to a chemical barrier >750mm?	Is the Soil Unit BSAL?
Soil Unit 13 – Epipedal Black Vertosol															^ – rock outcrop shown in **Appendix D**	
8[2]	Detailed	Epipedal Black Vertosol	✘	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✘	✘	**No**
11[2]	Detailed	Eutrophic Grey Dermosol	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
12[2]	Detailed	Epipedal Black Vertosol	✓	✓	✓	✓	×	✘^	✓	✓	✓	✓	✘	✓	✓	
Soil Unit 14 – Subnatric Brown Sodosol – Unit C															NLT – not lab tested	
16[2]	Detailed	Subnatric Brown Sodosol	✓	✓	✓	✓	×	✓	✘	✘	✓	✓	✓	✓	✓	**No**
17[2]	Detailed	Subnatric Brown Sodosol	✓	✓	✓	✓	×	✓	✘	✘	✓	✓	✓	✓	✓	
18[2]	Detailed	Mottled-Mesonatric Brown Sodosol	✓	✓	✓	✓	✓	✓	✘	✘	✘	✘	✓	✘	✘	
19[2]	Detailed	Eutrophic Brown Dermosol	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	
20[2]	Check	Brown Sodosol	✘	✓	✓	✓	×	✓	✘	✘	✓	✘	NLT	NLT	NLT	
21[2]	Check	Brown Sodosol	✘	✓	✓	✓	×	✓	✘	✘	✘	✓	NLT	NLT	NLT	
22[2]	Detailed	Mottled-Subnatric Brown Sodosol	✘	✓	✓	✓	×	✓	✘	✘	✓	✘	✓	✘	✘	
23[2]	Check	Red Sodosol	✓	✓	✓	✓	×	✓	✘	✘	✓	✘	NLT	NLT	NLT	
24[2]	Detailed	Eutrophic Brown Chromosol	✘	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✘	✘	
25[2]	Detailed	Subnatric Brown Sodosol	✘	✓	✓	✓	×	✓	✘	✘	✓	✓	✓	✘	✘	
26[2]	Detailed	Subnatric Grey Sodosol	✓	✓	✓	✓	×	✓	✘	✘	✓	✓	✓	✘	✘	
27[2]	Detailed	Subnatric Brown Sodosol	✘	✓	✓	✓	×	✓	✘	✘	✘	✓	✓	✘	✘	
28[2]	Check	Brown Sodosol	✓	✓	✓	✓	×	✓	✘	✘	✘	✓	NLT	NLT	NLT	
29[2]	Check	Red Sodosol	✘	✓	✓	✓	×	✓	✘	✘	✘	✘	NLT	NLT	NLT	

✓ = passes the BSAL criteria × = fails the criteria but not excluded as BSAL ✘ = fails the BSAL criteria

[1] Sites surveyed by SLR in 2015. [2] Sites surveyed by SLR in 2018/2019.
[3] Additional laboratory analysis was undertaken at SLR (2015) Sites 17 and 18 by SLR in 2018 and 2019, respectively.



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BSAL Verification Map

FIGURE 5

5 CONCLUSION

SLR Consulting has completed a refined BSAL assessment encompassing the Maxwell Project Gateway Certificate Area plus a 100 metre buffer.

This document presents the combined results of surveys and assessments:

- completed in 2015 in support of a Gateway Certificate Application for the Drayton South Coal Project (SLR, 2015) (covering 1,458 hectares);
- completed in May 2018 in support of the Gateway Certificate Application for the Project (SLR, 2018) (covering 1,757 hectares); and
- supplemented by additional work completed in January 2019 (within the area covered by the previous surveys).

The assessment has identified 72 hectares of verified BSAL, however some of this soil unit has already been disturbed by the existing Edderton Road, which bisects this soil unit. The area of verified BSAL is located outside of proposed surface development areas for the Project.

6 REFERENCES

DPI-OASFS (2013) Interim protocol for site verification and mapping of biophysical strategic agricultural land.

Isbell (2002) Australian Soil Classification Revised Edition.

NCST (2008) Guidelines for Surveying Soil and Land Resources.

NCST (2009) Australian Soil and Land Survey Field Handbook.

SLR (2015) BSAL Site Verification Assessment Drayton South Coal Project. Revision 2. Provided as Appendix F to the Drayton South Coal Project Response to Submissions (July 2015).

SLR (2018) Maxwell Project Biophysical Strategic Agricultural Land Verification Assessment. Final. Provided as Attachment A to the Agricultural Impact Statement in Support of an Application for a Gateway Certificate (August 2018).

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Appendix A

Consideration of Gateway Panel Comments on the Maxwell Project

Consideration of comments in the *Report by the Mining & Petroleum Gateway Panel to accompany a Conditional Gateway Certificate for the Maxwell Coal Project* (December, 2018) is provided in the table below.

Table 1 Consideration of Comments from the Gateway Panel (December, 2018)

Comment	Response/Consideration
The Panel notes that there are discrepancies between two survey documents in the total GCAA application area (-13 ha), the exclusion area (+97 ha) and the final detailed soil survey area (-110 ha) reported in SLR (2018) as representing the respective assessment areas in SLR (2015). The panel is assuming this occurrence may be due to refinements in border and elevation mapping techniques since the 2015 survey, however it is recommended that this issue be addressed/rectified in future documentation.	Land greater than 10% slope within the Study Area was identified using topographical data derived from updated LIDAR data provided by Malabar that was captured in June 2018. This updated LIDAR was applied across the entire BSAL Assessment Area, including the SLR (2015) Study Area (refer to Section 2.6.1). The minor differences in areas identified by the Panel are attributed to this more refined elevation mapping (updated LIDAR), along with refinement in boundaries. This report presents the consolidated work of all previous assessments.
The Panel does however wish to note that in the southwestern area of the GCAA that was examined in the new survey (SLR, 2018), close to the identified BSAL (SLR, 2015) and the potential BSAL (DP&I, 2012) the Applicant has taken only 6 detailed samples sites plus 3 check sites in an area that, with minimal access by the Panel to spatial data sets, is estimated at greater than 300ha. This results in a detailed survey resolution of 1 detailed site : 50ha. The Panel suggests that the sample density in this area of the GCAA is below that required to adequately determine BSAL condition in this case.	Although Malabar does not accept the Panel's conclusions regarding risk, additional soil sampling has been conducted to achieve an inspection density of 1:25,000 (refer to Section 2.6.2).
Site 15 is rejected as BSAL by the Applicant due to a reported restricted chemical barrier to plant root development within 750mm of the soil surface. The soil sample used to make this decision was taken from below this depth (800-900mm) according to the texture detail analysis in SLR (2015). The Panel believe that Site 15 (SLR, 2015) should be considered BSAL or the soil profile resampled and analysed.	The B22 horizon at Site 15 begins at 600 mm and ends with weathered rock at 900 mm. Although the sample for laboratory analysis was taken at 800-900 mm (during the 2015 sampling program), it is considered representative of the entire B22 soil horizon, as the boundary between the horizons is abrupt. Therefore, Site 15 fails BSAL Criteria 12 *"Is effective rooting depth to a chemical barrier >750 mm?"*, with >4 dS/m for ECe (salinity), being 7.4 dS/m, within the imperfectly drained B22 horizon. Even if Site 15 was considered as BSAL, four of the remaining five sites all fail the BSAL Criteria, which results in Soil Unit 2 being classed as non-BSAL A detailed profile description of Site 15 is shown at the end of **Appendix D**, with the profile and chemical parameters of Site 15 described in **Tables 2** and **3** of this document.

Comment	Response/Consideration
The Panel suggests that more detailed soil survey sites around Soil Unit 2 would be prudent to more accurately assess the BSAL condition of the soil within the Applicant-defined Soil Unit 2.	An additional 2 sites from SLR (2015) in Soil Unit 2 were laboratory analysed, being Sites 17 & 18. In addition, a further 2 sites in Soil Unit 2 were included in the 2019 survey (Sites 36 and 35). Sites 17 & 18 are considered non-BSAL due to failing BSAL Criteria 8 "*Is effective rooting depth to a physical barrier >750mm?"* and BSAL Criteria 11 *"Is salinity (ECe) < 4 dS/m?"*, respectively. Site 36 is a sub-dominant soil type, Eutrophic Red Chromosol and is considered non-BSAL due to failing BSA Criteria 8 *"Is effective rooting depth to a physical barrier >750mm?"* Site 35 was subsequently mapped into Soil Unit 10 – Subnatric Brown Sodosol – Unit B as a sub-dominant soil type Mesonatric Brown Sodosol and is considered non-BSAL due to failing BSAL Criteria *"7a. Does soil have moderate fertility?"* In total Soil Unit 2 has six detailed sites in 49 hectares which is considered very thorough mapping given the applied survey scale of 1:25,000.

Site 15 – Eutrophic Brown Dermosol

Table 2 Profile: Site 15 Eutrophic Brown Dermosol

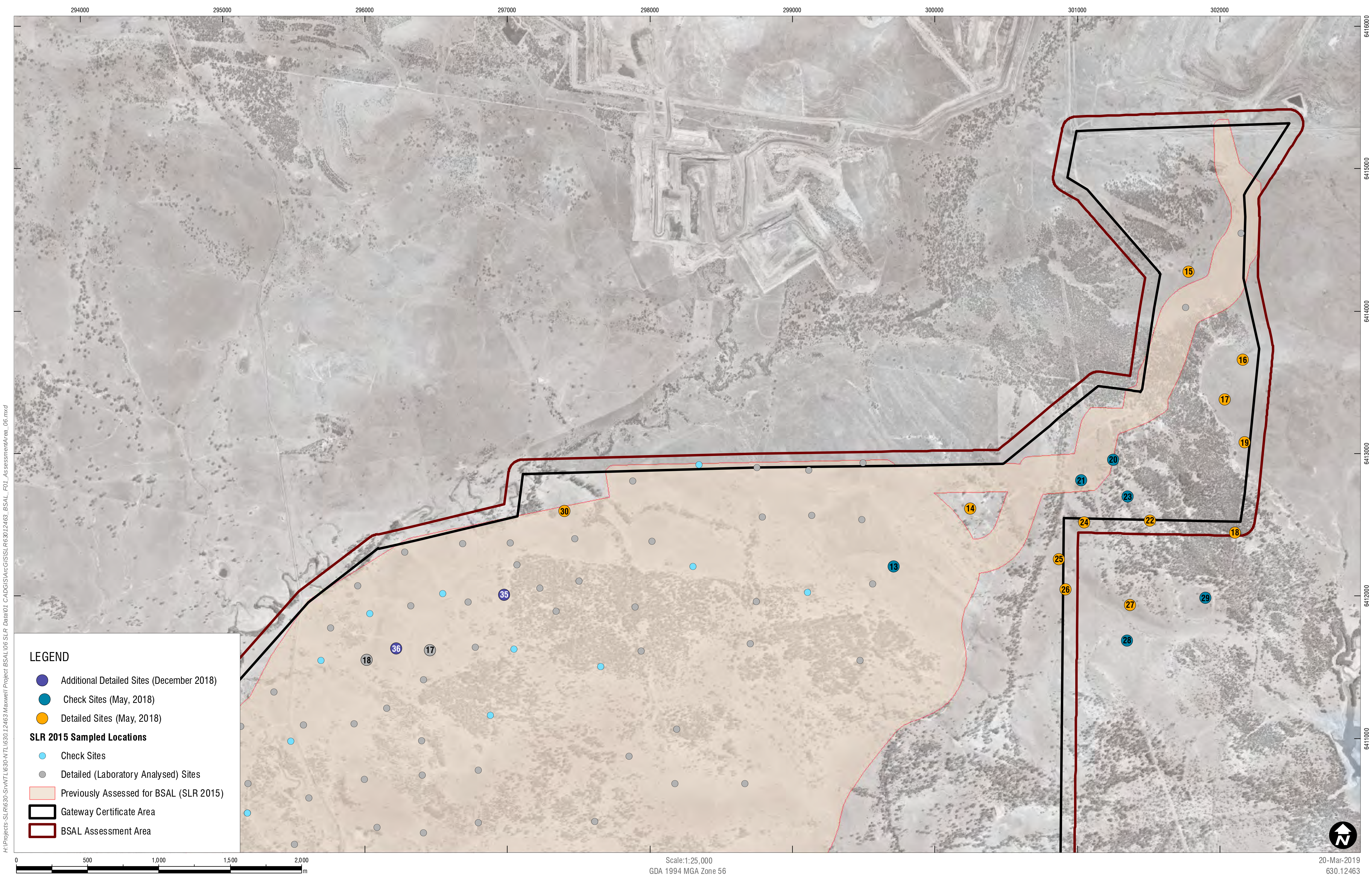
Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Very dark greyish brown (10YR 3/2) light-medium clay, moderate structure of 5-20 mm polyhedral peds with strong consistence and rough fabric. Nil mottling; nil stone content; nil segregations; well drained with a gradual and wavy boundary.
	B21 0.10 – 0.60	Brown (10YR 3/3) medium clay, strong structure of 20-50 mm angular blocky peds with a strong consistence and smooth fabric. Nil mottling; 10% rock 10 mm; nil segregations; moderately drained with a gradual and wavy boundary.
	B22 0.60 – 0.90	Light yellowish brown (10YR 6/4) light-medium clay, strong structure of 50-100 mm angular blocky peds with a strong consistence and rough fabric. Nil mottling; 5% gravel 15 mm; 15% calcium carbonate segregations; imperfectly drained with an abrupt and wavy boundary.
	C +0.90	Weathered rock

Table 3 Chemical Parameters: Eutrophic Brown Dermosol

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	Unit	Rating	%	Rating
A1	6.4	Slightly Acidic	0.2	Non Sodic	0.6	Non-Saline	1.6	Low
B21	7.2	Neutral	3.1	Non Sodic	0.5	Non-Saline	1.3	Low
B21	8.0	Moderately Alkaline	6.3	Marginally Sodic	3.4	Slightly Saline	1.1	Low
B22	8.5	Strongly Alkaline	6.3	Marginally Sodic	7.4	Moderately Saline	1.5	Low

Appendix B

1:25,000 Scale Figures



Sheet Size : A3

SLR

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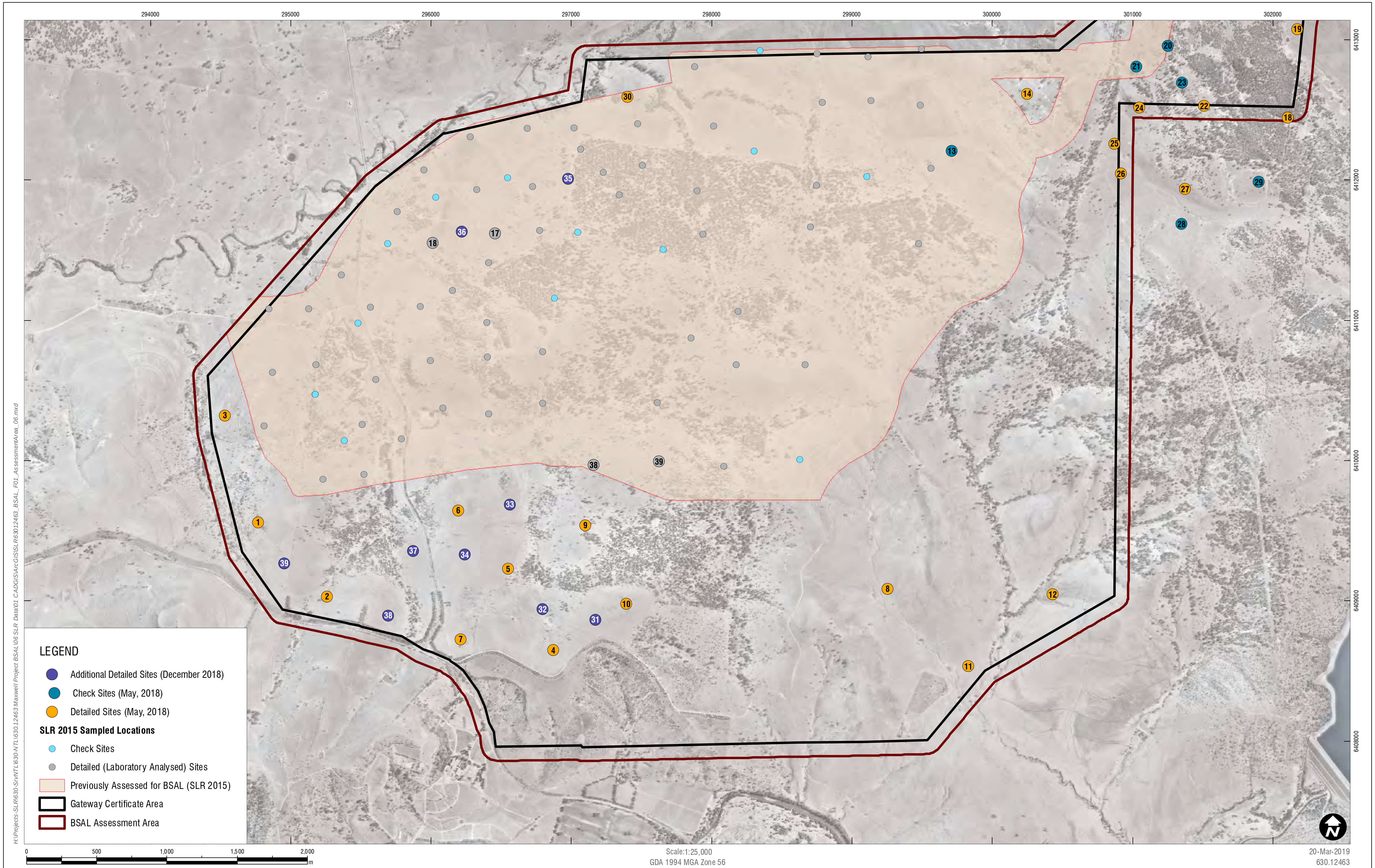
BSAL Assessment Area

FIGURE 1



Sheet Size : A3

SLR

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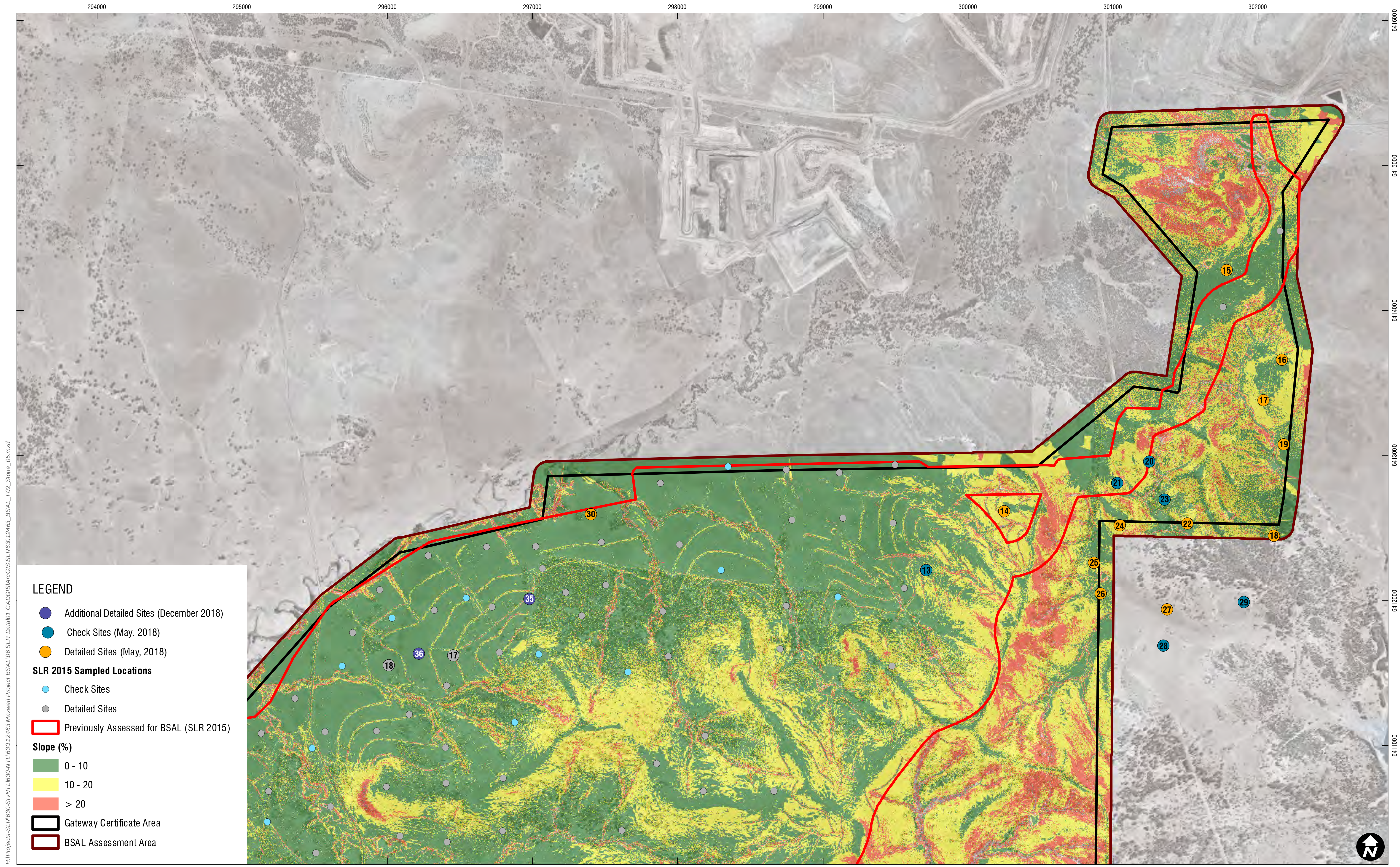
BSAL Assessment Area

FIGURE 1

TOC



0 500 1,000 1,500 2,000 m

Scale:1:25,000
GDA 1994 MGA Zone 56

20-Mar-2019
630.12463

Sheet Size : A3

SLR

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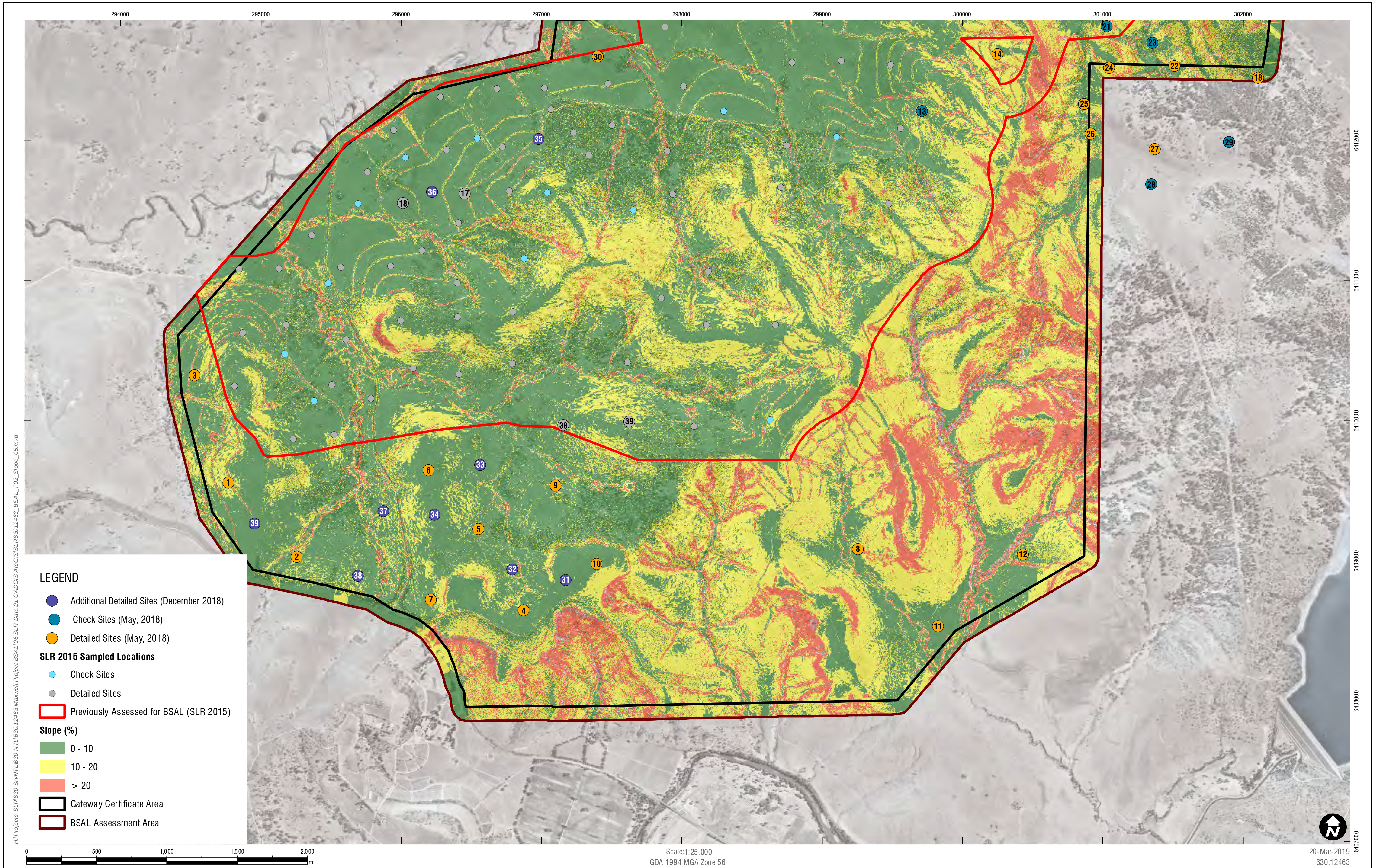
Slope Analysis

FIGURE 2



Sheet Size : A3

SLR

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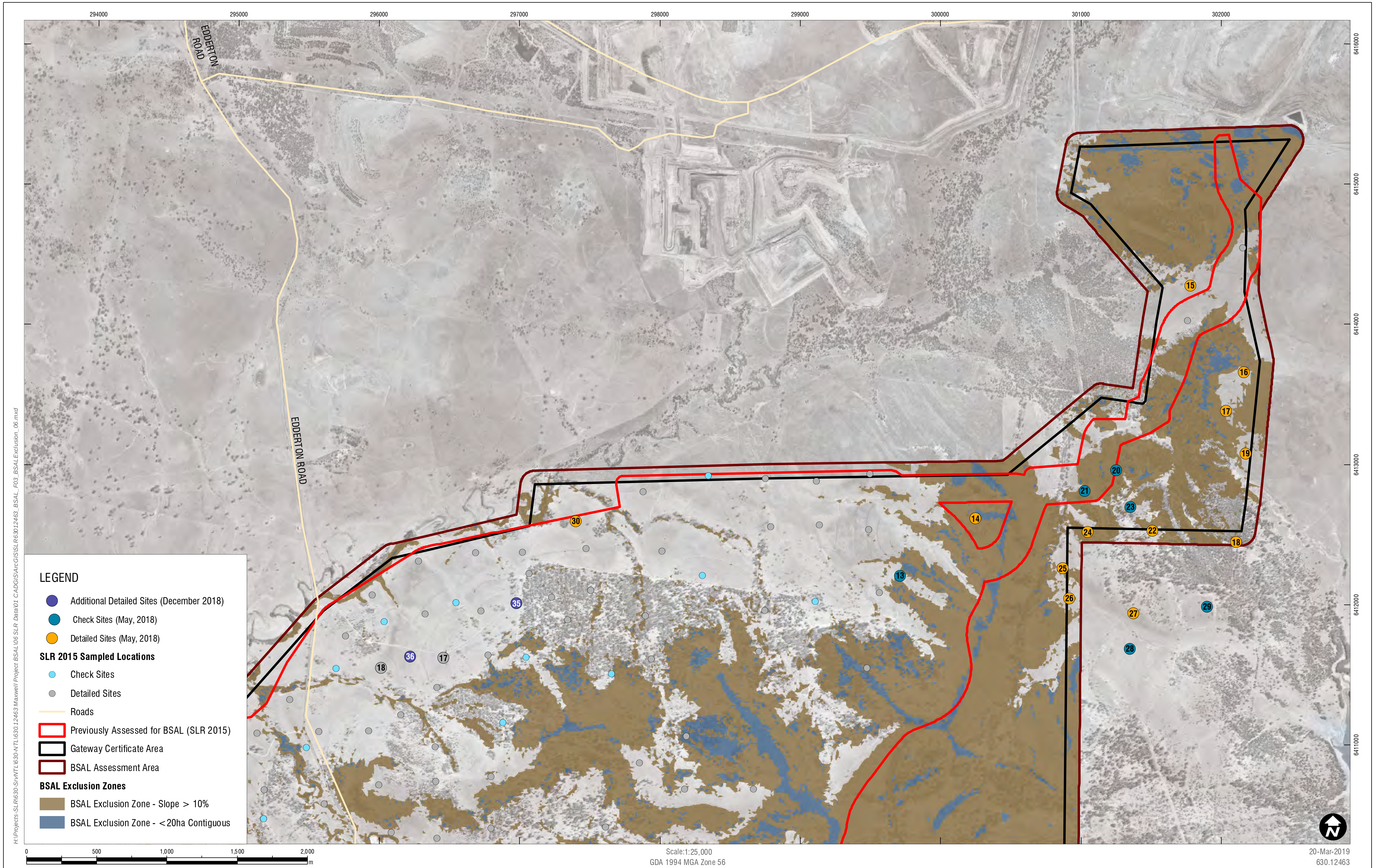
Slope Analysis

FIGURE 2

TOC



Sheet Size : A3

SLR

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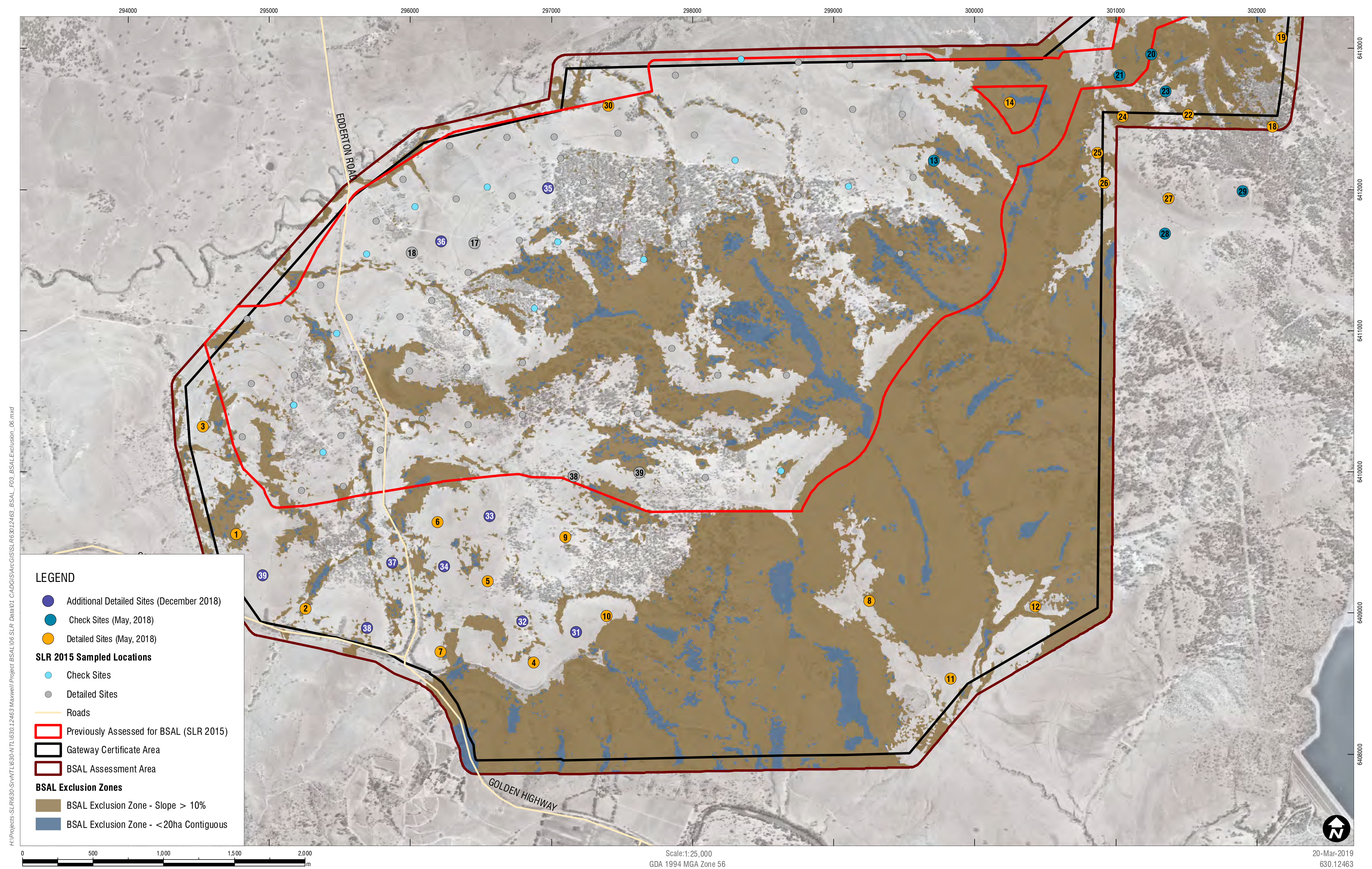
BSAL Exclusion Areas

FIGURE 3



Sheet Size : A3

SLR

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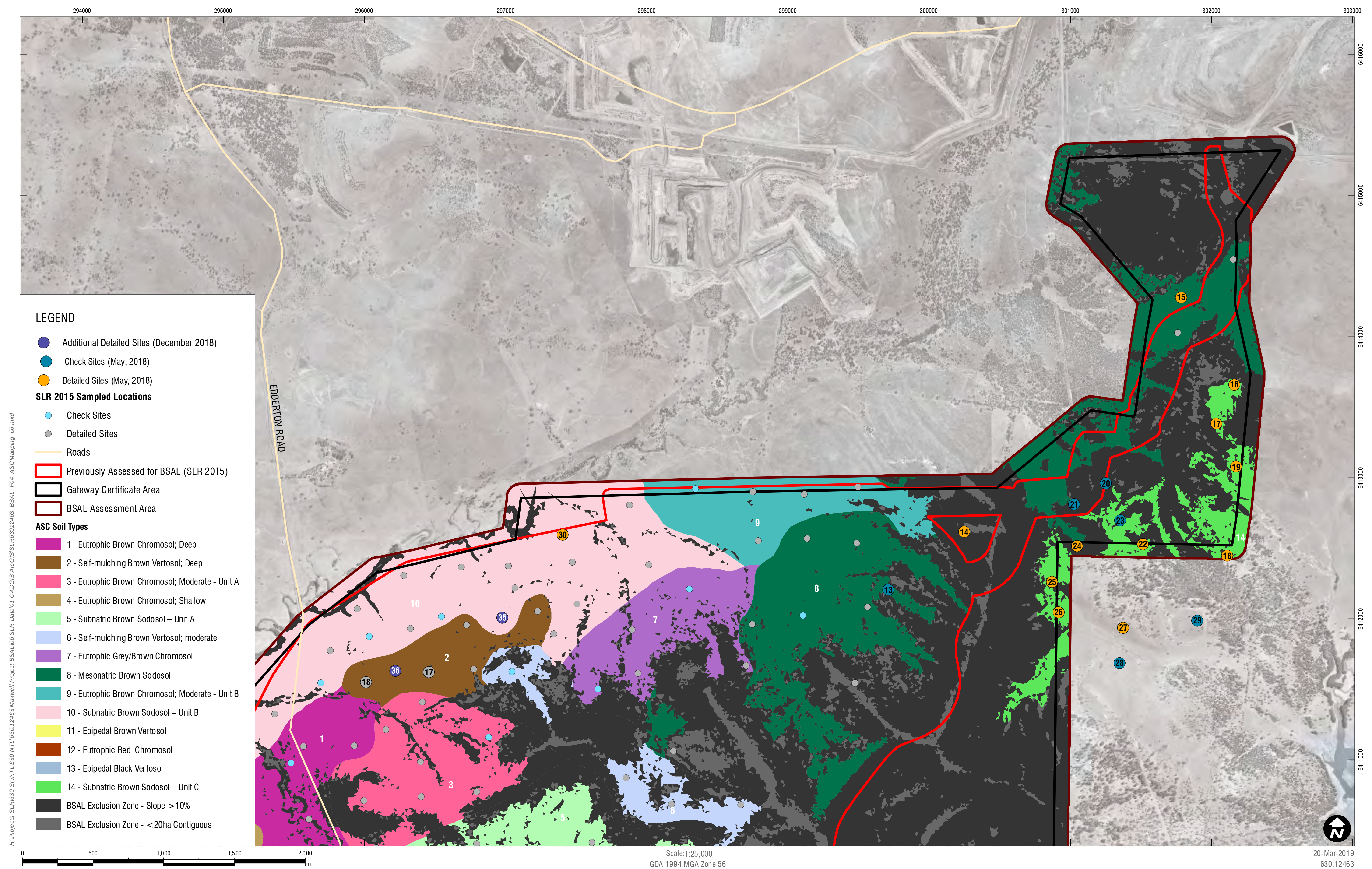
BSAL Exclusion Areas

FIGURE 3



Sheet Size : A3

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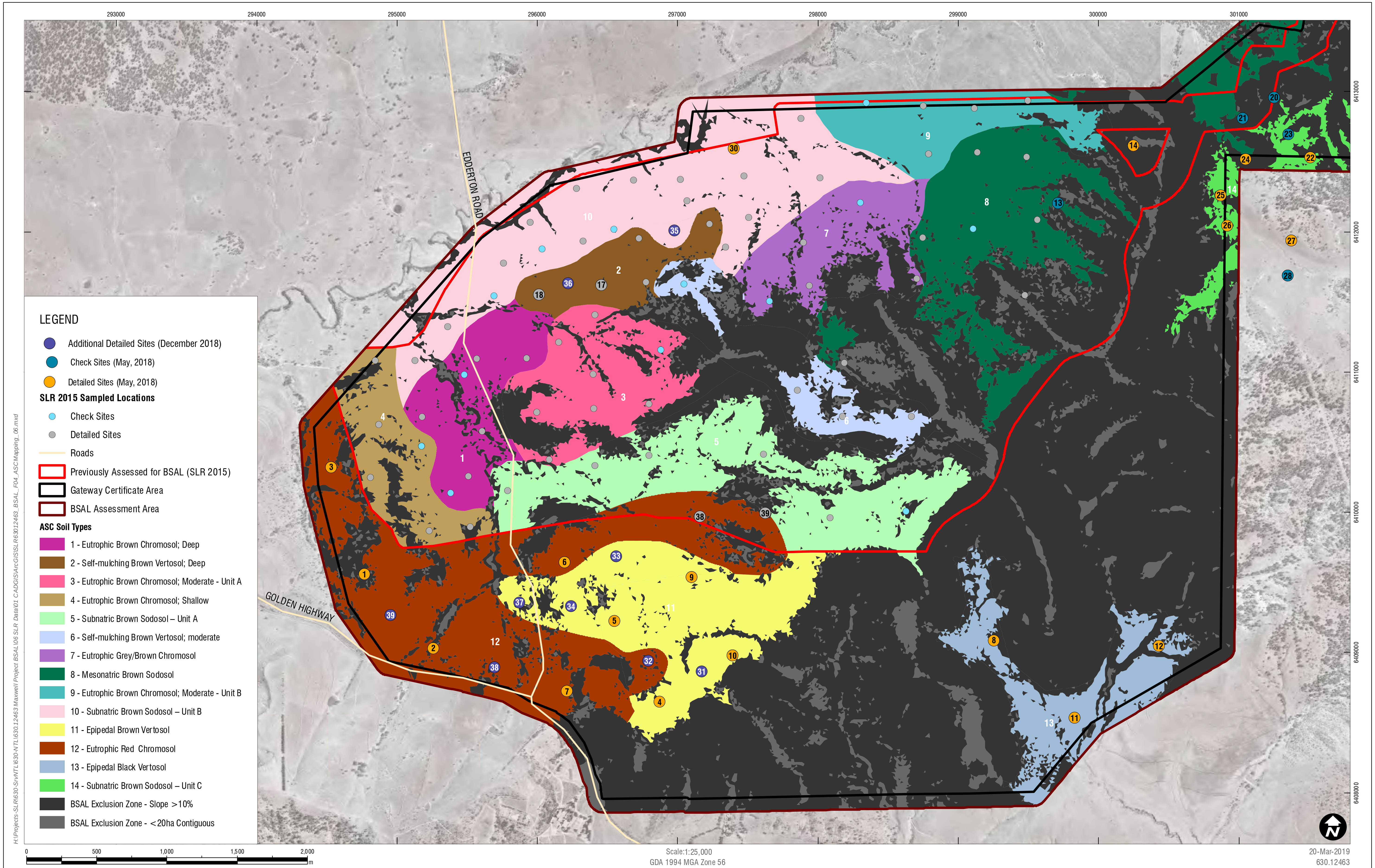
ASC Soil Types

FIGURE 4



Sheet Size : A3

SLR

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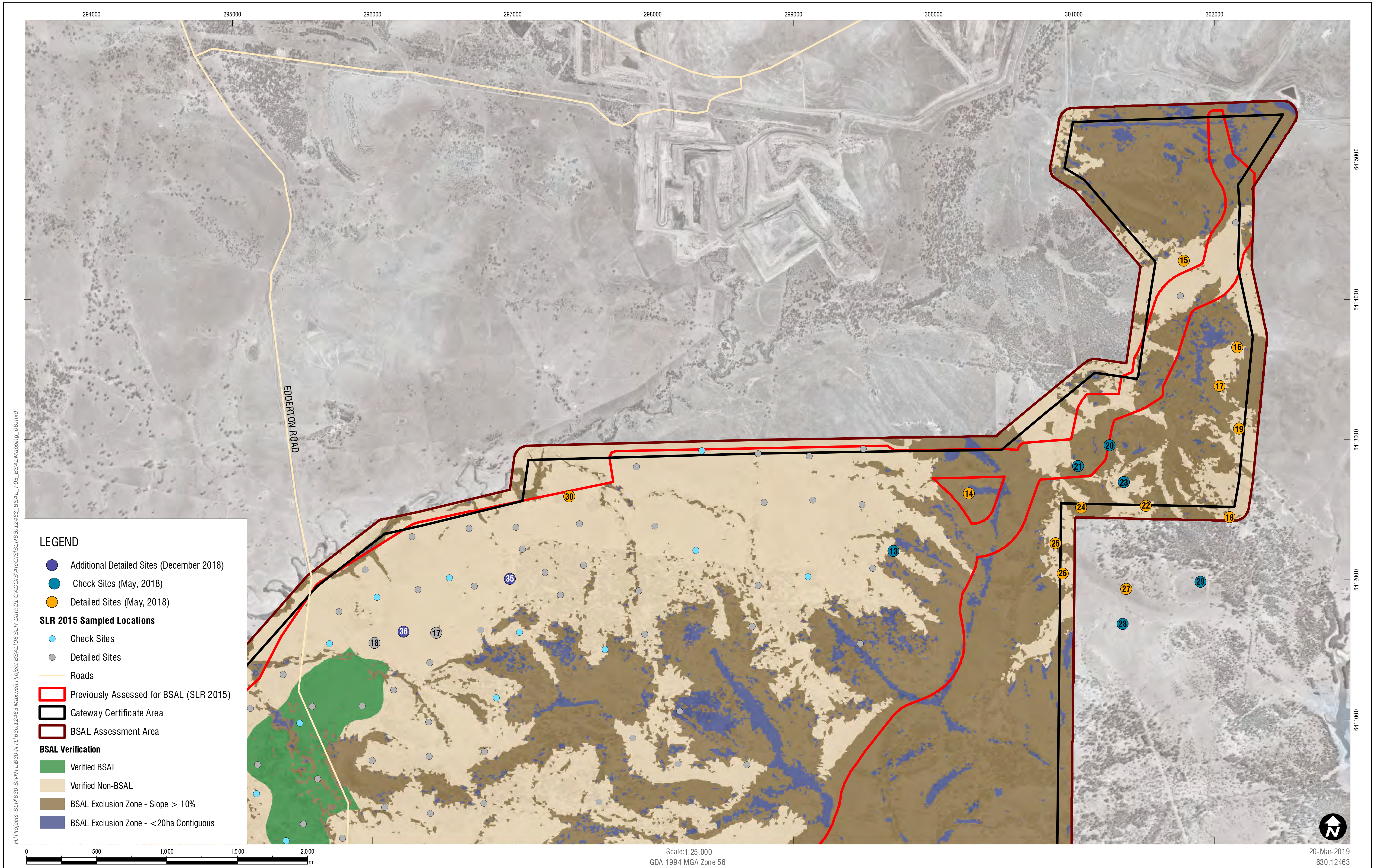
ASC Soil Types

FIGURE 4

TOC



Sheet Size : A3

SLR

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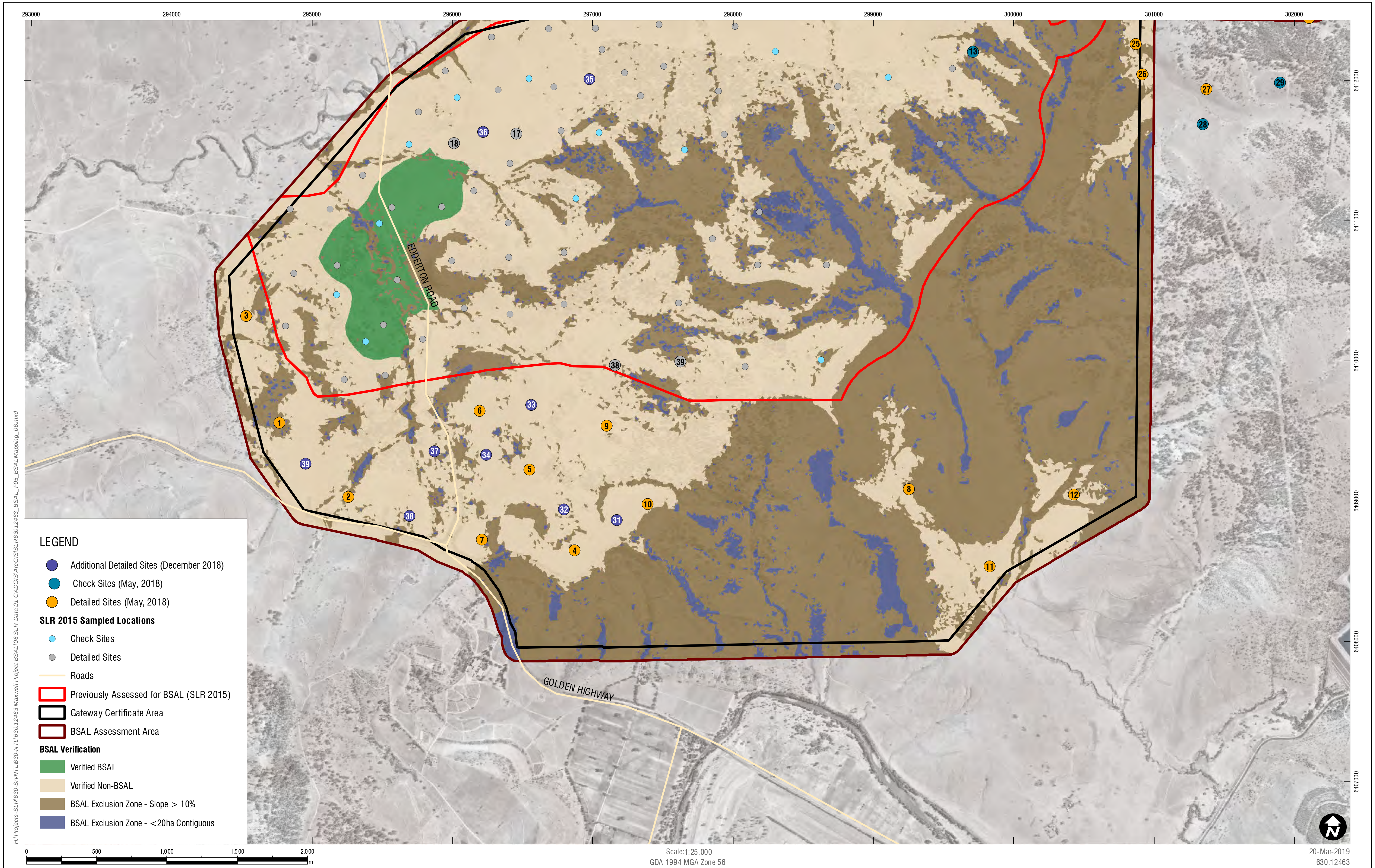
BSAL Verification Map

FIGURE 5



Sheet Size : A3

SLR

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BSAL Verification Map

FIGURE 5

Appendix C

Slope Analysis Methodology

25th June 2018

Maxwell Project
BSAL Verification Assessment
SLR Slope Analysis Methodology

1. Acquire appropriate elevation information. In this case, LIDAR data provided by Malabar Coal

2. Load Contours into ArcMap 10.3

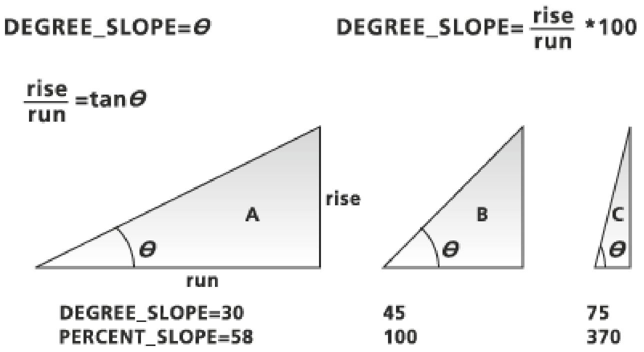
3. Using 3D Analyst Extension - Create a TIN Surface based on the contours (http://resources.arcgis.com/en/help/main/10.1/index.html#/Create_TIN/00q90000001v000000/)

4. Using 3D Analyst Extension – Run the Surface Slope Tool (http://resources.arcgis.com/en/help/main/10.1/index.html#//00q900000076000000) using a custom Break File (attached).

5. Using a Spatial Join, correlate the Surface Slope at the Soil Survey coordinates.

The Surface Slope Tool

Surface Slope creates an output polygon feature class containing polygons that classify an input TIN or terrain dataset by slope. The slope is the angle of inclination between the surface and a horizontal plane, which may be analysed in degrees or percent. Slope in degrees is given by calculating the arctangent of the ratio of the change in height (dZ) to the change in horizontal distance (dS), or slope = Arctan (dZ/dS). Percent slope is equal to the change in height divided by the change in horizontal distance multiplied by 100, or (dZ/dX) * 100.



The {**slope_field**} is the name of attribute field used to record the polygon aspect codes. Its default value is SlopeCode.

Each triangle is classified into a slope class. Contiguous triangles belonging to the same class are merged during the formation of output polygons. The {units} parameter can be set to use PERCENT or DEGREES. The default is PERCENT. The default percent slope class breaks are 1.00, 2.15, 4.64, 10.00, 21.50, 46.40, 100.00, 1000.00. Optionally, DEGREES may be used to classify slope. The default degree slope class breaks are 0.57, 1.43, 2.66, 5.71, 12.13, 24.89, 45.0, 90.0.

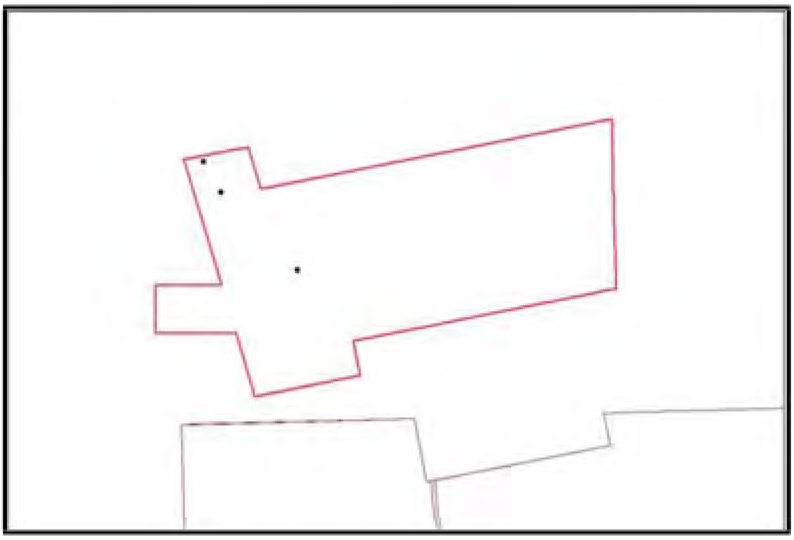
The {**class_breaks_table**} is used to define custom slope classes. The table can be either a TXT or DBF file for a Windows environment, and a DBF file in a UNIX environment. Each record in the table needs to contain two values that are used to represent the slope range of the class and its corresponding class code.

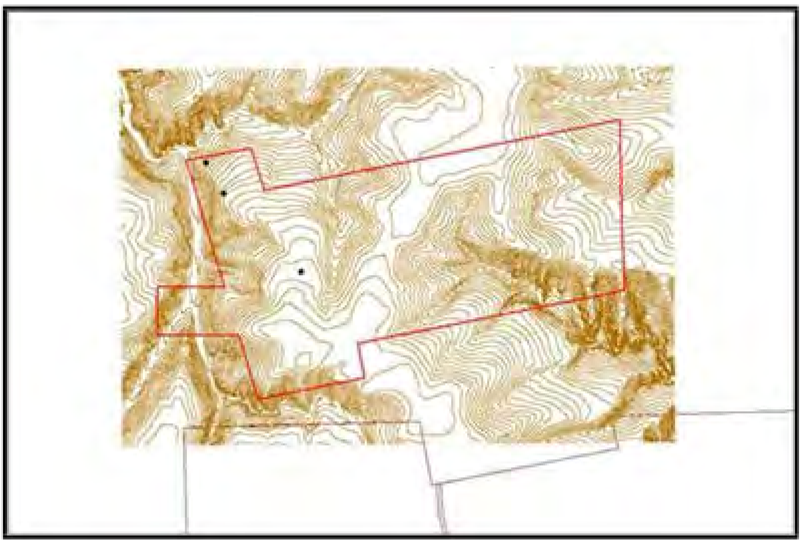
Table example:

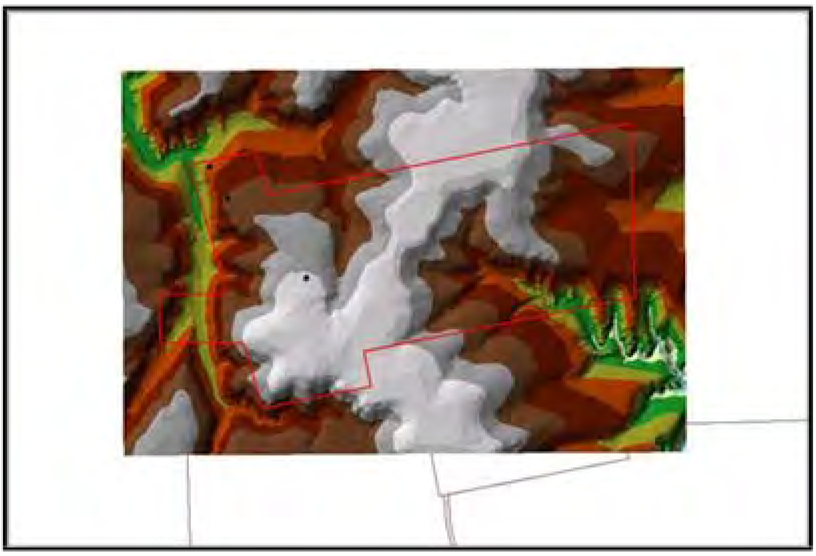
```
break, code

  10.0, 11

  25.0, 22

  40.0, 33

  70.0, 44
```

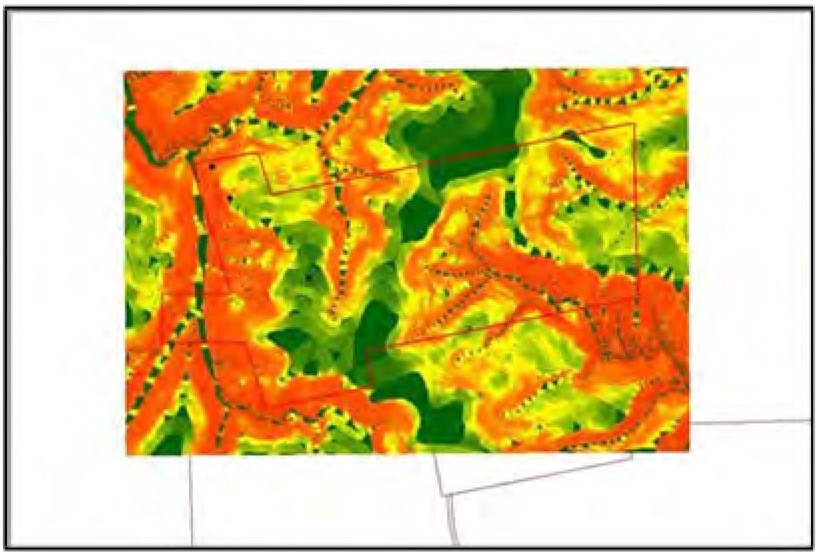
Note the comma delineation and use of decimals in the first field. Field names are needed but are ignored. The first field represents the breaks and values need to be decimal, the second field represents codes and values need to be integer. The units of the slope range are defined by the {units}. When this argument is not specified, the default classification is used.

And here is how we do it pictographically (example study shown):









Appendix D

Detailed & Check Site Profile Descriptions

Soil Unit 11: Epipedal Brown Vertosol

Site 4 – Epipedal Brown Vertosol

Table 1 Summary: Epipedal Black Vertosol (Site 4)

Overview	
	
Landscape Site 4	
ASC Name	Epipedal Black Vertosol
Representative Site	Site 4
Survey Type	Detailed
Dominant Topography	Mid Slope
Dominant Land Use	Cattle Grazing
Vegetation	White Box, Casuarina, Wire Grass, Corkscrew Grass
Inherent Soil Fertility	Moderately High
Slope	8%
Aspect	North-West
Site Verified	Non-BSAL – Soil Depth & Salinity

Table 2 Profile: Epipedal Black Vertosol (Site 4)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Very dark grey (10YR 3/1) light-medium clay, strongly structured 10- 30 mm blocky peds with strong consistence and a smooth fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and wavy boundary. Sampled 0.0 – 0.10
	B2 0.20 – 0.60	Dark yellowish brown (10YR 3/4) heavy clay, strongly structured 20-40 mm blocky peds with strong consistence and a smooth fabric. 10% soft calcium nodules 5-10 mm. Nil mottling, nil stone content, abundant coarse roots. Well drained with a clear and wavy boundary. Sampled 0.20 – 0.30 and 0.50 – 0.60
	BC +0.60	Weathered sandstone. Not sampled

Table 3 Chemical Parameters: Epipedal Black Vertosol (Site 4)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.9	Neutral	1.7	Non-Sodic	0.9	Non-Saline	1.8	Low
B2	8.9	Strongly Alkaline	6.8	Marginally Sodic	1.2	Non-Saline	1.5	Low
B2	9.0	Strongly Alkaline	14.9	Strongly Sodic	4.6	Moderately Saline	1.4	Low

Soil Unit 11: Epipedal Brown Vertosol

Site 5 – Epipedal Brown Vertosol

Table 4 Summary: Epipedal Brown Vertosol (Site 5)

Overview

Landscape Site 5

ASC Name	Epipedal Brown Vertosol
Representative Site	Site 5
Survey Type	Detail
Dominant Topography	Mid Slope
Dominant Land Use	Cattle Grazing
Vegetation	Casuarina, Red Grass, Wallaby Grass
Inherent Soil Fertility	Moderately High
Slope	8%
Aspect	North
Site Verified	Potential BSAL

Table 5 Profile: Epipedal Brown Vertosol (Site 5)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Dark brown (7.5YR 3/2) light-medium clay, strongly structured 5-20 mm blocky peds with strong consistence and a smooth fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and wavy boundary. Sampled 0.0 – 0.10
	B21 0.20 – 0.50	Brown (10YR 4/3) heavy clay, strongly structured 20-50 mm blocky peds with strong consistence and a smooth fabric. 10% soft calcium nodules 5-10 mm. Nil mottling, nil stone content, abundant coarse roots. Well drained with a gradual and wavy boundary. Sampled 0.20 – 0.30
	B22 0.50 – 0.60	Brown (10YR 4/3) heavy clay, strongly structured 20-50 mm blocky peds with strong consistence and a smooth fabric. 20% soft calcium nodules 5-10 mm. Nil mottling, nil stone content, coarse roots common. Well drained with a gradual and wavy boundary. Sampled 0.40 – 0.50
	B23 +0.60	Very dark greyish brown (10YR 3/2) heavy clay, massive structure with strong consistence and a smooth fabric. 5% soft calcium nodules 5-10 mm. Nil mottles, nil stone content, coarse roots common. Well drained with layer continuing beyond sampling depth. Sampled 0.65 – 0.75

Table 6 Chemical Parameters: Epipedal Brown Vertosol (Site 5)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	7.1	Neutral	0.8	Non-Sodic	1.0	Non-Saline	3.3	Moderate
B21	8.4	Strongly Alkaline	2.7	Non-Sodic	1.0	Non-Saline	2.5	Moderate
B22	8.5	Strongly Alkaline	10.4	Sodic	2.9	Slightly Saline	1.5	Low
B23	8.6	Strongly Alkaline	12.3	Sodic	3.7	Slightly saline	1.5	Low

Soil Unit 11: Epipedal Brown Vertosol

Site 10 – Eutrophic Brown Chromosol

Sub-Dominant Soil Type

Table 7 Summary: Eutrophic Brown Chromosol (Site 10)

Overview

Landscape Site 10

ASC Name	Eutrophic Brown Chromosol
Representative Site	Site 10
Survey Type	Detailed
Dominant Topography	Upper Slope
Dominant Land Use	Cattle Grazing
Vegetation	White Box, Acacia, Red Grass, Wire Grass
Inherent Soil Fertility	Moderately High
Slope	1%
Aspect	East
Site Verified	Non-BSAL – Soil Depth

Table 8 Profile: Eutrophic Brown Chromosol (Site 10)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Dark yellowish brown (10YR 4/6) loam, moderately structured 20-30 mm blocky peds with strong consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a clear and even boundary. Sampled 0.0 – 0.10
	B21 0.15 – 0.40	Yellowish brown (10YR 5/6) light-medium clay, strongly structured 20-40 mm subangular blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with gradual and even boundary. Sampled 0.20 – 0.30
	B22 0.40 – 0.60	Yellowish brown (10YR 5/4) clay loam, strongly structured 20-40 mm subangular blocky peds with moderate consistence and a rough fabric. 30% soft calcium nodules 5-10 mm. Nil mottling, nil stone content, coarse roots common. Well drained with gradual and wavy boundary. Sampled 0.40 – 0.50
	BC +0.60	Weathered sandstone. Not sampled

Table 9 Chemical Parameters: Eutrophic Brown Chromosol (Site 10)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.6	Neutral	1.3	Non-Sodic	0.7	Non-Saline	2.5	Low
B21	7.2	Neutral	2.2	Non-Sodic	0.5	Non-Saline	2.1	Low
B22	8.1	Moderately Alkaline	3.3	Non-Sodic	0.7	Non-Saline	2.1	Low

Soil Unit 11: Epipedal Brown Vertosol

Site 31 – Subnatric Black Sodosol

Sub-Dominant Soil Type

Table 10 Summary: Subnatric Black Sodosol (Site 31)

Overview

Landscape Site 31

ASC Name	Subnatric Black Sodosol
Representative Site	Site 31
Survey Type	Detailed
Dominant Topography	Upper Slope
Dominant Land Use	Cattle Grazing
Vegetation	Red Grass, Saffron Thistle
Inherent Soil Fertility	Moderately Low
Slope	10%
Aspect	South West
Site Verified	Non-BSAL – Fertility, pH & Sodicity

Table 11 Profile: Subnatric Black Sodosol (Site 31)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Dark brown (7.5YR 3/3) sandy loam, strongly structured 10-50 mm blocky peds with strong consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a clear and wavy boundary. Sampled 0.0 – 0.10
	B21 0.15 – 0.40	Dark reddish brown (5YR 3/2) light clay, strongly structured 20-40 mm blocky peds with strong consistence and a rough fabric. Nil mottling, nil stone content, coarse roots common. Well drained with a gradual and wavy boundary. Sampled 0.20 – 0.30
	B22 0.40 – 0.60	Brown (10YR 4/3) medium clay, moderately structured 10-20 mm blocky peds with strong consistence and a rough fabric. 20% calcium nodules 10-20 mm. Nil mottling, nil stone content, coarse roots common. Well drained with a gradual and wavy boundary. Sampled 0.40 – 0.50
	B23 +0.60	Light olive brown (2.5Y 5/4) silty clay, massive structure. 5% calcium nodules 10-20 mm. Nil mottles, nil stone content, few coarse roots. Well drained, layer continues beyond sampling depth. Sampled 0.65 – 0.75

Table 12 Chemical Parameters: Subnatric Black Sodosol (Site 31)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.2	Slightly Acidic	4.8	Non-Sodic	1.0	Non-Saline	0.9	Very Low
B21	8.2	Moderately Alkaline	13.1	Sodic	1.5	Non-Saline	0.6	Very Low
B22	9.2	Strongly Alkaline	15.9	Strongly Sodic	5.9	Moderately Saline	1.1	Low
B23	9.1	Strongly Alkaline	19.3	Strongly Sodic	8.7	Highly Saline	0.9	Very Low

Soil Unit 11: Epipedal Brown Vertosol

Site 33 – Epipedal Brown Vertosol

Table 13 Summary: Epipedal Brown Vertosol (Site 33)

Overview	
 Landscape Site 33	
ASC Name	Epipedal Brown Vertosol
Representative Site	Site 33
Survey Type	Detailed
Dominant Topography	Mid Slope
Dominant Land Use	Cattle Grazing
Vegetation	Casuarina, Red Grass, Saffron Thistle
Inherent Soil Fertility	Moderately High
Slope	8%
Aspect	North East
Site Verified	Non-BSAL – pH, Sodicity & Salinity

Table 14 Profile: Epipedal Brown Vertosol (Site 33)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.30	Dark reddish brown (5YR 3/2) light clay, strongly structured 10-40 mm blocky peds with strong consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and wavy boundary. Sampled 0.0 – 0.10 and 0.20 – 0.30
	B21 0.30 – 0.60	Brown (7.5YR 4/3) medium clay, strongly structured 20-50 mm blocky peds with strong consistence and a smooth fabric. Nil mottling, nil stone content, coarse roots common. Well drained with a gradual and wavy boundary. Sampled 0.40 – 0.50
	B22 +0.60	Brown (7.5YR 4/6) medium clay, strongly structured 30-50 mm blocky peds with strong consistence and a smooth fabric. 10% calcium nodules 10-15 mm. Nil mottles, nil stone content, coarse roots common. Well drained, layer continues beyond sampling depth. Sampled 0.65 – 0.75

Table 15 Chemical Parameters: Epipedal Brown Vertosol (Site 33)

Layer	pH ($CaCl_2$)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	5.4	Slightly Acidic	3.5	Non-Sodic	0.6	Non-Saline	1.6	Low
A1	8.0	Strongly Alkaline	9.3	Marginally Sodic	2.0	Slightly Saline	1.5	Low
B21	8.2	Strongly Alkaline	11.6	Sodic	3.6	Slightly Saline	1.7	Low
B22	8.2	Strongly Alkaline	17.1	Strongly Sodic	8.0	Moderately Saline	1.7	Low

Soil Unit 11: Epipedal Brown Vertosol

Site 34 – Epipedal Brown Vertosol

Table 16 Summary: Epipedal Brown Vertosol (Site 34)

Overview

Landscape Site 34

ASC Name	Epipedal Brown Vertosol
Representative Site	Site 34
Survey Type	Detailed
Dominant Topography	Mid Slope
Dominant Land Use	Cattle Grazing
Vegetation	Casuarina, Red Grass
Inherent Soil Fertility	Moderately High
Slope	5%
Aspect	West
Site Verified	Non-BSAL – pH

Table 17 Profile: Epipedal Brown Vertosol (Site 34)

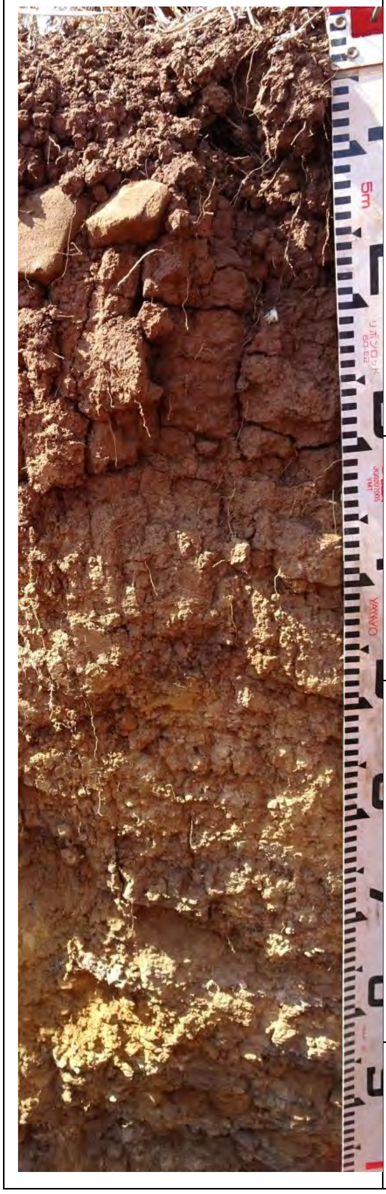
Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.30	Dark reddish brown (2.5YR 3/3) silty clay loam, strongly structured 20-50 mm blocky peds with strong consistence and a rough fabric. Nil mottling, 10% sandstone 20-50 mm, abundant fine roots. Well drained with a gradual and wavy boundary. Sampled 0.0 – 0.10 and 0.20 – 0.30
	B21 0.30 – 0.50	Brown (7.5YR 4/4) silty clay loam, moderately structured 10-30 mm blocky peds with moderate consistence and a smooth fabric. 10% calcium nodules 5-10 mm. Nil mottling, nil stone content, coarse roots common. Well drained with a gradual and wavy boundary. Sampled 0.40 – 0.50
	B22 0.50 – 0.90	Yellowish brown (10YR 5/4) silty clay loam, moderately structured 10-30 mm blocky peds with moderately consistence and a smooth fabric. 10% calcium nodules 5-10 mm. Nil mottling, nil stone content, coarse roots common. Well drained with a gradual and wavy boundary. Sampled 0.65 – 0.75
	BC +0.90	Weathered sandstone. Layer not sampled

Table 18 Chemical Parameters: Epipedal Brown Vertosol (Site 34)

Layer	pH ($CaCl_2$)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.8	Neutral	0.9	Non-Sodic	1.0	Non-Saline	1.9	Low
B21	8.0	Strongly Alkaline	0.6	Non-Sodic	1.0	Non-Saline	2.5	Low
B22	8.1	Strongly Alkaline	1.5	Non-Sodic	1.1	Non-Saline	2.1	Low
B22	8.1	Strongly Alkaline	1.1	Non-Sodic	1.0	Non-Saline	2.2	Low

Soil Unit 11: Epipedal Brown Vertosol

Site 37 – Epipedal Red Vertosol

Table 19 Summary: Epipedal Red Vertosol (Site 37)

Overview

Landscape Site 37

ASC Name	Epipedal Red Vertosol
Representative Site	Site 37
Survey Type	Detailed
Dominant Topography	Mid Slope
Dominant Land Use	Cattle Grazing
Vegetation	Casuarina, Wire Grass, Red Grass
Inherent Soil Fertility	Moderately High
Slope	8%
Aspect	West
Site Verified	Non-BSAL – Soil Depth, pH, Sodicity & Salinity

Table 20 Profile: Epipedal Red Vertosol (Site 37)

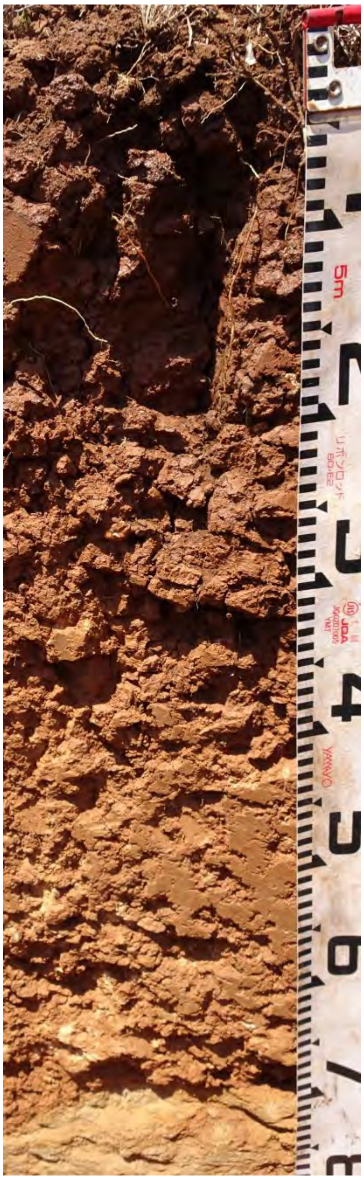
Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Dark reddish brown (5YR 3/3) heavy clay, strongly structured 20-40 mm blocky peds with strong consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and wavy boundary. Sampled 0.0 – 0.10
	B21 0.20 – 0.40	Reddish brown (5YR 4/4) clay, strongly structured 10-30 mm blocky peds with strong consistence and a smooth fabric. 10% calcium nodules 5-10 mm. Nil mottling, nil stone content, coarse roots common. Well drained with a gradual and wavy boundary. Sampled 0.20 – 0.30
	B22 0.40 – 0.70	Strong brown (7.5YR 4/6) clay, massive structure. 20% calcium nodules 5-10 mm. Nil mottling, nil stone content, coarse roots common. Well drained with an abrupt and wavy boundary. Sampled 0.40 – 0.50 and 0.60 – 0.70
	BC +0.70	Weathered Sandstone. Not sampled.

Table 21 Chemical Parameters: Epipedal Red Vertosol (Site 37)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	7.6	Mildly Alkaline	3.3	Non-Sodic	0.3	Non-Saline	1.0	Low
B21	9.0	Strongly Alkaline	4.7	Non-Sodic	1.8	Non-Saline	2.1	Low
B22	9.2	Strongly Alkaline	13.0	Sodic	5.1	Moderately Saline	1.8	Low
B22	9.1	Strongly Alkaline	16.4	Strongly Sodic	6.9	Moderately Saline	2.0	Low

Soil Unit 12: Eutrophic Red Chromosol

Site 1 – Eutrophic Red Dermosol

Sub-Dominant Soil Type

Table 22 Summary: Eutrophic Red Dermosol (Site 1)

Overview	
 Landscape Site 1	
ASC Name	Eutrophic Red Dermosol
Representative Site	Site 1
Survey Type	Detail
Dominant Topography	Lower Slope
Dominant Land Use	Cattle Grazing
Vegetation	Red Gum, Casuarina, Red Grass, Wire Grass
Inherent Soil Fertility	Moderately High
Slope	9%
Aspect	West
Site Verified	Non-BSAL – Sodicity & ECe

Table 23 Profile: Eutrophic Red Dermosol (Site 1)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Dark brown (7.5YR 3/4) silty loam, strongly structured 10-20 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a clear and even boundary. Sampled 0.0 – 0.10
	A2 0.10 – 0.20	Dark brown (7.5YR 3/3) silty clay loam, strongly structured 10-20 mm blocky peds with strong consistence and a smooth fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.10 – 0.20
	B21 0.20 – 0.50	Yellowish red (5YR 4/6) silty clay loam, strongly structured 20-30 mm subangular blocky peds with strong consistence and a smooth fabric. Nil mottles; nil stone content; coarse roots common. Well drained with a gradual and even boundary. Sampled 0.40 – 0.50
	B22 0.50 – 0.75	Dark reddish brown (5YR 3/4) light clay, massive structure with strong consistence and a smooth fabric. 5% soft calcium nodules 5-10 mm. Nil mottles, nil stone content, few coarse roots. Well drained with a gradual and even boundary. Sampled 0.65 – 0.75
	B23 +0.75	Layer continues beyond sampling depth Not lab tested

Table 24 Chemical Parameters: Eutrophic Red Dermosol (Site 1)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.3	Slightly Acidic	4.7	Non-Sodic	0.5	Non-Saline	1.0	Low
A2	7.4	Mildly Alkaline	11.0	Sodic	1.2	Non-Saline	0.7	Very Low
B21	8.7	Strongly Alkaline	22.3	Strongly Sodic	4.1	Moderately Saline	0.5	Very Low
B22	8.6	Strongly Alkaline	26.3	Strongly Sodic	9.2	Highly Saline	0.6	Very Low

Soil Unit 12: Eutrophic Red Chromosol

Site 2 – Subnatric Red Sodosol

Sub-Dominant Soil Type

Table 25 Summary: Subnatric Red Sodosol (Site 2)

Overview

Landscape Site 2

ASC Name	Subnatric Red Sodosol
Representative Site	Site 2
Survey Type	Detailed
Dominant Topography	Upper Slope
Dominant Land Use	Cattle Grazing
Vegetation	Acacia, Wire Grass, Red Grass
Inherent Soil Fertility	Moderately Low
Slope	12%
Aspect	North-West
Site Verified	Non-BSAL – Fertility, Soil Depth & Drainage

Table 26 Profile: Red Chromosol (Site 2)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.05	Yellowish brown (10YR 5/6) loam, moderately structured 10-20 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.0 – 0.05
	A2 0.05 – 0.10	Brown (10YR 4/3) loam, weak crumb structured 2-10 mm peds with weak consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with an abrupt and even boundary. Sampled 0.05 – 0.10
	B21 0.10 – 0.30	Yellowish brown (10YR 5/6) medium clay, strongly structured 20-30 mm subangular blocky peds with strong consistence and a rough fabric. 10% distinct yellow mottles; nil stone content; coarse roots common. Moderately drained with a gradual and even boundary. Sampled 0.20 – 0.30
	B22 0.30 – 0.50	Yellowish brown (10YR 5/8) medium clay, strongly structured 30-50 mm subangular blocky peds with strong consistence and a rough fabric. 30% distinct yellow mottles, nil stone content, few coarse roots. Poorly drained with a clear and even boundary. Sampled 0.40 – 0.50
	BC +0.50	Weathered sandstone. Not sampled

Table 27 Chemical Parameters: Subnatric Red Sodosol (Site 2)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.1	Slightly Acidic	0.9	Non Sodic	2.1	Slightly Saline	2.7	Low
A2	6.3	Slightly Acidic	2.3	Non Sodic	0.3	Non-Saline	2.3	Low
B21	6.6	Neutral	6.7	Marginally Sodic	0.6	Non-Saline	1.5	Low
B22	6.8	Neutral	8.8	Marginally Sodic	0.8	Non-Saline	1.4	Low

Soil Unit 12: Eutrophic Red Chromosol

Site 6 – Eutrophic Red Chromosol

Table 28 Summary: Eutrophic Red Chromosol (Site 6)

Overview

Landscape Site 6

ASC Name	Eutrophic Red Chromosol
Representative Site	Site 6
Survey Type	Detail
Dominant Topography	Upper Slope
Dominant Land Use	Cattle Grazing
Vegetation	Casuarina, Wire Grass, Corkscrew Grass
Inherent Soil Fertility	Moderately High
Slope	1%
Aspect	South
Site Verified	Non-BSAL – Soil Depth & Drainage

TOC

Table29 Profile: Eutrophic Red Chromosol (Site 6)

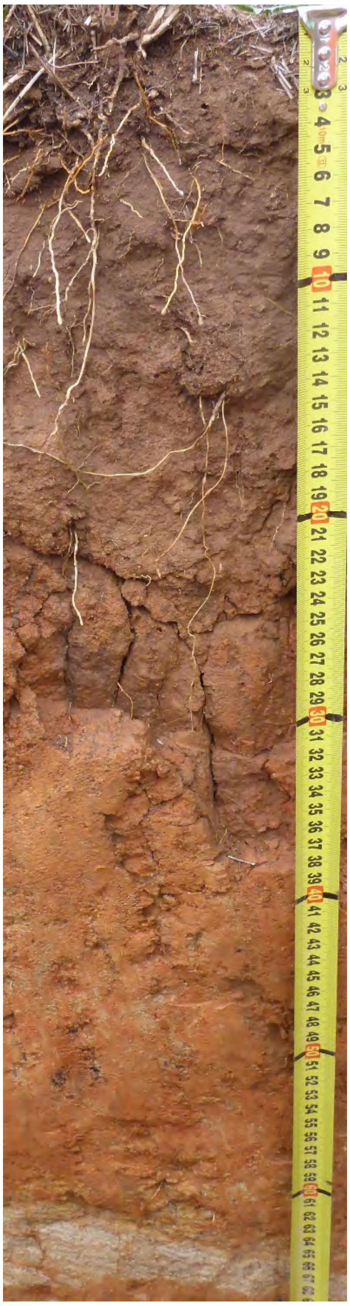
Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.05	Brown (7.5YR 4/4) loamy sand, weakly structured 5-10 mm blocky peds with weak consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.0 – 0.05
	A2 0.05 – 0.20	Strong brown (7.5YR 4/6) loamy sand, weakly structured 10-20 mm blocky peds with weak consistence and a rough fabric. Bleached when dry. Nil mottling, nil stone content, abundant fine roots. Well drained with a clear and even boundary. Sampled 0.10 – 0.20
	B21 0.20 – 0.40	Red (2.5YR 4/8) light clay, strongly structured 20-40 mm subangular blocky peds with strong consistence and a rough fabric. 20% distinct yellow mottles; nil stone content; coarse roots common. Poorly drained with a gradual and wavy boundary.
	B22 0.40 – 0.60	Yellowish red (5YR 4/6) clay loam, strongly structured 40-60 mm subangular blocky peds with strong consistence and a rough fabric. 30% distinct yellow mottles, nil stone content, few coarse roots. Poorly drained with a clear and even boundary. Sampled 0.50 – 0.60
	BC +0.60	Weathered sandstone. Not lab tested

Table 30 Chemical Parameters: Eutrophic Red Chromosol (Site 6)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.0	Moderately Acidic	2.2	Non-Sodic	0.7	Non-Saline	3.0	Moderate
A2	6.2	Slightly Acidic	1.3	Non-Sodic	0.9	Non-Saline	3.1	Moderate
B21	6.2	Slightly Acidic	1.5	Non-Sodic	0.5	Non-Saline	2.2	Moderate
B22	7.0	Neutral	1.9	Non-Sodic	0.5	Non-Saline	2.2	Moderate

Soil Unit 12: Eutrophic Red Chromosol

Site 7 – Eutrophic Brown Chromosol

Table 31 Summary: Eutrophic Brown Chromosol (Site 7)

Overview	
 Landscape Site 7	
ASC Name	Eutrophic Brown Chromosol
Representative Site	Site 7
Survey Type	Detail
Dominant Topography	Mid Slope
Dominant Land Use	Cattle Grazing
Vegetation	Casuarina, Acacia, Wire Grass, Red Grass
Inherent Soil Fertility	Moderately High
Slope	11%
Aspect	West
Site Verified	Non-BSAL – Soil Depth & Drainage

Table 32 Profile: Eutrophic Brown Chromosol (Site 7)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.12	Black (7.5YR 2.5/1) loam, moderately structured 5-10 mm blocky peds with weak consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with an abrupt and wavy boundary. Sampled 0.0 – 0.10
	B21 0.12 – 0.40	Brown (7.5YR 4/4) medium clay, strongly structured 20-40 mm subangular blocky peds with strong consistence and a rough fabric. 10% faint grey mottles, nil stone content, fine roots common. Moderately drained with a gradual and even boundary. Sampled 0.20 – 0.30
	B22 0.40 – 0.65	Yellowish brown (10YR 5/4) light clay, strongly structured 40-50 mm subangular blocky peds with strong consistence and a rough fabric. 10% soft calcium nodules 5-10 mm. 20% distinct grey mottles; nil stone content; few coarse roots. Poorly drained with a clear and even boundary. Sampled 0.40 – 0.50
	BC +0.65	Weathered sandstone. Not lab tested

Table 33 Chemical Parameters: Eutrophic Brown Chromosol (Site 7)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	5.8	Moderately Acidic	1.3	Non-Sodic	0.5	Non-Saline	2.2	Moderate
B21	7.8	Moderately Alkaline	5.8	Non-Sodic	0.7	Non-Saline	1.4	Moderate
B22	8.7	Strongly Alkaline	10.7	Sodic	2.3	Slightly Saline	1.2	Moderate

Soil Unit 12: Eutrophic Red Chromosol

Site 32 – Hypernatric Brown Sodosol

Sub-Dominant Soil Type

Table 34 Summary: Hypernatric Brown Sodosol (Site 32)

Overview

Landscape Site 32

ASC Name	Hypernatric Brown Sodosol
Representative Site	Site 32
Other Mapped Sites	1, 2, 3, 6, 7, 32, 38, 39
Survey Type	Detailed
Dominant Topography	Lower Slope
Dominant Land Use	Cattle Grazing
Vegetation	Casuarina, Spear Grass, Red Grass
Inherent Soil Fertility	Moderately Low
Slope	8%
Aspect	North
Site Verified	Non-BSAL – Fertility, Drainage, pH, Sodicity & Salinity

Table 35 Profile: Hypernatric Brown Sodosol (Site 32)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Dark brown (7.5YR 3/2) loamy sand, weak crumb structured 2-10 mm peds with weak consistence and a sandy fabric. Nil mottling, 10% gravel 5-10 mm, abundant fine roots. Poorly drained with a gradual and even boundary. Sampled 0.0 – 0.10
	A2 0.10 – 0.30	Light yellowish brown (2.5Y 6/3) loamy sand, apedal structured with a sandy fabric. Nil mottling, 10% gravel 5-10 mm, abundant fine roots. Poorly drained with an abrupt and even boundary. Sampled 0.20 – 0.30
	B21 0.30 – 0.60	Brown (10YR 5/3) clay loam, moderately structured 10-20 mm blocky peds with strong consistence and a rough fabric Nil mottling, 60% sandstone <60 mm, coarse roots common. moderately drained with a clear and even boundary. Sampled 0.40 – 0.50
	B22 +0.60	Brown (7.5YR 4/4) sandy clay loam, massive structure. 20% distinct yellow mottles, nil stone content, few coarse roots. Poorly drained, layer continues beyond sampling depth. Sampled 0.65 – 0.75

Table 36 Chemical Parameters: Hypernatric Brown Sodosol (Site 32)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.0	Slightly Acidic	3.8	Non-Sodic	1.1	Non-Saline	2.8	Low
A2	7.0	Neutral	12.9	Sodic	0.6	Non-Saline	2.0	Low
B21	8.5	Strongly Alkaline	31.6	Strongly Sodic	3.0	Slightly Saline	0.4	Very Low
B22	9.0	Strongly Alkaline	41.7	Strongly Sodic	4.3	Moderately Saline	0.3	Very Low

Soil Unit 12: Eutrophic Red Chromosol

Site 38 – Eutrophic Red Chromosol

Table 37 Summary: Eutrophic Red Chromosol (Site 38)

Overview

Landscape Site 38

ASC Name	Eutrophic Red Chromosol
Representative Site	Site 38
Survey Type	Detailed
Dominant Topography	Mid Slope
Dominant Land Use	Cattle Grazing
Vegetation	Wire Grass, Red Grass
Inherent Soil Fertility	Moderately High
Slope	9%
Aspect	East
Site Verified	Non-BSAL – Soil Depth

Table 38 Profile: Eutrophic Red Chromosol (Site 38)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Dark reddish brown (5YR 3/3) silty loam, strongly structured 10-40 mm blocky peds with strong consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a clear and even boundary. Sampled 0.0 – 0.10
	B21 0.10 – 0.40	Reddish brown (5YR 4/4) heavy clay, strongly structured 20-40 mm blocky peds with strong consistence and a rough fabric. Nil mottling, nil stone content, coarse roots common. Well drained with a gradual and wavy boundary. Sampled 0.20 – 0.30
	B22 0.40 – 0.60	Strong brown (7.5YR 4/6) heavy clay, strongly structured 10-30 mm blocky peds with strong consistence and a rough fabric. Nil mottling, nil stone content, coarse roots common. Well drained with an abrupt and wavy boundary. Sampled 0.40 – 0.50
	BC +0.60	Weathered sandstone. Layer not sampled.

Table 39 Chemical Parameters: Eutrophic Red Chromosol (Site 38)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.5	Slightly Acidic	1.8	Non-Sodic	0.8	Non-Saline	2.0	Low
B21	7.4	Mildly Alkaline	3.1	Non-Sodic	0.4	Non-Saline	1.4	Low
B22	8.5	Strongly Alkaline	3.5	Non-Sodic	1.1	Non-Saline	2.0	Low

Soil Unit 12: Eutrophic Red Chromosol

Site 39 – Eutrophic Red Chromosol

Table 40 Summary: Eutrophic Red Chromosol (Site 39)

Overview

Landscape Site 39

ASC Name	Eutrophic Red Chromosol
Representative Site	Site 39
Other Mapped Sites	1, 2, 3, 6, 7, 32, 38
Survey Type	Detailed
Dominant Topography	Mid Slope
Dominant Land Use	Cattle Grazing
Vegetation	Red Grass, Saffron Grass, Umbrella Grass
Inherent Soil Fertility	Moderately High
Slope	5%
Aspect	South West
Site Verified	Non-BSAL – Soil Depth

Table 41 Profile: Eutrophic Red Chromosol (Site 39)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Reddish brown (5YR 4/3) silty loam, moderately structured 10-20 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a clear and even boundary. Sampled 0.0 – 0.10
	B21 0.10 – 0.30	Reddish brown (2.5YR 4/4) silty clay, moderately structured 20-40 mm blocky peds with strong consistence and a rough fabric. Nil mottling, nil stone content, coarse roots common. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30
	B22 0.30 – 0.50	Yellowish red (5YR 4/6) light-medium clay, moderately structured 30-50 mm blocky peds with strong consistence and a rough fabric. Nil mottling, nil stone content, coarse roots common. Well drained with an abrupt and even boundary. Sampled 0.40 – 0.50
	BC +0.50	Weathered sandstone. Layer not sampled

Table 42 Chemical Parameters: Eutrophic Red Chromosol (Site 39)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.8	Neutral	1.1	Non-Sodic	1.0	Non-Saline	3.0	Low
B21	8.5	Strongly Alkaline	0.6	Non-Sodic	1.1	Non-Saline	5.2	Balanced
B22	8.7	Strongly Alkaline	0.8	Non-Sodic	1.1	Non-Saline	5.5	Balanced

Soil Unit 13: Black Vertosol

Site 8 – Epipedal Black Vertosol

Table 43 Summary: Epipedal Black Vertosol (Site 8)

Overview	

Landscape Site 8

ASC Name	Epipedal Black Vertosol
Representative Site	Site 8
Survey Type	Detail
Dominant Topography	Lower Slope
Dominant Land Use	Cattle Grazing
Vegetation	Kurrajong, Wire Grass, Red Grass
Inherent Soil Fertility	Moderately High
Slope	13%
Aspect	South-East
Site Verified	Non-BSAL – Sodicity & ECe

Table 44 Profile: Epipedal Black Vertosol (Site 8)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Dark brown (7.5YR 3/2) silty clay, strongly structured 10-20 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and wavy boundary. Sampled 0.0 – 0.10
	B21 0.10 – 0.30	Dark brown (7.5YR 3/2) silty clay, strongly structured 20-40 mm blocky peds with strong consistence and a smooth fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and wavy boundary. Sampled 0.20 – 0.30
	B22 0.30 – 0.60	Dark yellowish brown (10YR 3/4) medium clay, strongly structured 30-50 mm subangular blocky peds with strong consistence and a smooth fabric. 5% soft calcium nodules 5-10 mm. Nil mottling, nil stone content; coarse roots common. Well drained with a gradual and wavy boundary. Sampled 0.40 – 0.50
	B23 +0.60	Dark reddish brown (5YR 3/4) heavy clay, strongly structured 20-40 mm subangular blocky peds with strong consistence and a smooth fabric. 10% soft calcium nodules 5-10 mm. Nil mottling, nil stone content; coarse roots common. Well drained with layer continuing beyond sampling depth. Sampled 0.65 – 0.75

Table 45 Chemical Parameters: Epipedal Black Vertosol (Site 8)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	7.3	Neutral	7.6	Marginally Sodic	0.8	Non-Saline	0.9	Low
B21	8.1	Moderately Alkaline	14.4	Strongly Sodic	3.1	Slightly Saline	0.6	Low
B22	8.6	Strongly Alkaline	24.4	Strongly Sodic	8.1	Highly Saline	0.4	Low
B23	8.7	Strongly Alkaline	21.9	Strongly Sodic	7.7	Moderately Saline	0.9	Low

Soil Unit 13: Black Vertosol

Site 11 – Eutrophic Grey Dermosol

Sub-Dominant Soil Type

Table 46 Summary: Eutrophic Grey Dermosol (Site 11)

Overview	
 **Landscape Site 11**	
ASC Name	Eutrophic Grey Dermosol
Representative Site	Site 11
Other Mapped Sites	Nil
Survey Type	Detail
Dominant Topography	Alluvial Flat
Dominant Land Use	Cattle Grazing
Vegetation	White Box, Red Grass, Wire Grass
Inherent Soil Fertility	Moderately High
Slope	4%
Aspect	South
Site Verified	Potential BSAL

Table 47 Profile: Eutrophic Grey Dermosol (Site 11)

<table>
<tr><th>Profile</th><th>Horizon / Depth (m)</th><th>Description</th></tr>
<tr><td rowspan="3">
</td><td>A1
0.0 – 0.30</td><td>Dark brown (7.5YR 3/2) clay loam, strongly structured 10-30 mm subangular blocky peds with moderate consistence and a rough fabric.
Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and wavy boundary.
Sampled 0.0 – 0.10 and 0.20 – 0.30</td></tr>
<tr><td>B21
0.30 – 0.50</td><td>Dark grey (7.5YR 4/1) heavy clay, strongly structured 20-40 mm subangular blocky peds with moderate consistence and a smooth fabric.
Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and even boundary.
Sampled 0.40 – 0.50</td></tr>
<tr><td>B22
+0.50</td><td>Dark brown (7.5YR 3/2) medium clay, massive structure with strong consistence and a smooth fabric. 10% soft calcium nodules 5-10 mm.
Nil mottling, nil stone content, few coarse roots. Well drained with layer continuing beyond sampling depth.
Sampled 0.65 – 0.75</td></tr>
</table>

Table 48 Chemical Parameters: Eutrophic Grey Dermosol (Site 11)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	5.1	Strongly Acidic	3.7	Non-Sodic	3.4	Slightly Saline	2.6	Moderate
A1	7.9	Moderately Alkaline	5.5	Non-Sodic	0.8	Non-Saline	1.9	Low
B21	8.5	Strongly Alkaline	9.3	Marginally Sodic	1.9	Non-Saline	1.8	Low
B22	8.6	Strongly Alkaline	12.0	Sodic	3.6	Slightly Saline	1.9	Low

Soil Unit 14: Subnatric Brown Sodosol – Unit C

Site 17 – Subnatric Brown Sodosol

Table 49 Summary: Subnatric Brown Sodosol (Site 17)

Overview

Landscape Site 17

ASC Name	Subnatric Brown Sodosol
Representative Site	Site 17
Survey Type	Detail
Dominant Topography	Lower Slope
Dominant Land Use	Cattle Grazing
Vegetation	Wire Grass, Corkscrew Grass, Couch
Inherent Soil Fertility	Moderately Low
Slope	9%
Aspect	South-West
Verified	Non-BSAL – Fertility

Table 50 Profile: Subnatric Brown Sodosol (Site 17)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.30	Dark brown (7.5YR 3/3) sandy loam, weakly structured 5-20 mm subangular blocky peds with weak consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.0 – 0.10 and 0.20 – 0.30
	A2 0.30 – 0.55	Dark reddish brown (5YR 3/4) loamy sand, weakly structured 10-20 mm blocky peds with weak consistence and a rough fabric. 5% hard manganese nodules <5 mm. Nil mottling, 40% gravel 5-10 mm, abundant fine roots. Well drained with an abrupt and even boundary. Sampled 0.40 – 0.50
	B21 0.55 – 0.90	Dark yellowish brown (10YR 4/4) light clay, strongly structured 20-50 mm blocky peds with strong consistence and a rough fabric. 5% hard manganese nodules <5 mm Nil mottling; nil stone content; few coarse roots. Well drained with a gradual and even boundary. Sampled 0.65 – 0.75
	B22 +0.90	Dark yellowish brown (10YR 3/6) medium clay, massive structure. Not lab tested

Table 51 Chemical Parameters: Subnatric Brown Sodosol (Site 17)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	5.1	Strongly Acidic	5.0	Non-Sodic	0.7	Non-Saline	1.9	Low
A1	6.1	Slightly Acidic	2.1	Non-Sodic	0.5	Non-Saline	2.8	Moderate
A2	6.9	Neutral	4.2	Non-Sodic	0.6	Non-Saline	2.0	Moderate
B21	7.5	Mildly Alkaline	10.2	Sodic	0.9	Non-Saline	0.9	Very Low

Soil Unit 14: Subnatric Brown Sodosol – Unit C

Site 18 – Mottled-Mesonatric Brown Sodosol

Table 52 Summary: Mottled-Mesonatric Brown Sodosol (Site 18)

Overview

Landscape Site 18

ASC Name	Mottled-Mesonatric Brown Sodosol
Representative Site	Site 18
Survey Type	Detailed
Dominant Topography	Lower Slope
Dominant Land Use	Cattle Grazing
Vegetation	Casuarina, Wire Grass
Inherent Soil Fertility	Moderately Low
Slope	1%
Aspect	South-West
Site Verified	Non-BSAL – Fertility, Sodicity, ECe, & Drainage

Table 53 Profile: Mottled-Mesonatric Brown Sodosol (Site 18)

Profile	Horizon / Depth (m)	Description
	A2 0.0 – 0.20	A1 horizon has been eroded away. Yellowish brown (10YR 5/4) loamy sand, weak crumb structured 5-10 mm with weak consistence and a rough fabric. Nil mottling, nil stone content, few fine roots. Well drained with an abrupt and wavy boundary. Sampled 0.0 – 0.10
	B2 +0.20	Yellowish brown (10YR 5/6) clay loam, moderately structured 20-40 mm subangular blocky peds with strong consistence and a rough fabric. 30% distinct grey mottles; 10% gravel 5-20 mm; few coarse roots. Poorly drained with layer continuing beyond sampling depth. Sampled 0.20 – 30, 0.40 – 0.50 and 0.65 – 0.75

Table 54 Chemical Parameters: Mottled-Mesonatric Brown Sodosol (Site 18)

Layer	pH (1:5 water))		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A2	5.8	Moderately Acidic	8.2	Marginally Sodic	0.5	Non-Saline	0.9	Very Low
B2	6.3	Slightly Acidic	15.9	Strongly Sodic	1.2	Non-Saline	0.3	Very Low
B2	6.3	Slightly Acidic	20.5	Strongly Sodic	2.7	Slightly Saline	0.3	Very Low
B2	6.7	Neutral	26.1	Strongly Sodic	7.8	Moderately Saline	0.3	Very Low

Soil Unit 14: Subnatric Brown Sodosol – Unit C

Site 19 – Eutrophic Brown Dermosol

Sub-Dominant Soil Type

Table 55 Summary: Eutrophic Brown Dermosol (Site 19)

Overview

Landscape Site 19

ASC Name	Eutrophic Brown Dermosol
Representative Site	Site 19
Survey Type	Detail
Dominant Topography	Lower Slope
Dominant Land Use	Cattle Grazing
Vegetation	White Box, Wire Grass, Corkscrew Grass
Inherent Soil Fertility	Moderately High
Slope	9%
Aspect	South-West
Site Verified	Potential BSAL

Table 56 Profile: Eutrophic Brown Dermosol (Site 19)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Very dark brown (7.5YR 2.5/2) loam, moderately structured 5-20 mm subangular blocky peds with weak consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.0 – 0.10
	A2 0.15 – 0.30	Dark brown (7.5YR 2.5/2) silty loam, moderately structured 10-30 mm subangular blocky peds with strong consistence and a smooth fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30
	B2 +0.30	Dark brown (7.5YR 3/3) clay loam, massive structure with strong consistence and a smooth fabric. Nil mottling; nil stone content; coarse roots common. Well drained with layer continuing beyond sampling depth. Sampled 0.40 – 0.50 and 0.65 – 0.75

Table 57 Chemical Parameters: Eutrophic Brown Dermosol (Site 19)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	5.7	Moderately Acidic	1.4	Non-Sodic	0.4	Non-Saline	3.4	Moderate
A2	6.0	Moderately Acidic	1.5	Non-Sodic	0.3	Non-Saline	3.7	Moderate
B2	6.7	Neutral	1.9	Non-Sodic	0.4	Non-Saline	2.5	Moderate
B2	7.8	Mildly Alkaline	2.4	Non-Sodic	0.5	Non-Saline	2.3	Moderate

Soil Unit 14: Subnatric Brown Sodosol – Unit C

Site 20 – Brown Sodosol

Table 58 Summary: Brown Sodosol (Site 20)

Overview	
 Landscape Site 20	
ASC Name	Brown Sodosol
Representative Site	Site 20
Survey Type	Check
Dominant Topography	Drainage Line
Dominant Land Use	Cattle Grazing
Vegetation	Casuarina, Wire Grass
Inherent Soil Fertility	Moderately Low
Slope	18%
Aspect	North
Verified	Non-BSAL – Fertility & Drainage

Table 59 Profile: Brown Sodosol (Site 20)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Yellowish brown (10YR 5/4) sandy loam, weak crumb structure 5-10 mm peds with weak consistence and a rough fabric. Nil mottling, nil stone content, fine roots common. Well drained with a gradual and even boundary. Sampled 0.0 – 0.10
	A2 0.20 – 0.35	Yellowish brown (10YR 5/4) sandy loam, weakly structured 10-20 mm blocky peds with weak consistence and a rough fabric. Nil mottling, 20% gravel 5-20 mm, coarse roots common. Moderately drained with an abrupt and even boundary. Sampled 0.20 – 30
	B2 +0.35	Yellowish brown (10YR 5/8) medium clay, strongly structured 30-50 mm subangular blocky peds with strong consistence and a rough fabric. 30% distinct yellow mottles, nil stone content, few coarse roots. Poorly drained with layer continuing beyond sampling depth. Sampled 0.40 – 0.50 and 0.65 – 0.75

Table 60 Field Chemical Parameters: Brown Sodosol (Site 20)

Horizon	Field pH		Field Dispersion
	Unit	Rating	Rating
A1	6.5	Slightly Acidic	Non
A2	6.5	Slightly Acidic	Slightly
B2	7.0	Neutral	Highly
B2	7.0	Neutral	Highly

Soil Unit 14: Subnatric Brown Sodosol – Unit C

Site 21 – Brown Sodosol

Table 61 Summary: Brown Sodosol (Site 21)

Overview

Landscape Site 21

ASC Name	Brown Sodosol
Representative Site	Site 21
Survey Type	Check
Dominant Topography	Mid Slope
Dominant Land Use	Cattle Grazing
Vegetation	Acacia, Wire Grass
Inherent Soil Fertility	Moderately Low
Slope	13%
Aspect	East
Verified	Non-BSAL – Fertility & Soil Depth

Table 62 Profile: Brown Sodosol (Site 21)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Dark yellowish brown (10YR 4/4) loam, moderately structured 5-20 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a clear and wavy boundary. Sampled 0.0 – 0.10
	B2 0.15 – 0.60	Yellowish brown (10YR 5/4) medium clay, strongly structured 30-50 mm blocky peds with strong consistence and a smooth fabric. Nil mottles, nil stone content, coarse roots common. Well drained with a clear and even boundary. Sampled 0.20 – 0.30 and 0.40 – 0.50
	BC +0.60	Weathered sandstone. Not sampled

Table 63 Field Chemical Parameters: Brown Sodosol (Site 21)

Horizon	Field pH		Field Dispersion
	Unit	Rating	Rating
A1	6.0	Moderately Acidic	Non
B2	7.5	Mildly Alkaline	Moderately
B2	8.0	Moderately Alkaline	Highly

Soil Unit 14: Subnatric Brown Sodosol – Unit C

Site 22 – Mottled-Subnatric Brown Sodosol

Table 64 Summary: Mottled-Subnatric Brown Sodosol (Site 22)

Overview

Landscape Site 22

ASC Name	Mottled-Subnatric Brown Sodosol
Representative Site	Site 22
Survey Type	Detail
Dominant Topography	Drainage Line
Dominant Land Use	Cattle Grazing
Vegetation	Casuarina, Grey Box, Wire Grass
Inherent Soil Fertility	Moderately Low
Slope	10%
Aspect	Flat
Verified	Non-BSAL – Fertility, Sodicity, ECe & Drainage

Table 65 Profile: Mottled-Subnatric Brown Sodosol (Site 22)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Dark yellowish brown (10YR 3/4) silty loam, moderately structured 5-20 mm subangular blocky peds with weak consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.0 – 0.10
	A2 0.10 – 0.15	Yellowish brown (10YR 5/4) loamy sand, weakly structured 10-20 mm blocky peds with weak consistence and a rough fabric. Nil mottling, nil stone content, fine roots common. Well drained with a clear and even boundary. Not sampled
	B2 0.40 – 0.90	Dark yellowish brown (10YR 4/6) clay loam, strongly structured 30-50 mm subangular blocky peds with strong consistence and a rough fabric. 40% distinct grey mottles, nil stone content, few coarse roots. Poorly drained with layer continuing beyond sampling depth. Sampled 0.20 – 0.30, 0.40 – 0.50 and 0.65 – 0.75

Table 66 Chemical Parameters: Mottled-Subnatric Brown Sodosol (Site 22)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	5.6	Moderately Acidic	2.9	Non-Sodic	0.3	Non-Saline	2.2	Moderate
B2	6.7	Neutral	10.8	Sodic	1.0	Non-Saline	0.8	Very Low
B2	7.6	Mildly Alkaline	18.2	Strongly Sodic	2.1	Slightly Saline	0.7	Very Low
B2	7.5	Mildly Alkaline	23.6	Strongly Sodic	7.0	Moderately Saline	0.7	Very Low

Soil Unit 14: Subnatric Brown Sodosol – Unit C

Site 23 – Red Sodosol

Table 67 Summary: Red Sodosol (Site 23)

Overview	
 Landscape Site 23	
ASC Name	Red Sodosol
Representative Site	Site 23
Survey Type	Check
Dominant Topography	Drainage Line
Dominant Land Use	Cattle Grazing
Vegetation	Grey Box, Wire Grass
Inherent Soil Fertility	Moderately Low
Slope	8%
Aspect	West
Verified	Non-BSAL – Fertility & Drainage

Table 68 Profile: Red Sodosol (Site 23)

Profile	Horizon / Depth (m)	Description
	A2 0.0 – 0.15	A1 horizon has been eroded away. Yellowish brown (10YR 5/6) sandy loam, weakly structured 5-20 mm blocky peds with weak consistence and a rough fabric. Nil mottling, nil stone content, few fine roots. Well drained with an abrupt and wavy boundary. Sampled 0.0 – 0.10
	B2 0.15 – 0.90	Dark yellowish brown (7.5YR 4/6) medium clay, strongly structured 30-50 mm subangular blocky peds with strong consistence and a rough fabric. 40% distinct yellow mottles, 10% gravel 5-15 mm, few coarse roots. Poorly drained with layer continuing beyond sampling depth. Sampled 0.20 – 0.30, 0.40 – 0.50 and 0.65 – 0.75

Table 69 Field Chemical Parameters: Red Sodosol (Site 23)

Horizon	Field pH		Field Dispersion
	Unit	Rating	Rating
A2	6.0	Moderately Acidic	Slightly
B2	7.5	Mildly Alkaline	Highly
B2	8.0	Moderately Alkaline	Highly
B2	8.0	Moderately Alkaline	Highly

Soil Unit 14: Subnatric Brown Sodosol – Unit C

Site 24 – Eutrophic Brown Chromosol

Sub-Dominant Soil Type

Table 70 Eutrophic Brown Chromosol (Site 24)

Overview

Landscape Site 24

ASC Name	Eutrophic Brown Chromosol
Representative Site	Site 24
Survey Type	Detail
Dominant Topography	Upper Slope
Dominant Land Use	Cattle Grazing
Vegetation	Kurrajong, White Box, Wire Grass
Inherent Soil Fertility	Moderately High
Slope	11%
Aspect	South
Verified	Non-BSAL – Sodicity, ECe & Drainage

Table 71 Profile: Eutrophic Brown Chromosol (Site 24)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Dark brown (7.5YR 3/4) silty loam, weakly structured 10-20 mm subangular blocky peds with weak consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with an abrupt and wavy boundary. Sampled 0.0 – 0.10
	B21 0.15 – 0.50	Strong brown (7.5YR 4/6) light-medium clay, strongly structured 20-40 mm subangular blocky peds with strong consistence and a rough fabric. Nil mottling; nil stone content; coarse roots common. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30 and 0.40 – 0.50
	B22 +0.50	Yellowish brown (10YR 5/6) silty clay loam, massive structure with strong consistence and a rough fabric. 10% soft calcium nodules 5-10 mm. 30% distinct grey mottles, nil stone content, few coarse roots. Poorly drained with layer continuing beyond sampling depth. Sampled 0.65 – 0.75

Table 72 Chemical Parameters: Eutrophic Brown Chromosol (Site 24)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	5.4	Strongly Acidic	6.2	Marginally Sodic	0.9	Non-Saline	1.7	Low
B21	6.7	Neutral	4.1	Non-Sodic	1.1	Non-Saline	1.4	Low
B21	7.7	Mildly Alkaline	15.8	Strongly Sodic	4.2	Moderately Saline	0.7	Very Low
B22	8.5	Strongly Alkaline	15.5	Strongly Sodic	9.5	Highly Saline	1.8	Low

Soil Unit 14: Subnatric Brown Sodosol – Unit C

Site 25 – Subnatric Brown Sodosol

Table 73 Summary: Subnatric Brown Sodosol (Site 25)

Overview

Landscape Site 25

ASC Name	Subnatric Brown Sodosol
Representative Site	Site 25
Survey Type	Detail
Dominant Topography	Mid Slope
Dominant Land Use	Cattle Grazing
Vegetation	White Box, Wire Grass, Red Grass
Inherent Soil Fertility	Moderately Low
Slope	11%
Aspect	East
Verified	Non-BSAL – Fertility, Sodicity & ECe

Table 74 Profile: Subnatric Brown Sodosol (Site 25)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Very dark greyish brown (10YR 3/2) silty loam, strongly structured 5-20 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil gravel, abundant fine roots. Well drained with a clear and even boundary. Sampled 0.0 – 0.10
	B21 0.10 – 0.55	Dark yellowish brown (10YR 3/4) medium clay, strongly structured 10-30 mm subangular blocky peds with strong consistence and a rough fabric. 20% soft calcium nodules 10-20 mm from 0.30 m. Nil mottling, nil gravel, abundant coarse roots. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30 and 0.40 – 0.50
	B22 +0.55	Yellowish brown (10YR 5/4) silty clay loam, strongly structured 20-50 mm subangular blocky peds with strong consistence and a rough fabric. Nil mottling; nil stone content; coarse roots common. Well drained with layer continuing beyond sampling depth. Sampled 0.65 – 0.75

Table 75 Chemical Parameters: Subnatric Brown Sodosol (Site 25)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.1	Slightly Acidic	2.7	Non-Sodic	0.9	Non-Saline	1.7	Low
B21	7.7	Mildly Alkaline	10.0	Marginally Sodic	1.1	Non-Saline	1.2	Low
B21	8.2	Moderately Alkaline	16.9	Strongly Sodic	3.2	Slightly Saline	1.0	Low
B22	8.6	Strongly Alkaline	19.4	Strongly Sodic	8.7	Highly Saline	1.6	Low

Soil Unit 14: Subnatric Brown Sodosol – Unit C

Site 26 – Subnatric Grey Sodosol

Table 76 Summary: Subnatric Grey Sodosol (Site 26)

Overview	
 Landscape Site 26	
ASC Name	Subnatric Grey Sodosol
Representative Site	Site 26
Survey Type	Detail
Dominant Topography	Lower Slope
Dominant Land Use	Cattle Grazing
Vegetation	Red Grass, Wire Grass
Inherent Soil Fertility	Moderately Low
Slope	8%
Aspect	North-East
Verified	Non-BSAL – Fertility, Sodicity & ECe

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Table 77 Profile: Subnatric Grey Sodosol (Site 26)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Very dark greyish brown (10YR 3/2) silty loam, moderately structured 5-20 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, <5% gravel, abundant fine roots. Well drained with a clear and wavy boundary. Sampled 0.0 – 0.10
	B21 0.10 – 0.30	Dark grey (10YR 4/1) light clay, strongly structured 20-50 mm subangular blocky peds with strong consistence and a smooth fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30
	B22 0.30 – 0.60	Dark greyish brown (10YR 4/2) silty clay loam, moderately structured 20-40 mm subangular blocky peds with strong consistence and a smooth fabric. 10% soft calcium nodules 5-10 mm. Nil mottling; nil stone content; coarse roots common. Well drained with a gradual and even boundary. Sampled 0.40 – 0.50
	B23 +0.60	Dark yellowish brown (10YR 4/4) heavy clay, massive structure with strong consistence and a smooth fabric. Nil mottling, nil stone content, few coarse roots. Well drained with layer continuing beyond sampling depth. Sampled 0.65 – 0.75

Table 78 Chemical Parameters: Subnatric Grey Sodosol (Site 26)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.4	Slightly Acidic	6.4	Marginally Sodic	0.8	Non-Saline	1.4	Low
B21	8.7	Strongly Alkaline	9.6	Marginally Sodic	3.3	Slightly Saline	1.5	Low
B22	8.9	Strongly Alkaline	18.0	Strongly Sodic	7.8	Moderately Saline	1.2	Low
B23	8.9	Strongly Alkaline	20.0	Strongly Sodic	6.4	Moderately Saline	1.2	Low

Soil Unit 14: Subnatric Brown Sodosol – Unit C

Site 27 – Subnatric Brown Sodosol

Table 79 Summary: Subnatric Brown Sodosol (Site 27)

Overview

Landscape Site 27

ASC Name	Subnatric Brown Sodosol
Representative Site	Site 27
Survey Type	Detail
Dominant Topography	Hill Crest
Dominant Land Use	Cattle Grazing
Vegetation	Acacia, Red Grass, Wire Grass
Inherent Soil Fertility	Moderately Low
Slope	23%
Aspect	South
Verified	Non-BSAL – Fertility, Sodicity, ECe & Soil Depth

Table 80 Profile: Subnatric Brown Sodosol (Site 27)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Dark brown (7.5YR 3/4) loam, weakly structured 10-20 mm blocky peds with weak consistence and a rough fabric. Nil mottling, Nil stone content, abundant fine roots. Well drained with an abrupt and even boundary. Sampled 0.0 – 0.10
	B2 0.10 – 0.60	Strong brown (7.5YR 4/6) light-medium clay, strongly structured 20-40 mm subangular blocky peds with strong consistence and a rough fabric. Nil mottling; nil stone content; coarse roots common. Well drained with a clear and even boundary. Sampled 0.20 – 0.30 and 0.40 – 0.50
	BC +0.60	Weathered sandstone. Not lab tested

Table 81 Chemical Parameters: Subnatric Brown Sodosol (Site 27)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	5.8	Moderately Acidic	3.1	Non-Sodic	0.6	Non-Saline	2.2	Moderate
B2	7.3	Mildly Alkaline	11.4	Sodic	2.9	Slightly Saline	0.9	Very Low
B2	8.1	Moderately Alkaline	23.6	Strongly Sodic	7.3	Moderately Saline	0.6	Very Low

Soil Unit 14: Subnatric Brown Sodosol – Unit C

Site 28 – Brown Sodosol

Table 82 Summary: Brown Sodosol (Site 28)

Overview	
 Landscape Site 28	
ASC Name	Brown Sodosol
Representative Site	Site 28
Survey Type	Check
Dominant Topography	Lower Slope
Dominant Land Use	Cattle Grazing
Vegetation	Red Grass, Wire Grass, Couch
Inherent Soil Fertility	Moderately Low
Slope	9%
Aspect	North
Verified	Non-BSAL – Fertility & Soil Depth

Table 83 Profile: Brown Sodosol (Site 28)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Brown (10YR 5/3) sandy loam, moderately structured 5-20 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with an abrupt and wavy boundary. Sampled 0.0 – 0.10
	B2 0.10 – 0.60	Strong brown (7.5YR 4/6) medium clay, strongly structured 20-50 mm blocky peds with strong consistence and a rough fabric. 10% soft calcium nodules 5-10 mm. Nil mottling; nil stone content; coarse roots common. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30 and 0.40 – 0.50
	BC +0.60	Weathered sandstone. Not sampled

Table 84 Field Chemical Parameters: Brown Sodosol (Site 28)

Horizon	Field pH		Field Dispersion
	Unit	Rating	Rating
A1	6.0	Moderately Acidic	Non
B2	8.0	Moderately Alkaline	Moderately
B2	8.0	Moderately Alkaline	Highly

Soil Unit 14: Subnatric Brown Sodosol – Unit C

Site 29 – Red Sodosol

Table 85 Summary: Red Sodosol (Site 29)

Overview

Landscape Site 29

ASC Name	Red Sodosol
Representative Site	Site 29
Survey Type	Check
Dominant Topography	Upper Slope
Dominant Land Use	Cattle Grazing
Vegetation	Casuarina, Wire Grass
Inherent Soil Fertility	Moderately Low
Slope	14%
Aspect	South
Verified	Non-BSAL – Fertility, Soil Depth & Drainage

Table 86 Profile: Red Sodosol (Site 29)

Profile	Horizon / Depth (m)	Description
	A2 0.0 – 0.15	A1 horizon has been eroded away. Brown (10YR 5/3) sandy loam, weak crumb structure 5-10 mm peds with weak consistence and a rough fabric. Nil mottling, 10% gravel 10-20 mm, few fine roots. Well drained with an abrupt and wavy boundary. Sampled 0.00 – 0.10
	B2 0.15 – 0.60	Yellowish red (5YR 4/6) medium clay, moderately structured 20-40 mm subangular blocky peds with strong consistence and a rough fabric. 20% distinct yellow mottles; nil stone content; few coarse roots. Poorly drained with a gradual and even boundary. Sampled 0.20 – 0.30 and 0.40 – 0.50
	BC +0.60	Weathered sandstone. Not sampled

Table 87 Field Chemical Parameters: Red Sodosol (Site 29)

Horizon	Field pH		Field Dispersion
	Unit	Rating	Rating
A2	6.5	Slightly Acidic	Non
B2	7.0	Neutral	Highly
B2	8.0	Moderately Alkaline	Highly

Soil Unit 2: Self-Mulching Brown Vertosol – Deep

Site 36 – Eutrophic Red Chromosol

Table 88 Summary: Eutrophic Red Chromosol (Site 36)

Overview

Landscape Site 36

ASC Name	Eutrophic Red Chromosol
Representative Site	Site 36
Other Mapped Sites	(SLR, 2015)
Survey Type	Detailed
Dominant Topography	Mid Slope
Dominant Land Use	Cattle Grazing
Vegetation	Wire Grass, Red Grass
Inherent Soil Fertility	Moderately High
Slope	6%
Aspect	North West
Site Verified	Non-BSAL – Soil Depth

Table 89 Profile: Eutrophic Red Chromosol (Site 36)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Dark brown (7.5YR 3/2) silty clay loam, moderately structured 5-20 mm blocky peds with strong consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a clear and wavy boundary. Sampled 0.0 – 0.10
	B21 0.10 – 0.30	Dark reddish brown (2.5YR 3/4) heavy clay, strongly structured 20-60 mm blocky peds with strong consistence and a rough fabric. Nil mottling, nil stone content, coarse roots common. Well drained with a gradual and wavy boundary. Sampled 0.20 – 0.30
	B22 0.30 – 0.60	Strong brown (7.5YR 4/6) light-medium clay, massive structure. Nil mottling, nil stone content, coarse roots common. Well drained with a gradual and even boundary. Sampled 0.40 – 0.50
	BC +0.60	Weathered sandstone. Layer not Sampled

Table 90 Chemical Parameters: Eutrophic Red Chromosol (Site 36)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.1	Slightly Acidic	1.5	Non-Sodic	0.7	Non-Saline	2..4	Low
B21	7.3	Neutral	1.5	Non-Sodic	0.2	Non-Saline	2.0	Low
B22	7.6	Mildly Alkaline	2.0	Non-Sodic	0.4	Non-Saline	1.9	Low

Soil Unit 10: Subnatric Brown Sodosol – Unit B

Site 35 – Mesonatric Brown Sodosol

Table 91 Summary: Mesonatric Brown Sodosol (Site 35)

Overview

Landscape Site 35

ASC Name	Mesonatric Brown Sodosol
Representative Site	Site 35
Other Mapped Sites	30 & (SLR, 2015)
Survey Type	Detailed
Dominant Topography	Mid Slope
Dominant Land Use	Cattle Grazing
Vegetation	Grey Box, Red Grass
Inherent Soil Fertility	Moderately Low
Slope	5%
Aspect	South
Site Verified	Non-BSAL – Fertility, pH, Sodicity & Salinity

Table 92 Profile: Mesonatric Brown Sodosol (Site 35)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Dark brown (7.5YR 3/2) loam, moderately structured 5-30 mm blocky peds with strong consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a clear and even boundary. Sampled 0.0 – 0.10
	B21 0.10 – 0.40	Brown (7.5YR 4/3) light-medium clay, strongly structured 20-60 mm blocky peds with strong consistence and a rough fabric. Nil mottling, nil stone content, coarse roots common. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30
	B22 0.40 – 0.60	Strong brown (7.5YR 4/6) medium clay, moderately structured 20-40 mm blocky peds with strong consistence and a rough fabric. 10% calcium nodules 5-10 mm. Nil mottling, nil stone content, coarse roots common. Well drained with a gradual and even boundary. Sampled 0.40 – 0.50
	B23 +0.60	Yellowish brown (10YR 5/6) heavy clay, massive structure. 10% calcium nodules 5-10 mm. Nil mottles, nil stone content, few coarse roots. Well drained, layer continues beyond sampling depth. Sampled 0.65 – 0.75

Table 93 Chemical Parameters: Mesonatric Brown Sodosol (Site 35)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	7.1	Neutral	7.7	Marginally Sodic	1.3	Non-Saline	1.1	Low
B21	9.1	Strongly Alkaline	17.4	Strongly Sodic	5.3	Moderately Saline	0.9	Very Low
B22	9.2	Strongly Alkaline	20.4	Strongly Sodic	8.0	Highly Saline	1.2	Low
B23	9.2	Strongly Alkaline	22.5	Strongly Sodic	7.0	Moderately Saline	1.0	Low

Additional Mapped Site for SLR (2015)

Soil Unit 8: Mesonatric Brown Sodosol

Site 13 – Brown Sodosol

Table 94 Summary: Brown Sodosol (Site 13)

Overview

Landscape Site 13

ASC Name	Brown Sodosol
Representative Site	Site 13
Survey Type	Check
Dominant Topography	Mid Slope
Dominant Land Use	Cattle Grazing
Vegetation	Casuarina, Red Grass, Wire Grass
Inherent Soil Fertility	Moderately Low
Slope	11%
Aspect	West
Site Verified	Non-BSAL – Fertility & Soil Depth

Table 95 Profile: Brown Sodosol (Site 13)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Brown (10YR 5/3) loam, strongly structured 10-20 mm blocky peds with strong consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a clear and wavy boundary. Sampled 0.0 – 0.10
	B2 0.15 – 0.50	Strong brown (7.5YR 4/6) medium clay, strongly structured 20-50 mm subangular blocky peds with strong consistence and a smooth fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30 and 0.40 – 0.50
	BC +0.50	Weathered sandstone. Not sampled

Table 96 Field Chemical Parameters: Brown Sodosol (Site 13)

Horizon	Field pH		Field Dispersion
	Unit	Rating	Rating
A1	6.5	Slightly Acidic	Non
B2	7.5	Mildly Alkaline	Moderately
B2	7.5	Mildly Alkaline	Moderately

Additional Mapped Site for SLR (2015)

Soil Unit 8: Mesonatric Brown Sodosol

Site 14 – Mottled-Subnatric Red Sodosol

Sub-Dominant Soil Type

Table 97 Summary: Mottled-Subnatric Red Sodosol (Site 14)

Overview

Landscape Site 14

ASC Name	Mottled-Subnatric Red Sodosol
Representative Site	Site 14
Survey Type	Detail
Dominant Topography	Mid Slope
Dominant Land Use	Cattle Grazing
Vegetation	White Box, Acacia, Red Grass, Wire Grass
Inherent Soil Fertility	Moderately Low
Slope	11%
Aspect	South-West
Site Verified	Non-BSAL – Fertility, Sodicity, ECe, Soil Depth & Drainage

Table 98 Profile: Mottled-Subnatric Red Sodosol (Site 14)

Profile	Horizon / Depth (m)	Description
	A2 0.0 – 0.15	A1 horizon has been eroded away. Very dark brown (7.5YR 2.5/3) sandy loam, weakly structured 5-15 mm blocky peds with weak consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with an abrupt and even boundary. Sampled 0.0 – 0.10
	B21 0.15 – 0.40	Yellowish red (5YR 4/6) light clay, strongly structured 20-40 mm subangular blocky peds with moderate consistence and a rough fabric. 20% distinct grey mottles, nil stone content, coarse roots common. Poorly drained with a gradual and even boundary. Sampled 0.20 – 0.30
	B22 0.40 – 0.65	Strong brown (7.5YR 5/6) silty clay, strongly structured 40-60 mm blocky peds with strong consistence and a rough fabric. 40% distinct grey mottles; nil stone content; few coarse roots. Poorly drained with a clear and even boundary. Sampled 0.40 – 0.50
	BC +0.65	Weathered sandstone. Not lab tested

Table 99 Chemical Parameters: Mottled-Subnatric Red Sodosol (Site 14)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A2	6.5	Slightly Acidic	2.6	Non-Sodic	1.7	Non-Saline	2.1	Moderate
B21	6.5	Slightly Acidic	6.5	Marginally Sodic	1.9	Non-Saline	0.7	Very Low
B22	6.5	Slightly Acidic	15.0	Strongly Sodic	5.1	Moderately Saline	0.5	Very Low

Additional Mapped Site for SLR (2015)

Soil Unit 8: Mesonatric Brown Sodosol

Site 15 – Eutrophic Brown Chromosol

Sub-Dominant Soil Type

Table 100 Summary: Eutrophic Brown Chromosol (Site 15)

Overview

Landscape Site 15

ASC Name	Eutrophic Brown Chromosol
Representative Site	Site 15
Survey Type	Detail
Dominant Topography	Lower Slope
Dominant Land Use	Cattle Grazing
Vegetation	Kurrajong, Red Grass, Wire Grass
Inherent Soil Fertility	Moderately High
Slope	7%
Aspect	West
Site Verified	Potential BSAL

Table 101 Profile: Eutrophic Brown Chromosol (Site 15)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Dark brown (7.5YR 3/3) silty loam, strongly structured 5-20 mm subangular blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a clear and wavy boundary. Sampled 0.0 – 0.10
	B21 0.10 – 0.35	Dark brown (7.5YR 3/3) heavy clay, strongly structured 10-30 mm subangular blocky peds with strong consistence and a smooth fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30
	B22 0.35 – 0.80	Dark reddish-brown (5YR 3/4) clay loam, massive structure with strong consistence and a smooth fabric. Nil mottles; 10% gravel 5-10 mm; coarse roots common. Well drained with a gradual and even boundary. Sampled 0.40 – 0.50 and 0.65 – 0.75
	BC +0.80	Weathered sandstone. Not lab tested

Table 102 Chemical Parameters: Eutrophic Brown Chromosol (Site 15)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	5.6	Moderately Acidic	3.8	Non-Sodic	0.9	Non-Saline	1.6	Low
B21	7.2	Neutral	5.4	Non-Sodic	0.3	Non-Saline	1.4	Low
B22	8.3	Moderately Alkaline	9.4	Marginally Sodic	1.1	Non-Saline	1.2	Low
B22	8.7	Strongly Alkaline	11.0	Sodic	3.3	Slightly Saline	1.8	Low

Additional Mapped Site for SLR (2015)

Soil Unit 10: Subnatric Brown Sodosol – Unit B

Site 30 – Epipedal Brown Vertosol

Sub-Dominant Soil Type

Table 103 Summary: Epipedal Brown Vertosol (Site 30)

Overview

Landscape Site 30

ASC Name	Epipedal Brown Vertosol
Representative Site	Site 30
Survey Type	Detail
Dominant Topography	Drainage Flat
Dominant Land Use	Cattle Grazing
Vegetation	White Box, Red Grass, Wire Grass, Couch
Inherent Soil Fertility	Moderately High
Slope	3%
Aspect	West
Site Verified	Non-BSAL – Sodicity & ECe

Table 104 Profile: Epipedal Brown Vertosol (Site 30)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Dark brown (7.5YR 3/2) heavy clay, strongly structured 10-40 mm blocky peds with weak consistence and a rough fabric. Nil mottling, <5% gravel 5-10 mm, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.0 – 0.10
	B21 0.15 – 0.40	Brown (7.5YR 4/4) heavy clay, strongly structured 20-50 mm blocky peds with strong consistence and a smooth fabric. Nil mottles; nil stone content; coarse roots common. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30
	B22 +0.40	Brown (7.5YR 4/4) medium clay, massive structure with strong consistence and a smooth fabric. Nil mottles, <5% gravel 5-10 mm, few coarse roots. Well drained with layer continuing beyond sampling depth. Sampled 0.40 – 0.50 and 0.65 – 0.75

Table 105 Chemical Parameters: Epipedal Brown Vertosol (Site 30)

Layer	pH (1:5 Water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.0	Slightly Acidic	3.0	Non-Sodic	0.7	Non-Saline	1.6	Low
B21	8.1	Moderately Alkaline	13.2	Sodic	0.9	Non-Saline	1.0	Low
B22	8.6	Strongly Alkaline	21.1	Strongly Sodic	3.0	Slightly Saline	0.9	Very Low
B22	8.6	Strongly Alkaline	26.8	Strongly Sodic	4.9	Moderately Saline	0.7	Very Low

Soil Unit 2 – Self-Mulching Brown Vertosol; Deep

Site 15 – Eutrophic Brown Dermosol

Sub-Dominant Soil Type

Table 106 Summary: Eutrophic Brown Dermosol

Overview	
 Landscape Site 15	
ASC Name	Eutrophic Brown Dermosol
Representative Site	Site 15
Survey Year	2015
Other Mapped Sites 2015	11, 16, 17, 18, 64
Other Mapped Sites 2018/2019	36
Survey Type	Detailed
Dominant Land Use	Grazing
Inherent Soil Fertility	Moderately High
Site Verified	Non-BSAL – ECe

Table 107 Profile: Eutrophic Brown Dermosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Very dark greyish brown (10YR 3/2) light-medium clay, moderate structure of 5-20 mm polyhedral peds with strong consistence and rough fabric. Nil mottling; nil stone content; nil segregations; well drained with a gradual and wavy boundary.
	B21 0.10 – 0.60	Brown (10YR 3/3) medium clay, strong structure of 20-50 mm angular blocky peds with a strong consistence and smooth fabric. Nil mottling; 10% rock 10 mm; nil segregations; moderately drained with a gradual and wavy boundary.
	B22 0.60 – 0.90	Light yellowish brown (10YR 6/4) light-medium clay, strong structure of 50-100 mm angular blocky peds with a strong consistence and rough fabric. Nil mottling; 5% gravel 15 mm; 15% calcium carbonate segregations; imperfectly drained with an abrupt and wavy boundary.
	C +0.90	Weathered rock

Table 108 Chemical Parameters: Eutrophic Brown Dermosol

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	Unit	Rating	Ratio	Rating
A1	6.4	Slightly Acidic	0.2	Non Sodic	0.6	Non-Saline	1.6	Low
B21	7.2	Neutral	3.1	Non Sodic	0.5	Non-Saline	1.3	Low
B21	8.0	Moderately Alkaline	6.3	Marginally Sodic	3.4	Slightly Saline	1.1	Low
B22	8.5	Strongly Alkaline	6.3	Marginally Sodic	7.4	Moderately Saline	1.5	Low

Soil Unit 2 – Self-Mulching Brown Vertosol; Deep

Site 17 –Self-Mulching Red Vertosol

Sub-Dominant Soil Type

Table 109 Summary: Self-Mulching Red Vertosol

Overview	
 Landscape Site 17	
ASC Name	Self-Mulching Red Vertosol
Representative Site	Site 17 (SLR, 2015)
Survey Year	2015
Other Mapped Sites 2015	11, 15, 16, 18
Other Mapped Sites 2018/2019	36
Survey Type	Detailed
Dominant Land Use	Grazing
Inherent Soil Fertility	Moderately High
Site Verified	Non-BSAL – Soil Depth, pH, ECe & Sodicity

Table 110 Profile: Self-Mulching Red Vertosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Dark brown (7.5YR 3/2) loam, strong structure of 5-20 mm angular blocky peds with strong consistence and smooth fabric. Nil mottling; 5% rock 10 mm; nil segregations; well drained with a gradual and even boundary.
	B2 0.10 – 0.70	Dark reddish brown (2.5YR 2.5/3) light-medium clay, strong structure of 20-50 mm angular blocky peds with a strong consistence and smooth fabric. Nil mottling; nil stone content; 10% soft calcium carbonate segregations; well drained with a gradual and wavy boundary.
	BC +0.70	Brown (7.5YR 5/3) silty clay loam, strong structure of 50-100 mm angular blocky peds with a strong consistence and rough fabric. Nil mottling; 20% fine gravel; nil segregations; imperfectly drained.

Table 111 Chemical Parameters: Self-Mulching Red Vertosol

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	Unit	Rating	%	Rating
A1	6.1	Slightly Acidic	3.7	Non-Sodic	1.2	Non-Saline	1.3	Low
B2	8.2	Moderately Alkaline	12.5	Sodic	1.3	Non-Saline	0.8	Very Low
B2	9.0	Strongly Alkaline	22.5	Strongly Sodic	7.1	Moderately Saline	0.9	Very Low
BC	9.2	Strongly Alkaline	16.6	Strongly Sodic	7.3	Moderately Saline	1.3	Low

Soil Unit 2 – Self-Mulching Brown Vertosol; Deep

Site 18 – Self Mulching Brown Vertosol

Table 112 Summary: Self-Mulching Brown Vertosol

Overview	
 Landscape Site 18	
ASC Name	Self-Mulching Brown Vertosol
Representative Site	Site 18 (SLR, 2015)
Survey Year	2015
Other Mapped Sites 2015	11, 15, 16, 17
Other Mapped Sites 2018/2019	36
Survey Type	Detailed
Dominant Land Use	Grazing
Inherent Soil Fertility	Moderately High
Site Verified	Non-BSAL – ECe & Sodicity

Table 113 Profile: Self-Mulching Brown Vertosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Dark reddish-brown (5YR 3/3) clay loam, strong structure of 10-20 mm subangular blocky peds with strong consistence and rough fabric. Nil mottling; 10% rock 20-50 mm; nil segregations; well drained with a gradual and wavy boundary.
	B21 0.10 – 0.50	Dark brown (7.5YR 3/4) heavy clay, strong structure of 20-50 mm angular blocky peds with a strong consistence and smooth fabric. Nil mottling; nil stone content; nil segregations; well drained with a gradual and wavy boundary.
	B22 0.50 – 0.80	Dark reddish brown (2.5YR 2.5/4) heavy clay, strong structure of 20-50 mm angular blocky peds with a strong consistence and smooth fabric. Nil mottling; nil stone content; 15% soft calcium carbonate segregations; well drained with a gradual and wavy boundary.
	B23 0.80 – 1.20	Dark reddish brown (5YR 3/4) heavy clay, strong structure of 50-100 mm angular blocky peds with a strong consistence and smooth fabric. Nil mottling; 5% rock <10 mm; 15% soft calcium carbonate segregations; well drained.

Table 114 Chemical Parameters: Self-Mulching Brown Vertosol

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	Unit	Rating	%	Rating
A1	5.9	Moderately Acidic	7.5	Marginally Sodic	2.3	Slightly Saline	1.1	Low
B21	8.0	Moderately Alkaline	15.0	Strongly Sodic	1.9	Non-Saline	0.7	Low
B22	8.6	Strongly Alkaline	19.9	Strongly Sodic	6.7	Moderately Saline	1.0	Low
B23	8.6	Strongly Alkaline	21.7	Strongly Sodic	9.2	Highly Saline	1.0	Low

Site 12 Rock Outcrop (Epipedal Black Vertosol)

Appendix E

Laboratory Certificates of Analysis

Notes for Appendix E – Laboratory Certificates of Analysis

- Site D18 results (EAL Job Numbers H0793 & H0485) are samples from Site 18, SLR (2015), which were subsequently analysed by EAL in May 2018.
- Site D17 results (EAL Job Number H8052) are samples from Site 17, SLR (2015), which were subsequently analysed by EAL in February 2019.
- All other analysis dated May 2018 and February 2019 are samples from the Maxwell Project Biophysical Strategic Agricultural Land Verification Assessment analysed by EAL.
- All analysis dated December 2014 and January 2015 from ALS and Scone Research Centre are SLR (2015).

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

AGRICULTURAL SOIL ANALYSIS REPORT

47 samples supplied by SLR Consulting Australia Pty Ltd on 1st February, 2019. Lab Job No.H8052

Analysis requested by Murray Fraser. Your Job: SLR630.12463.001 BSAL

10 Kings Road NEW LAMBTON NSW 2305

Parameter	Unit	Method reference	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7
		Sample ID:	BSAL 31 0-10	BSAL 31 20-30	BSAL 31 40-50	BSAL 31 65-75	BSAL 32 0-10	BSAL 32 20-30	BSAL 32 40-50
		Crop:	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Client:	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL
			H8052/1	H8052/2	H8052/3	H8052/4	H8052/5	H8052/6	H8052/7
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	5.64	7.02	8.47	8.48	5.26	6.13	7.53
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.18	8.17	9.24	9.14	5.99	6.95	8.53
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.075	0.170	0.781	1.013	0.049	0.025	0.352
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	6.66	9.58	24.44	21.24	4.74	1.60	3.76
	(kg/ha)		2991	4299	10973	9534	2129	720	1690
	(mg/kg)		1335	1919	4899	4256	950	322	754
Exchangeable Magnesium	(cmol$_+$/kg)		7.70	16.65	22.61	24.25	1.69	0.80	8.44
	(kg/ha)		2097	4532	6155	6602	459	217	2297
	(mg/kg)		936	2023	2748	2947	205	97	1026
Exchangeable Potassium	(cmol$_+$/kg)		1.01	0.58	0.42	0.47	0.48	0.15	0.28
	(kg/ha)		886	512	368	408	423	127	247
	(mg/kg)		396	229	164	182	189	57	110
Exchangeable Sodium	(cmol$_+$/kg)		0.79	4.05	9.01	11.02	0.28	0.38	5.77
	(kg/ha)		406	2088	4642	5677	145	196	2969
	(mg/kg)		181	932	2072	2534	65	87	1325
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.02	<0.01	0.01	<0.01	0.03	<0.01	0.01
	(kg/ha)		4	1	2	2	6	2	2
	(mg/kg)		2	<1	1	<1	3	<1	1
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.27	<0.01	<0.01	<0.01	0.19	<0.01	<0.01
	(kg/ha)		6	<1	<1	<1	4	<1	<1
	(mg/kg)		3	<1	<1	<1	2	<1	<1
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	16.46	30.87	56.50	56.99	7.42	2.94	18.26
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	40.5	31.0	43.3	37.3	64.0	54.6	20.6
Magnesium (%)			46.8	53.9	40.0	42.6	22.7	27.2	46.2
Potassium (%)			6.1	1.9	0.7	0.8	6.5	5.0	1.5
Sodium - ESP (%)			4.8	13.1	16.0	19.3	3.8	12.9	31.6
Aluminium (%)			0.1	0.0	0.0	0.0	0.4	0.3	0.1
Hydrogen			1.6	0.0	0.0	0.0	2.6	0.0	0.0
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	0.9	0.6	1.1	0.9	2.8	2.0	0.4
Chloride Estimate (equiv. mg/kg)		**Calculation: Electrical Conductivity x 640	48	109	500	649	31	16	225
Colour (Munsell Soil Colour Classification) - Hue/Colour, Value/Chroma		**Inhouse	7.5YR 3/3	5YR 3/2	10YR 4/3	2.5Y 5/4	7.5YR 3/2	2.5Y 6/3	10YR 5/3
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	--	--	--	--	--	--	--

Notes:

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

Quality Checked: Kris Saville
Agricultural Co-Ordinator

KS

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

Southern Cross University

ASPAC

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

AGRICULTURAL SOIL ANALYSIS REPORT

47 samples supplied by SLR Consulting Australia Pty Ltd on 1st February, 2019. Lab Job No.H8052

Analysis requested by Murray Fraser. Your Job: SLR630.12463.001 BSAL

10 Kings Road NEW LAMBTON NSW 2305

			Sample 8	Sample 9	Sample 10	Sample 11	Sample 12	Sample 13	Sample 14
		Sample ID:	BSAL 32 65-75	BSAL 33 0-10	BSAL 33 20-30	BSAL 33 40-50	BSAL 33 65-75	BSAL 34 0-10	BSAL 34 20-30
		Crop:	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Client:	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL
Parameter		**Method reference**	**H8052/8**	**H8052/9**	**H8052/10**	**H8052/11**	**H8052/12**	**H8052/13**	**H8052/14**
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	7.90	5.39	8.01	8.20	8.16	6.75	7.95
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.97	6.05	8.66	8.88	8.70	7.17	8.57
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.455	0.065	0.346	0.477	1.059	0.119	0.122
Exchangeable Calcium	($cmol_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	1.67	6.55	19.80	23.56	24.12	15.33	25.57
	(kg/ha)		749	2941	8890	10576	10827	6881	11479
	(mg/kg)		334	1313	3969	4721	4833	3072	5125
Exchangeable Magnesium	($cmol_+$/kg)		6.20	4.12	13.35	13.69	14.07	8.06	10.33
	(kg/ha)		1686	1121	3634	3726	3830	2195	2811
	(mg/kg)		753	500	1622	1663	1710	980	1255
Exchangeable Potassium	($cmol_+$/kg)		0.36	0.68	0.58	0.47	0.51	1.40	0.78
	(kg/ha)		319	592	507	410	448	1224	681
	(mg/kg)		143	264	226	183	200	546	304
Exchangeable Sodium	($cmol_+$/kg)		5.89	0.42	3.48	4.94	8.00	0.22	0.21
	(kg/ha)		3033	217	1792	2544	4119	116	106
	(mg/kg)		1354	97	800	1136	1839	52	47
Exchangeable Aluminium	($cmol_+$/kg)	**Inhouse S37 (KCl)	0.01	0.01	<0.01	0.01	0.02	0.02	0.03
	(kg/ha)		2	3	2	2	4	3	6
	(mg/kg)		1	1	<1	1	2	2	3
Exchangeable Hydrogen	($cmol_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	0.08	<0.01	<0.01	<0.01	<0.01	<0.01
	(kg/ha)		<1	2	<1	<1	<1	<1	<1
	(mg/kg)		<1	<1	<1	<1	<1	<1	<1
Effective Cation Exchange Capacity (ECEC) ($cmol_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H ($cmol_+$/kg)	14.13	11.86	37.22	42.67	46.72	25.03	36.91
Calcium (%)		**Base Saturation Calculations - Cation $cmol_+$/kg / ECEC x 100	11.8	55.3	53.2	55.2	51.6	61.2	69.3
Magnesium (%)			43.8	34.7	35.9	32.1	30.1	32.2	28.0
Potassium (%)			2.6	5.7	1.6	1.1	1.1	5.6	2.1
Sodium - ESP (%)			41.7	3.6	9.4	11.6	17.1	0.9	0.6
Aluminium (%)			0.1	0.1	0.0	0.0	0.0	0.1	0.1
Hydrogen			0.0	0.7	0.0	0.0	0.0	0.0	0.0
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium ($cmol_+$/kg)	0.3	1.6	1.5	1.7	1.7	1.9	2.5
Chloride Estimate (equiv. mg/kg)		**Calculation: Electrical Conductivity x 640	291	41	221	305	677	76	78
Colour (Munsell Soil Colour Classification) - Hue/Colour, Value/Chroma		**Inhouse	7.5YR 4/4	5YR 3/2	7.5YR 4/3	7.5YR 4/4	7.5YR 4/6	2.5YR 3/3	7.5YR 4/4
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	5YR 4/6 15%	--	--	--	--	--	--

Notes:

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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 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

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

AGRICULTURAL SOIL ANALYSIS REPORT

47 samples supplied by SLR Consulting Australia Pty Ltd on 1st February, 2019. Lab Job No.H8052
Analysis requested by Murray Fraser. Your Job: SLR630.12463.001 BSAL
10 Kings Road NEW LAMBTON NSW 2305

Parameter	Unit	Method reference	Sample 15	Sample 16	Sample 17	Sample 18	Sample 19	Sample 20	Sample 21
Sample ID:			BSAL 34 40-50	BSAL 34 65-75	BSAL 35 0-10	BSAL 35 20-30	BSAL 35 40-50	BSAL 35 65-75	BSAL 36 0-10
Crop:			N/A	N/A	N/A	N/A	N/A	N/A	N/A
Client:			Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL
			H8052/15	H8052/16	H8052/17	H8052/18	H8052/19	H8052/20	H8052/21
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	8.13	8.12	6.46	8.42	8.54	8.54	5.63
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.88	8.83	7.08	9.08	9.23	9.22	6.14
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.129	0.118	0.138	0.614	1.072	1.201	0.069
Exchangeable Calcium	($cmol_+/kg$)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	24.81	25.29	8.68	14.68	21.77	20.81	10.89
	(kg/ha)		11139	11352	3895	6590	9773	9344	4888
	(mg/kg)		4973	5068	1739	2942	4363	4171	2182
Exchangeable Magnesium	($cmol_+/kg$)		11.98	11.62	8.15	15.80	18.02	20.06	4.59
	(kg/ha)		3261	3165	2218	4301	4904	5461	1249
	(mg/kg)		1456	1413	990	1920	2189	2438	558
Exchangeable Potassium	($cmol_+/kg$)		0.41	0.43	0.85	0.46	0.50	0.53	1.16
	(kg/ha)		361	372	742	403	441	462	1017
	(mg/kg)		161	166	331	180	197	206	454
Exchangeable Sodium	($cmol_+/kg$)		0.58	0.43	1.47	6.51	10.34	12.02	0.25
	(kg/ha)		300	220	758	3353	5327	6190	127
	(mg/kg)		134	98	338	1497	2378	2764	57
Exchangeable Aluminium	($cmol_+/kg$)	**Inhouse S37 (KCl)	0.02	0.02	0.03	0.02	0.02	0.02	0.02
	(kg/ha)		5	5	5	4	3	4	5
	(mg/kg)		2	2	2	2	1	2	2
Exchangeable Hydrogen	($cmol_+/kg$)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.11
	(kg/ha)		<1	<1	<1	<1	<1	<1	2
	(mg/kg)		<1	<1	<1	<1	<1	<1	1
Effective Cation Exchange Capacity (ECEC) ($cmol_+/kg$)		**Calculation: Sum of Ca,Mg,K,Na,Al,H ($cmol_+/kg$)	37.81	37.79	19.17	37.47	50.65	53.44	17.02
Calcium (%)		**Base Saturation Calculations - Cation $cmol_+/kg$ / ECEC x 100	65.6	66.9	45.3	39.2	43.0	38.9	64.0
Magnesium (%)			31.7	30.8	42.5	42.2	35.6	37.5	27.0
Potassium (%)			1.1	1.1	4.4	1.2	1.0	1.0	6.8
Sodium - ESP (%)			1.5	1.1	7.7	17.4	20.4	22.5	1.5
Aluminium (%)			0.1	0.1	0.1	0.1	0.0	0.0	0.1
Hydrogen			0.0	0.0	0.0	0.0	0.0	0.0	0.6
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium ($cmol_+/kg$)	2.1	2.2	1.1	0.9	1.2	1.0	2.4
Chloride Estimate (equiv. mg/kg)		**Calculation: Electrical Conductivity x 640	82	76	88	393	686	769	44
Colour (Munsell Soil Colour Classification) - Hue/Colour, Value/Chroma		**Inhouse	10YR 4/4	10YR 5/4	7.5YR 3/2	7.5YR 4/3	7.5YR 4/6	10YR 5/6	7.5YR 3/2
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	--	--	--	--	--	--	--

Notes:

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7. Total Acid Extractable Nutrients indicate a store of nutrients.
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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'.
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122 mg/kg Magnesium, 200 mg/kg Calcium
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Quality Checked: Kris Saville
Agricultural Co-Ordinator
KS

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

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Analysis requested by Murray Fraser. Your Job: SLR630.12463.001 BSAL
10 Kings Road NEW LAMBTON NSW 2305

Parameter	Unit	Method reference	Sample 22	Sample 23	Sample 24	Sample 25	Sample 26	Sample 27	Sample 28
		Sample ID:	BSAL 36 20-30	BSAL 36 40-50	BSAL 37 0-10	BSAL 37 20-30	BSAL 37 40-50	BSAL 37 60-70	BSAL 38 0-10
		Crop:	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Client:	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL
			H8052/22	H8052/23	H8052/24	H8052/25	H8052/26	H8052/27	H8052/28
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	6.43	6.80	6.69	8.17	8.32	8.19	6.09
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	7.27	7.59	7.58	8.96	9.22	9.13	6.46
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.038	0.047	0.060	0.208	0.592	0.802	0.079
Exchangeable Calcium	(cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	20.10	22.57	13.32	27.62	23.17	22.65	11.32
	(kg/ha)		9025	10134	5979	12400	10402	10166	5082
	(mg/kg)		4029	4524	2669	5536	4644	4538	2269
Exchangeable Magnesium	(cmol+/kg)		10.23	11.66	12.96	12.95	12.64	11.24	5.63
	(kg/ha)		2785	3174	3529	3525	3442	3060	1532
	(mg/kg)		1243	1417	1575	1574	1537	1366	684
Exchangeable Potassium	(cmol+/kg)		0.45	0.41	0.76	0.43	0.36	0.36	1.32
	(kg/ha)		394	358	663	376	313	315	1154
	(mg/kg)		176	160	296	168	140	141	515
Exchangeable Sodium	(cmol+/kg)		0.46	0.70	0.92	2.03	5.41	6.70	0.33
	(kg/ha)		238	361	474	1043	2787	3451	170
	(mg/kg)		106	161	212	466	1244	1540	76
Exchangeable Aluminium	(cmol+/kg)	**Inhouse S37 (KCl)	0.02	0.02	0.02	0.03	0.02	0.02	0.03
	(kg/ha)		4	4	5	5	5	5	7
	(mg/kg)		2	2	2	2	2	2	3
Exchangeable Hydrogen	(cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.09
	(kg/ha)		<1	<1	<1	<1	<1	<1	2
	(mg/kg)		<1	<1	<1	<1	<1	<1	<1
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	31.26	35.36	27.98	43.05	41.61	40.97	18.72
Calcium (%)		**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	64.3	63.8	47.6	64.2	55.7	55.3	60.5
Magnesium (%)			32.7	33.0	46.3	30.1	30.4	27.4	30.1
Potassium (%)			1.4	1.2	2.7	1.0	0.9	0.9	7.0
Sodium - ESP (%)			1.5	2.0	3.3	4.7	13.0	16.4	1.8
Aluminium (%)			0.1	0.1	0.1	0.1	0.1	0.1	0.2
Hydrogen			0.0	0.0	0.0	0.0	0.0	0.0	0.5
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol+/kg)	2.0	1.9	1.0	2.1	1.8	2.0	2.0
Chloride Estimate (equiv. mg/kg)		**Calculation: Electrical Conductivity x 640	24	30	38	133	379	514	51
Colour (Munsell Soil Colour Classification) - Hue/Colour, Value/Chroma		**Inhouse	2.5YR 3/4	5YR 4/3	5YR 3/3	5YR 4/4	7.5YR 4/6	5YR 5/6	5YR 3/3
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	--	--	--	--	--	--	--

Notes:

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2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwood.
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9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil results'.
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Southern Cross University

CRICOS Provider: 01241G

ASPAC

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
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AGRICULTURAL SOIL ANALYSIS REPORT

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Analysis requested by Murray Fraser. Your Job: SLR630.12463.001 BSAL

10 Kings Road NEW LAMBTON NSW 2305

			Sample 29	Sample 30	Sample 31	Sample 32	Sample 33	Sample 34	Sample 35
		Sample ID:	BSAL 38 20-30	BSAL 38 40-50	M2 (2018) 0-5	M2 (2018) 5-10	M2 (2018) 20-30	M2 (2018) 40-50	M4 (2018) 0-10
		Crop:	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Client:	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL
Parameter		**Method reference**	**H8052/29**	**H8052/30**	**H8052/31**	**H8052/32**	**H8052/33**	**H8052/34**	**H8052/35**
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	6.57	7.92	5.81	5.54	5.62	5.90	6.40
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	7.39	8.52	6.11	6.26	6.55	6.84	6.90
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.070	0.197	0.090	0.035	0.070	0.088	0.101
Exchangeable Calcium	($cmol_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	18.30	30.20	5.49	3.76	10.90	9.81	19.10
	(kg/ha)		8214	13557	2464	1688	4894	4403	8574
	(mg/kg)		3667	6052	1100	754	2185	1966	3828
Exchangeable Magnesium	($cmol_+$/kg)		12.93	15.16	2.04	1.62	7.27	6.96	10.65
	(kg/ha)		3519	4127	554	441	1980	1894	2901
	(mg/kg)		1571	1842	247	197	884	846	1295
Exchangeable Potassium	($cmol_+$/kg)		1.23	0.81	0.94	0.85	0.47	0.39	1.87
	(kg/ha)		1078	708	821	746	414	345	1642
	(mg/kg)		481	316	366	333	185	154	733
Exchangeable Sodium	($cmol_+$/kg)		1.04	1.70	0.08	0.15	1.34	1.65	0.56
	(kg/ha)		534	874	42	79	689	849	286
	(mg/kg)		238	390	19	35	308	379	128
Exchangeable Aluminium	($cmol_+$/kg)	**Inhouse S37 (KCl)	0.04	0.03	0.03	0.03	0.05	0.03	0.03
	(kg/ha)		7	6	7	6	10	7	6
	(mg/kg)		3	2	3	3	4	3	3
Exchangeable Hydrogen	($cmol_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	0.08	0.18	0.09	<0.01	<0.01
	(kg/ha)		<1	<1	2	4	2	<1	<1
	(mg/kg)		<1	<1	<1	2	<1	<1	<1
Effective Cation Exchange Capacity (ECEC) ($cmol_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H ($cmol_+$/kg)	33.53	47.89	8.66	6.60	20.13	18.84	32.22
Calcium (%)		**Base Saturation Calculations - Cation $cmol_+$/kg / ECEC x 100	54.6	63.1	63.4	57.0	54.2	52.1	59.3
Magnesium (%)			38.6	31.7	23.5	24.6	36.1	36.9	33.1
Potassium (%)			3.7	1.7	10.8	12.9	2.3	2.1	5.8
Sodium - ESP (%)			3.1	3.5	0.9	2.3	6.7	8.7	1.7
Aluminium (%)			0.1	0.1	0.4	0.4	0.2	0.2	0.1
Hydrogen			0.0	0.0	0.9	2.7	0.5	0.0	0.0
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium ($cmol_+$/kg)	1.4	2.0	2.7	2.3	1.5	1.4	1.8
Chloride Estimate (equiv. mg/kg)		**Calculation: Electrical Conductivity x 640	45	126	58	23	45	57	65
Colour (Munsell Soil Colour Classification) - Hue/Colour, Value/Chroma		**Inhouse	5YR 4/4	7.5YR 4/6	7.5YR 3/4	7.5YR 4/4	5YR 4/6	7.5YR 4/6	5YR 2.5/1
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	--	--	--	--	--	--	--

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Southern Cross University
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P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

AGRICULTURAL SOIL ANALYSIS REPORT

47 samples supplied by SLR Consulting Australia Pty Ltd on 1st February, 2019. Lab Job No.H8052

Analysis requested by Murray Fraser. Your Job: SLR630.12463.001 BSAL

10 Kings Road NEW LAMBTON NSW 2305

			Sample 36	Sample 37	Sample 38	Sample 39	Sample 40	Sample 41	Sample 42
		Sample ID:	M4 (2018) 20-30	M4 (2018) 50-60	M10 (2018) 0-10	M10 (2018) 20-30	M10 (2018) 40-50	17 (2015) 0-10	17 (2015) 20-30
		Crop:	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Client:	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL
Parameter		**Method reference**	**H8052/36**	**H8052/37**	**H8052/38**	**H8052/39**	**H8052/40**	**H8052/41**	**H8052/42**
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	8.10	8.28	6.05	6.46	7.33	5.66	7.16
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.88	8.97	6.63	7.23	8.14	6.08	8.22
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.213	0.801	0.077	0.055	0.087	0.126	0.148
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	27.20	28.98	16.54	18.06	18.80	8.71	11.64
	(kg/ha)		12209	13008	7424	8107	8439	3910	5227
	(mg/kg)		5451	5807	3314	3619	3767	1746	2333
Exchangeable Magnesium	(cmol$_+$/kg)		18.13	21.11	6.58	8.50	9.14	6.50	13.80
	(kg/ha)		4935	5748	1792	2313	2489	1769	3757
	(mg/kg)		2203	2566	800	1033	1111	790	1677
Exchangeable Potassium	(cmol$_+$/kg)		0.80	0.62	1.04	0.67	0.49	0.91	0.42
	(kg/ha)		702	540	909	588	425	794	366
	(mg/kg)		313	241	406	263	190	354	164
Exchangeable Sodium	(cmol$_+$/kg)		3.38	8.86	0.32	0.62	0.96	0.63	3.71
	(kg/ha)		1741	4561	163	317	494	323	1912
	(mg/kg)		777	2036	73	141	221	144	853
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.03	0.03	<0.01	<0.01	0.01	0.01	0.01
	(kg/ha)		5	6	2	1	2	2	2
	(mg/kg)		2	3	<1	<1	1	1	<1
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	0.06	<0.01	<0.01	0.09	<0.01
	(kg/ha)		<1	<1	1	<1	<1	2	<1
	(mg/kg)		<1	<1	<1	<1	<1	<1	<1
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	49.54	59.59	24.55	27.85	29.40	16.84	29.59
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	54.9	48.6	67.4	64.8	63.9	51.7	39.4
Magnesium (%)			36.6	35.4	26.8	30.5	31.1	38.6	46.7
Potassium (%)			1.6	1.0	4.2	2.4	1.7	5.4	1.4
Sodium - ESP (%)			6.8	14.9	1.3	2.2	3.3	3.7	12.5
Aluminium (%)			0.1	0.0	0.0	0.0	0.0	0.1	0.0
Hydrogen			0.0	0.0	0.3	0.0	0.0	0.5	0.0
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	1.5	1.4	2.5	2.1	2.1	1.3	0.8
Chloride Estimate (equiv. mg/kg)		**Calculation: Electrical Conductivity x 640	136	513	49	35	56	80	95
Colour (Munsell Soil Colour Classification) - Hue/Colour, Value/Chroma		**Inhouse	7.5YR 3/1	7.5YR 4/2	7.5YR 3/3	7.5YR 4/4	7.5YR 5/3	7.5YR 3/2	2.5YR 2.5/3
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	--	--	--	--	--	--	--

Notes:

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

KS

EAL Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

AGRICULTURAL SOIL ANALYSIS REPORT

47 samples supplied by SLR Consulting Australia Pty Ltd on 1st February, 2019. Lab Job No.H8052

Analysis requested by Murray Fraser. Your Job: SLR630.12463.001 BSAL

10 Kings Road NEW LAMBTON NSW 2305

Parameter		Method reference	Sample 43	Sample 44	Sample 45	Sample 46	Sample 47
		Sample ID:	17 (2015) 40-50	17 (2015) 65-75	BSAL 39 0-10	BSAL 39 20-30	BSAL 39 40-50
		Crop:	N/A	N/A	N/A	N/A	N/A
		Client:	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL	Maxwell BSAL
			H8052/43	H8052/44	H8052/45	H8052/46	H8052/47
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	8.33	8.44	6.60	7.86	8.09
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.97	9.24	6.78	8.47	8.68
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.819	0.853	0.105	0.131	0.130
Exchangeable Calcium	(cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	13.17	21.43	11.39	25.51	30.47
	(kg/ha)		5911	9621	5111	11453	13680
	(mg/kg)		2639	4295	2282	5113	6107
Exchangeable Magnesium	(cmol+/kg)		14.28	16.45	3.80	4.92	5.53
	(kg/ha)		3886	4478	1035	1338	1504
	(mg/kg)		1735	1999	462	598	672
Exchangeable Potassium	(cmol+/kg)		0.43	0.37	1.45	1.07	0.78
	(kg/ha)		375	324	1267	933	686
	(mg/kg)		167	145	566	417	306
Exchangeable Sodium	(cmol+/kg)		8.08	7.62	0.18	0.20	0.31
	(kg/ha)		4159	3925	93	105	160
	(mg/kg)		1857	1752	41	47	71
Exchangeable Aluminium	(cmol+/kg)	**Inhouse S37 (KCl)	<0.01	<0.01	0.01	0.01	0.01
	(kg/ha)		2	1	3	3	2
	(mg/kg)		<1	<1	1	1	1
Exchangeable Hydrogen	(cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	0.09	<0.01	<0.01
	(kg/ha)		<1	<1	2	<1	<1
	(mg/kg)		<1	<1	<1	<1	<1
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	35.96	45.88	16.92	31.71	37.11
Calcium (%)		**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	36.6	46.7	67.3	80.5	82.1
Magnesium (%)			39.7	35.9	22.5	15.5	14.9
Potassium (%)			1.2	0.8	8.6	3.4	2.1
Sodium - ESP (%)			22.5	16.6	1.1	0.6	0.8
Aluminium (%)			0.0	0.0	0.1	0.0	0.0
Hydrogen			0.0	0.0	0.5	0.0	0.0
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol+/kg)	0.9	1.3	3.0	5.2	5.5
Chloride Estimate (equiv. mg/kg)		**Calculation: Electrical Conductivity x 640	524	546	67	84	83
Colour (Munsell Soil Colour Classification) - Hue/Colour, Value/Chroma		**Inhouse	7.5YR 4/6	7.5YR 5/3	5YR 4/3	2.5YR 4/4	5YR 4/6
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	--	--	--	--	--

Notes:

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

2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia*. CSIRO Publishing: Collingwood.

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

4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.

5. Guidelines for phosphorus have been reduced for Australian soils.

6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.

7. Total Acid Extractable Nutrients indicate a store of nutrients.

8. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.

9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil results'.

10. Conversions for 1 cmol+/kg = 230 mg/kg Sodium, 390 mg/kg Potassium, 122 mg/kg Magnesium, 200 mg/kg Calcium

11. Conversions to kg/ha = mg/kg x 2.24

12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimate

13. ** NATA accreditation does not cover the performance of this service.

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

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Quality Checked: Kris Saville
Agricultural Co-Ordinator

KS

GRAIN SIZE ANALYSIS (hydrometer and sieving techniques)

47 soil samples supplied by SLR Consulting Australia Pty Ltd on 1st February, 2019 - Lab Job No. H8052
Analysis requested by Murray Fraser. **Your Project: SLR630.12463.001 BSAL**
10 Kings Road NEW LAMBTON NSW 2305

SAMPLE ID	Lab Code	MOISTURE CONTENT (% of water in air-dry 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)
BSAL 31 0-10	H8052/1	4.0%	11.4%	29.2%	38.0%	4.8%	16.6%	100.0%
BSAL 31 20-30	H8052/2	10.9%	0.9%	23.9%	27.6%	9.8%	37.8%	100.0%
BSAL 31 40-50	H8052/3	13.3%	0.5%	10.2%	19.6%	22.9%	46.7%	100.0%
BSAL 31 65-75	H8052/4	14.9%	0.1%	4.9%	17.0%	33.2%	44.8%	100.0%
BSAL 32 0-10	H8052/5	2.2%	0.7%	30.4%	47.9%	12.1%	8.9%	100.0%
BSAL 32 20-30	H8052/6	2.5%	2.2%	33.4%	50.5%	9.3%	4.6%	100.0%
BSAL 32 40-50	H8052/7	9.5%	2.3%	28.3%	36.9%	8.0%	24.4%	100.0%
BSAL 32 65-75	H8052/8	8.0%	4.0%	34.9%	35.7%	6.3%	19.1%	100.0%
BSAL 33 0-10	H8052/9	4.8%	0.2%	20.1%	44.4%	12.4%	22.9%	100.0%
BSAL 33 20-30	H8052/10	13.7%	3.0%	13.9%	21.0%	8.4%	53.7%	100.0%
BSAL 33 40-50	H8052/11	13.0%	2.8%	15.6%	26.3%	10.0%	45.4%	100.0%
BSAL 33 65-75	H8052/12	14.7%	2.6%	14.5%	26.0%	9.8%	47.0%	100.0%
BSAL 34 0-10	H8052/13	8.5%	1.4%	4.1%	37.0%	24.7%	32.8%	100.0%
BSAL 34 20-30	H8052/14	12.4%	0.2%	2.2%	18.0%	28.8%	50.8%	100.0%
BSAL 34 40-50	H8052/15	8.3%	1.4%	5.8%	25.5%	41.1%	26.1%	100.0%
BSAL 34 65-75	H8052/16	9.3%	1.3%	5.5%	27.6%	33.9%	31.6%	100.0%
BSAL 35 0-10	H8052/17	5.1%	1.2%	23.9%	36.3%	16.4%	22.2%	100.0%
BSAL 35 20-30	H8052/18	11.2%	1.2%	19.8%	25.5%	9.5%	44.0%	100.0%
BSAL 35 40-50	H8052/19	13.0%	2.4%	15.0%	15.1%	19.4%	48.1%	100.0%
BSAL 35 65-75	H8052/20	15.4%	1.0%	9.6%	19.7%	20.1%	49.6%	100.0%
BSAL 36 0-10	H8052/21	6.4%	6.1%	13.6%	36.8%	25.3%	18.3%	100.0%
BSAL 36 20-30	H8052/22	15.9%	0.0%	3.7%	24.5%	20.9%	50.9%	100.0%
BSAL 36 40-50	H8052/23	14.8%	0.1%	4.0%	35.7%	17.8%	42.4%	100.0%
BSAL 37 0-10	H8052/24	10.4%	0.6%	6.2%	27.5%	15.0%	50.7%	100.0%
BSAL 37 20-30	H8052/25	11.6%	4.6%	7.0%	28.8%	17.8%	41.7%	100.0%
BSAL 37 40-50	H8052/26	9.5%	5.3%	12.2%	32.8%	13.3%	36.5%	100.0%
BSAL 37 60-70	H8052/27	9.2%	7.5%	16.7%	32.1%	13.7%	29.9%	100.0%
BSAL 38 0-10	H8052/28	6.6%	1.1%	7.3%	36.3%	31.5%	23.9%	100.0%
BSAL 38 20-30	H8052/29	16.9%	0.5%	3.3%	28.7%	14.3%	53.2%	100.0%
BSAL 38 40-50	H8052/30	14.6%	0.4%	6.6%	23.9%	17.8%	51.2%	100.0%
M2 (2018) 0-5	H8052/31	2.7%	0.3%	31.8%	47.2%	16.4%	4.3%	100.0%
M2 (2018) 5-10	H8052/32	5.1%	2.3%	25.9%	44.2%	14.6%	13.1%	100.0%
M2 (2018) 20-30	H8052/33	10.2%	0.0%	9.8%	38.5%	13.8%	37.8%	100.0%
M2 (2018) 40-50	H8052/34	8.2%	0.0%	18.2%	38.9%	12.1%	30.9%	100.0%
M4 (2018) 0-10	H8052/35	12.9%	0.4%	13.0%	26.0%	17.3%	43.3%	100.0%
M4 (2018) 20-30	H8052/36	16.6%	1.3%	15.1%	14.2%	12.5%	56.9%	100.0%
M4 (2018) 50-60	H8052/37	15.1%	1.1%	12.6%	14.6%	21.2%	50.5%	100.0%
M10 (2018) 0-10	H8052/38	5.9%	3.2%	46.1%	19.0%	15.8%	15.9%	100.0%
M10 (2018) 20-30	H8052/39	11.8%	0.6%	14.7%	30.0%	13.0%	41.7%	100.0%
M10 (2018) 40-50	H8052/40	9.9%	0.2%	8.4%	34.9%	23.2%	33.3%	100.0%
17 (2015) 0-10	H8052/41	4.1%	1.6%	13.0%	39.8%	23.9%	21.7%	100.0%
17 (2015) 20-30	H8052/42	6.8%	2.0%	13.7%	33.2%	10.1%	41.0%	100.0%
17 (2015) 40-50	H8052/43	6.9%	3.6%	12.6%	34.3%	12.0%	37.5%	100.0%
17 (2015) 65-75	H8052/44	6.9%	0.4%	5.0%	18.6%	40.6%	35.4%	100.0%
BSAL 39 0-10	H8052/45	26.1%	0.7%	6.4%	44.9%	26.9%	21.1%	100.0%
BSAL 39 20-30	H8052/46	41.1%	0.0%	3.8%	0.8%	25.8%	69.5%	100.0%
BSAL 39 40-50	H8052/47	9.6%	6.0%	4.9%	30.1%	20.1%	38.9%	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: All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions.
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checked: ....
Graham Lancaster (Nata signatory)
Laboratory Manager

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

ROUTINE AGRICULTURAL SOIL ANALYSIS REPORT

80 samples supplied by SLR Consulting Australia Pty Ltd on 23/05/18. Lab Job No.H0640

Analysis requested by Murray Fraser. Your Job: SLR630.12463

10 Kings Road NEW LAMBTON NSW 2305

			Sample 1	Sample 2	Sample 3	Sample 4
		Sample ID:	M1 0-10	M1 20-30	M1 40-50	M1 65-75
		Crop:	Soil	Soil	Soil	Soil
		Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter		**Method reference**	H0640/1	H0640/2	H0640/3	H0640/4
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.34	7.37	8.67	8.63
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.049	0.137	0.481	1.064
Exchangeable Calcium	(cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	6.72	8.86	5.89	8.01
	(kg/ha)		3015	3977	2646	3596
	(mg/kg)		1346	1775	1181	1605
Exchangeable Magnesium	(cmol+/kg)		6.60	12.26	11.17	14.04
	(kg/ha)		1796	3338	3040	3822
	(mg/kg)		802	1490	1357	1706
Exchangeable Potassium	(cmol+/kg)		0.98	0.81	0.47	0.77
	(kg/ha)		862	710	415	671
	(mg/kg)		385	317	185	300
Exchangeable Sodium	(cmol+/kg)		0.71	2.70	5.04	8.13
	(kg/ha)		368	1390	2596	4188
	(mg/kg)		164	620	1159	1870
Exchangeable Aluminium	(cmol+/kg)	**Inhouse S37 (KCl)	0.02	0.02	0.02	0.02
	(kg/ha)		3	4	4	3
	(mg/kg)		2	2	2	2
Exchangeable Hydrogen	(cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.01	0.00	0.00	0.00
	(kg/ha)		0	0	0	0
	(mg/kg)		0	0	0	0
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)		**Calculation - Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	15.04	24.65	22.59	30.96
Calcium (%)		**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	44.7	35.9	26.1	25.9
Magnesium (%)			43.9	49.7	49.4	45.3
Potassium (%)			6.5	3.3	2.1	2.5
Sodium - ESP (%)			4.7	10.9	22.3	26.3
Aluminium (%)			0.1	0.1	0.1	0.1
Hydrogen			0.1	0.0	0.0	0.0
Calcium/Magnesium Ratio		**Calculation - Calcium / Magnesium (cmol+/kg)	1.0	0.7	0.5	0.6
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	5.61	6.47	7.93	8.07
Colour (Munsell Soil Colour Classification) - Hue/Colour		**Inhouse	7.5YR	7.5YR	5YR	5YR
Colour (Munsell Soil Colour Classification) - Value/Chroma		**Inhouse	3/4	3/3	4/6	3/4
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	None	None	None	None

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

80 samples supplied by SLR Consulting Australia Pty Ltd on 23/05/18. Lab Job No.H0640
Analysis requested by Murray Fraser. Your Job: SLR630.12463
10 Kings Road NEW LAMBTON NSW 2305

		Sample 1	Sample 2	Sample 3	Sample 4
	Sample ID:	M1 0-10	M1 20-30	M1 40-50	M1 65-75
	Crop:	Soil	Soil	Soil	Soil
	Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter	**Method reference**	**H0640/1**	**H0640/2**	**H0640/3**	**H0640/4**

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 Lamonte 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. Contaminant Guides based on 'Residential with gardens and accessible soil including childrens daycare centres, preschools, primary schools, town houses or villas' (NSW EPA 1998).
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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Quality Checked: Kris Saville
Agricultural Co-Ordinator
KS

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

ROUTINE AGRICULTURAL SOIL ANALYSIS REPOI

80 samples supplied by SLR Consulting Australia Pty Ltd on 23/05/18. Lab Job No.H0640
Analysis requested by Murray Fraser. Your Job: SLR630.12463
10 Kings Road NEW LAMBTON NSW 2305

		Sample 5	Sample 6	Sample 7	Sample 8
	Sample ID:	M3 0-10	M3 20-30	M3 40-50	M5 0-10
	Crop:	Soil	Soil	Soil	Soil
	Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter	**Method reference**	**H0640/5**	**H0640/6**	**H0640/7**	**H0640/8**
pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.28	6.15	6.83	7.09
Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.023	0.010	0.040	0.121
Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	2.96	1.65	9.57	27.99
Exchangeable Calcium (kg/ha)		1328	739	4295	12567
Exchangeable Calcium (mg/kg)		593	330	1917	5610
Exchangeable Magnesium (cmol+/kg)		1.10	0.38	3.43	8.48
Exchangeable Magnesium (kg/ha)		299	103	933	2310
Exchangeable Magnesium (mg/kg)		134	46	416	1031
Exchangeable Potassium (cmol+/kg)		0.66	0.32	0.34	2.48
Exchangeable Potassium (kg/ha)		574	277	294	2170
Exchangeable Potassium (mg/kg)		256	124	131	969
Exchangeable Sodium (cmol+/kg)		0.17	0.09	0.60	0.33
Exchangeable Sodium (kg/ha)		89	46	307	171
Exchangeable Sodium (mg/kg)		40	20	137	76
Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.01	0.00	0.02	0.01
Exchangeable Aluminium (kg/ha)		3	1	4	2
Exchangeable Aluminium (mg/kg)		1	0	2	1
Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.01	0.01	0.00	0.00
Exchangeable Hydrogen (kg/ha)		0	0	0	0
Exchangeable Hydrogen (mg/kg)		0	0	0	0
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation - Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	4.91	2.44	13.94	39.30
Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	60.3	67.4	68.6	71.2
Magnesium (%)		22.4	15.5	24.6	21.6
Potassium (%)		13.4	12.9	2.4	6.3
Sodium - ESP (%)		3.5	3.6	4.3	0.8
Aluminium (%)		0.3	0.2	0.1	0.0
Hydrogen		0.1	0.3	0.0	0.0
Calcium/Magnesium Ratio	**Calculation - Calcium / Magnesium (cmol+/kg)	2.7	4.3	2.8	3.3
pH	**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	6.03	5.17	5.98	6.68
Colour (Munsell Soil Colour Classification) - Hue/Colour	**Inhouse	10YR	7.5YR	5YR	7.5YR
Colour (Munsell Soil Colour Classification) - Value/Chroma	**Inhouse	4/4	4/6	4/6	3/2
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion	**Inhouse	None	None	10YR, 6/6, 20%	None

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

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Analysis requested by Murray Fraser. Your Job: SLR630.12463

10 Kings Road NEW LAMBTON NSW 2305

		Sample 5	Sample 6	Sample 7	Sample 8
	Sample ID:	M3 0-10	M3 20-30	M3 40-50	M5 0-10
	Crop:	Soil	Soil	Soil	Soil
	Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter	**Method reference**	**H0640/5**	**H0640/6**	**H0640/7**	**H0640/8**

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 Publishin
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
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80 samples supplied by SLR Consulting Australia Pty Ltd on 23/05/18. Lab Job No.H0640
Analysis requested by Murray Fraser. Your Job: SLR630.12463
10 Kings Road NEW LAMBTON NSW 2305

			Sample 9	Sample 10	Sample 11	Sample 12
		Sample ID:	M5 20-30	M5 40-50	M5 65-75	M6 0-5
		Crop:	Soil	Soil	Soil	Soil
		Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter		Method reference	H0640/9	H0640/10	H0640/11	H0640/12
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.44	8.51	8.58	5.96
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.164	0.497	0.635	0.031
Exchangeable Calcium	(cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	37.03	28.84	28.62	4.52
	(kg/ha)		16624	12948	12847	2029
	(mg/kg)		7421	5780	5735	906
Exchangeable Magnesium	(cmol+/kg)		14.83	19.38	19.26	1.51
	(kg/ha)		4037	5275	5242	410
	(mg/kg)		1802	2355	2340	183
Exchangeable Potassium	(cmol+/kg)		1.20	1.00	0.88	0.68
	(kg/ha)		1052	880	774	596
	(mg/kg)		470	393	345	266
Exchangeable Sodium	(cmol+/kg)		1.49	5.73	6.85	0.15
	(kg/ha)		766	2948	3527	79
	(mg/kg)		342	1316	1575	35
Exchangeable Aluminium	(cmol+/kg)	**Inhouse S37 (KCl)	0.01	0.02	0.02	0.01
	(kg/ha)		3	4	3	3
	(mg/kg)		1	2	2	1
Exchangeable Hydrogen	(cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.00	0.00	0.00	0.02
	(kg/ha)		0	0	0	0
	(mg/kg)		0	0	0	0
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)		**Calculation - Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	54.56	54.97	55.62	6.89
Calcium (%)		**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	67.9	52.5	51.5	65.6
Magnesium (%)			27.2	35.3	34.6	21.9
Potassium (%)			2.2	1.8	1.6	9.9
Sodium - ESP (%)			2.7	10.4	12.3	2.2
Aluminium (%)			0.0	0.0	0.0	0.2
Hydrogen			0.0	0.0	0.0	0.3
Calcium/Magnesium Ratio		**Calculation - Calcium / Magnesium (cmol+/kg)	2.5	1.5	1.5	3.0
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	7.87	7.97	8.01	5.72
Colour (Munsell Soil Colour Classification) - Hue/Colour		**Inhouse	10YR	10YR	10YR	7.5YR
Colour (Munsell Soil Colour Classification) - Value/Chroma		**Inhouse	4/3	4/3	3/2	4/4
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	None	None	None	None

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		Sample 9	Sample 10	Sample 11	Sample 12
	Sample ID:	M5 20-30	M5 40-50	M5 65-75	M6 0-5
	Crop:	Soil	Soil	Soil	Soil
	Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter	**Method reference**	H0640/9	H0640/10	H0640/11	H0640/12

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 Publishin
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 Lamonte Soil H
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8. Contaminant Guides based on 'Residential with gardens and accessible soil including childrens d preschools, primary schools, town houses or villas' (NSW EPA 1998).
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultu
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11. Conversions to kg/ha = mg/kg x 2.24
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Southern Cross University

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ASPAC

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
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ABN: 41 995 651 524

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Analysis requested by Murray Fraser. Your Job: SLR630.12463
10 Kings Road NEW LAMBTON NSW 2305

			Sample 13	Sample 14	Sample 15	Sample 16
Sample ID:			M6 10-20	M6 30-40	M6 50-60	M7 0-10
Crop:			Soil	Soil	Soil	Soil
Client:			Maxwell	Maxwell	Maxwell	Maxwell
Parameter		**Method reference**	**H0640/13**	**H0640/14**	**H0640/15**	**H0640/16**
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.17	6.21	6.96	5.75
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.039	0.058	0.052	0.052
Exchangeable Calcium	(cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	3.67	11.28	10.79	7.30
	(kg/ha)		1647	5061	4843	3276
	(mg/kg)		735	2260	2162	1463
Exchangeable Magnesium	(cmol+/kg)		1.18	5.08	4.92	3.25
	(kg/ha)		321	1384	1338	886
	(mg/kg)		143	618	597	396
Exchangeable Potassium	(cmol+/kg)		0.50	1.02	0.56	1.16
	(kg/ha)		442	893	490	1018
	(mg/kg)		197	399	219	454
Exchangeable Sodium	(cmol+/kg)		0.07	0.27	0.32	0.16
	(kg/ha)		38	140	164	84
	(mg/kg)		17	63	73	37
Exchangeable Aluminium	(cmol+/kg)	**Inhouse S37 (KCl)	0.13	0.02	0.01	0.01
	(kg/ha)		25	4	2	2
	(mg/kg)		11	2	1	1
Exchangeable Hydrogen	(cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.00	0.00	0.00	0.03
	(kg/ha)		0	0	0	1
	(mg/kg)		0	0	0	0
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)		**Calculation - Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	5.55	17.67	16.59	11.91
Calcium (%)		**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	66.1	63.8	65.0	61.3
Magnesium (%)			21.2	28.8	29.6	27.3
Potassium (%)			9.1	5.8	3.4	9.8
Sodium - ESP (%)			1.3	1.5	1.9	1.4
Aluminium (%)			2.3	0.1	0.1	0.1
Hydrogen			0.0	0.0	0.0	0.2
Calcium/Magnesium Ratio		**Calculation - Calcium / Magnesium (cmol+/kg)	3.1	2.2	2.2	2.2
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	5.88	5.90	6.44	5.29
Colour (Munsell Soil Colour Classification) - Hue/Colour		**Inhouse	7.5YR	2.5YR	5YR	7.5YR
Colour (Munsell Soil Colour Classification) - Value/Chroma		**Inhouse	4/6	4/8	4/6	2.5/1
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	None	None	None	None

Environmental Analysis Laboratory

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			Sample 13	Sample 14	Sample 15	Sample 16
		Sample ID:	M6 10-20	M6 30-40	M6 50-60	M7 0-10
		Crop:	Soil	Soil	Soil	Soil
		Client:	Maxwell	Maxwell	Maxwell	Maxwell
	Parameter	**Method reference**	**H0640/13**	**H0640/14**	**H0640/15**	**H0640/16**

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 Publishin
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
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ASPAC

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Analysis requested by Murray Fraser. Your Job: SLR630.12463

10 Kings Road NEW LAMBTON NSW 2305

			Sample 17	Sample 18	Sample 19	Sample 20
		Sample ID:	M7 20-30	M7 40-50	M8 0-10	M8 20-30
		Crop:	Soil	Soil	Soil	Soil
		Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter		Method reference	H0640/17	H0640/18	H0640/19	H0640/20
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	7.84	8.68	7.25	8.06
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.087	0.264	0.098	0.363
Exchangeable Calcium	(cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	14.93	12.73	12.60	12.89
	(kg/ha)		6703	5715	5654	5788
	(mg/kg)		2992	2551	2524	2584
Exchangeable Magnesium	(cmol+/kg)		10.56	10.52	14.40	21.06
	(kg/ha)		2874	2863	3920	5732
	(mg/kg)		1283	1278	1750	2559
Exchangeable Potassium	(cmol+/kg)		0.67	0.40	1.15	0.86
	(kg/ha)		585	350	1007	753
	(mg/kg)		261	156	450	336
Exchangeable Sodium	(cmol+/kg)		1.60	2.83	2.32	5.87
	(kg/ha)		823	1457	1196	3025
	(mg/kg)		367	651	534	1350
Exchangeable Aluminium	(cmol+/kg)	**Inhouse S37 (KCl)	0.01	0.01	0.01	0.01
	(kg/ha)		1	2	2	2
	(mg/kg)		1	1	1	1
Exchangeable Hydrogen	(cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.00	0.00	0.00	0.00
	(kg/ha)		0	0	0	0
	(mg/kg)		0	0	0	0
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)		**Calculation - Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	27.76	26.49	30.48	40.69
Calcium (%)		**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	53.8	48.1	41.3	31.7
Magnesium (%)			38.0	39.7	47.2	51.7
Potassium (%)			2.4	1.5	3.8	2.1
Sodium - ESP (%)			5.8	10.7	7.6	14.4
Aluminium (%)			0.0	0.0	0.0	0.0
Hydrogen			0.0	0.0	0.0	0.0
Calcium/Magnesium Ratio		**Calculation - Calcium / Magnesium (cmol+/kg)	1.4	1.2	0.9	0.6
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	6.94	8.13	6.40	7.32
Colour (Munsell Soil Colour Classification) - Hue/Colour		**Inhouse	7.5YR	10YR	7.5YR	7.5YR
Colour (Munsell Soil Colour Classification) - Value/Chroma		**Inhouse	4/4	5/4	3/2	3/2
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	None	None	None	None

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		Sample 17	Sample 18	Sample 19	Sample 20
	Sample ID:	M7 20-30	M7 40-50	M8 0-10	M8 20-30
	Crop:	Soil	Soil	Soil	Soil
	Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter	**Method reference**	**H0640/17**	**H0640/18**	**H0640/19**	**H0640/20**

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 Publishin
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
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10 Kings Road NEW LAMBTON NSW 2305

			Sample 21	Sample 22	Sample 23	Sample 24
		Sample ID:	M8 40-50	M8 65-75	M9 0-10	M9 20-30
		Crop:	Soil	Soil	Soil	Soil
		Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter		**Method reference**	**H0640/21**	**H0640/22**	**H0640/23**	**H0640/24**
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.56	8.74	6.43	8.03
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	1.075	1.332	0.070	0.192
Exchangeable Calcium	(cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	9.98	19.43	11.76	12.65
	(kg/ha)		4480	8723	5278	5680
	(mg/kg)		2000	3894	2356	2536
Exchangeable Magnesium	(cmol+/kg)		23.38	22.79	7.79	16.66
	(kg/ha)		6364	6203	2122	4536
	(mg/kg)		2841	2769	947	2025
Exchangeable Potassium	(cmol+/kg)		0.72	0.70	1.70	0.92
	(kg/ha)		635	609	1486	807
	(mg/kg)		283	272	663	360
Exchangeable Sodium	(cmol+/kg)		11.00	12.07	0.69	3.95
	(kg/ha)		5664	6216	356	2035
	(mg/kg)		2528	2775	159	909
Exchangeable Aluminium	(cmol+/kg)	**Inhouse S37 (KCl)	0.01	0.01	0.01	0.01
	(kg/ha)		2	2	2	1
	(mg/kg)		1	1	1	1
Exchangeable Hydrogen	(cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.00	0.00	0.02	0.00
	(kg/ha)		0	0	0	0
	(mg/kg)		0	0	0	0
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)		**Calculation - Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	45.09	54.99	21.96	34.20
Calcium (%)		**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	22.1	35.3	53.5	37.0
Magnesium (%)			51.8	41.4	35.5	48.7
Potassium (%)			1.6	1.3	7.7	2.7
Sodium - ESP (%)			24.4	21.9	3.1	11.6
Aluminium (%)			0.0	0.0	0.0	0.0
Hydrogen			0.0	0.0	0.1	0.0
Calcium/Magnesium Ratio		**Calculation - Calcium / Magnesium (cmol+/kg)	0.4	0.9	1.5	0.8
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	8.09	8.20	6.54	7.15
Colour (Munsell Soil Colour Classification) - Hue/Colour		**Inhouse	10YR	5YR	7.5YR	7.5YR
Colour (Munsell Soil Colour Classification) - Value/Chroma		**Inhouse	3/4	3/4	2.5/2	3/3
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	None	None	None	None

Southern Cross University

ASPAC

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal
ABN: 41 995 651 524

80 samples supplied by SLR Consulting Australia Pty Ltd on 23/05/18. Lab Job No.H0640
Analysis requested by Murray Fraser. Your Job: SLR630.12463
10 Kings Road NEW LAMBTON NSW 2305

		Sample 21	Sample 22	Sample 23	Sample 24
	Sample ID:	M8 40-50	M8 65-75	M9 0-10	M9 20-30
	Crop:	Soil	Soil	Soil	Soil
	Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter	**Method reference**	H0640/21	H0640/22	H0640/23	H0640/24

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 Publishin
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 Lamonte Soil H
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. Contaminant Guides based on 'Residential with gardens and accessible soil including childrens d
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9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultu
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 ov
13. ** NATA accreditation does not cover the performance of this service.
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Agricultural Co-Ordinator KS

Southern Cross University

ASPAC

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

ROUTINE AGRICULTURAL SOIL ANALYSIS REPOI

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Analysis requested by Murray Fraser. Your Job: SLR630.12463

10 Kings Road NEW LAMBTON NSW 2305

		Sample 25	Sample 26	Sample 27	Sample 28
	Sample ID:	M9 40-50	M9 65-75	M11 0-10	M11 20-30
	Crop:	Soil	Soil	Soil	Soil
	Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter	**Method reference**	**H0640/25**	**H0640/26**	**H0640/27**	**H0640/28**
pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.59	8.70	5.07	7.85
Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.826	0.961	0.395	0.136
Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	13.44	20.87	8.64	22.53
Exchangeable Calcium (kg/ha)		6035	9368	3881	10116
Exchangeable Calcium (mg/kg)		2694	4182	1732	4516
Exchangeable Magnesium (cmol+/kg)		21.58	19.66	3.27	11.59
Exchangeable Magnesium (kg/ha)		5876	5352	890	3156
Exchangeable Magnesium (mg/kg)		2623	2389	397	1409
Exchangeable Potassium (cmol+/kg)		0.78	0.69	2.25	0.90
Exchangeable Potassium (kg/ha)		685	602	1973	786
Exchangeable Potassium (mg/kg)		306	269	881	351
Exchangeable Sodium (cmol+/kg)		8.78	8.70	0.55	2.05
Exchangeable Sodium (kg/ha)		4520	4481	281	1058
Exchangeable Sodium (mg/kg)		2018	2000	126	472
Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.01	0.01	0.04	0.02
Exchangeable Aluminium (kg/ha)		2	2	8	3
Exchangeable Aluminium (mg/kg)		1	1	4	1
Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.00	0.00	0.08	0.00
Exchangeable Hydrogen (kg/ha)		0	0	2	0
Exchangeable Hydrogen (mg/kg)		0	0	1	0
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation - Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	44.60	49.93	14.83	37.10
Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	30.1	41.8	58.3	60.7
Magnesium (%)		48.4	39.4	22.0	31.3
Potassium (%)		1.8	1.4	15.2	2.4
Sodium - ESP (%)		19.7	17.4	3.7	5.5
Aluminium (%)		0.0	0.0	0.3	0.0
Hydrogen		0.0	0.0	0.5	0.0
Calcium/Magnesium Ratio	**Calculation - Calcium / Magnesium (cmol+/kg)	0.6	1.1	2.6	1.9
pH	**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	8.11	8.10	4.86	7.16
Colour (Munsell Soil Colour Classification) - Hue/Colour	**Inhouse	10YR	7.5YR	7.5YR	10YR
Colour (Munsell Soil Colour Classification) - Value/Chroma	**Inhouse	3/4	4/4	3/2	4/1
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion	**Inhouse	None	None	None	None

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal
ABN: 41 995 651 524

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		Sample 25	Sample 26	Sample 27	Sample 28
	Sample ID:	**M9 40-50**	**M9 65-75**	**M11 0-10**	**M11 20-30**
	Crop:	**Soil**	**Soil**	**Soil**	**Soil**
	Client:	**Maxwell**	**Maxwell**	**Maxwell**	**Maxwell**
Parameter	**Method reference**	**H0640/25**	**H0640/26**	**H0640/27**	**H0640/28**

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 Publishin
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 Lamonte Soil H
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. Contaminant Guides based on 'Residential with gardens and accessible soil including childrens d preschools, primary schools, town houses or villas' (NSW EPA 1998).
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultu
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 ov
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Southern Cross University

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ASPAC

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal
ABN: 41 995 651 524

ROUTINE AGRICULTURAL SOIL ANALYSIS REPOI

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Analysis requested by Murray Fraser. Your Job: SLR630.12463
10 Kings Road NEW LAMBTON NSW 2305

			Sample 29	Sample 30	Sample 31	Sample 32
Sample ID:			M11 40-50	M11 65-75	M12 0-10	M12 20-30
Crop:			Soil	Soil	Soil	Soil
Client:			Maxwell	Maxwell	Maxwell	Maxwell
Parameter		**Method reference**	**H0640/29**	**H0640/30**	**H0640/31**	**H0640/32**
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.54	8.56	7.78	8.21
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.328	0.475	0.187	0.154
Exchangeable Calcium	**(cmol+/kg)**	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	24.63	24.56	50.31	49.82
	(kg/ha)		11057	11026	22584	22363
	(mg/kg)		4936	4922	10082	9983
Exchangeable Magnesium	**(cmol+/kg)**		13.42	12.80	7.58	13.48
	(kg/ha)		3654	3486	2065	3669
	(mg/kg)		1631	1556	922	1638
Exchangeable Potassium	**(cmol+/kg)**		0.69	0.64	1.76	0.89
	(kg/ha)		602	565	1543	782
	(mg/kg)		269	252	689	349
Exchangeable Sodium	**(cmol+/kg)**		4.00	5.17	0.56	1.40
	(kg/ha)		2057	2660	289	722
	(mg/kg)		918	1188	129	322
Exchangeable Aluminium	**(cmol+/kg)**	**Inhouse S37 (KCl)	0.01	0.01	0.01	0.03
	(kg/ha)		2	2	2	7
	(mg/kg)		1	1	1	3
Exchangeable Hydrogen	**(cmol+/kg)**	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.00	0.00	0.00	0.00
	(kg/ha)		0	0	0	0
	(mg/kg)		0	0	0	0
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)		**Calculation - Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	42.75	43.19	60.23	65.62
Calcium (%)		**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	57.6	56.9	83.5	75.9
Magnesium (%)			31.4	29.6	12.6	20.5
Potassium (%)			1.6	1.5	2.9	1.4
Sodium - ESP (%)			9.3	12.0	0.9	2.1
Aluminium (%)			0.0	0.0	0.0	0.0
Hydrogen			0.0	0.0	0.0	0.0
Calcium/Magnesium Ratio		**Calculation - Calcium / Magnesium (cmol+/kg)	1.8	1.9	6.6	3.7
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	7.98	8.05	7.47	7.57
Colour (Munsell Soil Colour Classification) - Hue/Colour		**Inhouse	7.5YR	7.5YR	7.5YR	7.5YR
Colour (Munsell Soil Colour Classification) - Value/Chroma		**Inhouse	4/1	3/2	3/2	3/2
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	None	None	None	None

Southern Cross University

ASPAC

Environmental Analysis Laboratory

Southern Cross University
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E: eal@scu.edu.au
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		Sample 29	Sample 30	Sample 31	Sample 32
	Sample ID:	M11 40-50	M11 65-75	M12 0-10	M12 20-30
	Crop:	Soil	Soil	Soil	Soil
	Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter	**Method reference**	H0640/29	H0640/30	H0640/31	H0640/32

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 Publishin
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 Lamonte Soil H
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6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. Contaminant Guides based on 'Residential with gardens and accessible soil including childrens d
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9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultu
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122 mg/kg Magnesium, 200 mg/kg Calcium
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Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

ROUTINE AGRICULTURAL SOIL ANALYSIS REPOI

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Analysis requested by Murray Fraser. Your Job: SLR630.12463

10 Kings Road NEW LAMBTON NSW 2305

			Sample 33	Sample 34	Sample 35	Sample 36
		Sample ID:	M12 40-50	M12 65-75	M14 0-10	M14 20-30
		Crop:	Soil	Soil	Soil	Soil
		Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter		Method reference	H0640/33	H0640/34	H0640/35	H0640/36
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.77	8.89	6.50	6.54
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.261	0.491	0.124	0.221
Exchangeable Calcium	(cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	35.32	29.37	7.24	5.79
	(kg/ha)		15855	13185	3248	2599
	(mg/kg)		7078	5886	1450	1160
Exchangeable Magnesium	(cmol+/kg)		19.65	23.82	3.51	8.78
	(kg/ha)		5349	6485	957	2390
	(mg/kg)		2388	2895	427	1067
Exchangeable Potassium	(cmol+/kg)		0.70	0.66	1.16	0.75
	(kg/ha)		616	576	1015	660
	(mg/kg)		275	257	453	295
Exchangeable Sodium	(cmol+/kg)		5.11	9.21	0.31	1.06
	(kg/ha)		2633	4742	162	548
	(mg/kg)		1175	2117	72	245
Exchangeable Aluminium	(cmol+/kg)	**Inhouse S37 (KCl)	0.01	0.01	0.01	0.02
	(kg/ha)		2	2	2	3
	(mg/kg)		1	1	1	1
Exchangeable Hydrogen	(cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.00	0.00	0.02	0.00
	(kg/ha)		0	0	0	0
	(mg/kg)		0	0	0	0
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)		**Calculation - Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	60.79	63.07	12.25	16.40
Calcium (%)		**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	58.1	46.6	59.1	35.3
Magnesium (%)			32.3	37.8	28.7	53.5
Potassium (%)			1.2	1.0	9.5	4.6
Sodium - ESP (%)			8.4	14.6	2.6	6.5
Aluminium (%)			0.0	0.0	0.1	0.1
Hydrogen			0.0	0.0	0.1	0.0
Calcium/Magnesium Ratio		**Calculation - Calcium / Magnesium (cmol+/kg)	1.8	1.2	2.1	0.7
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	8.01	8.21	6.53	6.17
Colour (Munsell Soil Colour Classification) - Hue/Colour		**Inhouse	7.5YR	7.5YR	7.5YR	5YR
Colour (Munsell Soil Colour Classification) - Value/Chroma		**Inhouse	3/2	2.5/3	2.5/3	4/6
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	10YR, 6/4, 40%	None	None	None

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal
ABN: 41 995 651 524

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		Sample 33	Sample 34	Sample 35	Sample 36
	Sample ID:	M12 40-50	M12 65-75	M14 0-10	M14 20-30
	Crop:	Soil	Soil	Soil	Soil
	Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter	**Method reference**	H0640/33	H0640/34	H0640/35	H0640/36

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
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Environmental Analysis Laboratory

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PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal
ABN: 41 995 651 524

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		Sample 37	Sample 38	Sample 39	Sample 40
Sample ID:		M14 40-50	M15 0-10	M15 20-30	M15 40-50
Crop:		Soil	Soil	Soil	Soil
Client:		Maxwell	Maxwell	Maxwell	Maxwell
Parameter	**Method reference**	**H0640/37**	**H0640/38**	**H0640/39**	**H0640/40**
pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.52	5.58	7.24	8.28
Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.592	0.094	0.060	0.131
Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	5.27	8.61	16.20	16.41
Exchangeable Calcium (kg/ha)		2365	3867	7270	7366
Exchangeable Calcium (mg/kg)		1056	1726	3245	3289
Exchangeable Magnesium (cmol+/kg)		11.64	5.50	11.29	13.16
Exchangeable Magnesium (kg/ha)		3170	1497	3073	3582
Exchangeable Magnesium (mg/kg)		1415	668	1372	1599
Exchangeable Potassium (cmol+/kg)		0.62	0.45	0.43	0.34
Exchangeable Potassium (kg/ha)		544	397	374	298
Exchangeable Potassium (mg/kg)		243	177	167	133
Exchangeable Sodium (cmol+/kg)		3.10	0.57	1.58	3.12
Exchangeable Sodium (kg/ha)		1597	294	813	1604
Exchangeable Sodium (mg/kg)		713	131	363	716
Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.01	0.03	0.00	0.00
Exchangeable Aluminium (kg/ha)		2	6	1	0
Exchangeable Aluminium (mg/kg)		1	3	0	0
Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.00	0.05	0.00	0.00
Exchangeable Hydrogen (kg/ha)		0	1	0	0
Exchangeable Hydrogen (mg/kg)		0	1	0	0
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation - Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	20.64	15.22	29.49	33.03
Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	25.5	56.6	54.9	49.7
Magnesium (%)		56.4	36.1	38.3	39.8
Potassium (%)		3.0	3.0	1.4	1.0
Sodium - ESP (%)		15.0	3.8	5.4	9.4
Aluminium (%)		0.0	0.2	0.0	0.0
Hydrogen		0.0	0.3	0.0	0.0
Calcium/Magnesium Ratio	**Calculation - Calcium / Magnesium (cmol+/kg)	0.5	1.6	1.4	1.2
pH	**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	6.18	5.18	6.42	7.40
Colour (Munsell Soil Colour Classification) - Hue/Colour	**Inhouse	7.5YR	7.5YR	7.5YR	7.5YR
Colour (Munsell Soil Colour Classification) - Value/Chroma	**Inhouse	5/6	3/3	3/3	3/4
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion	**Inhouse	None	None	None	None

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

80 samples supplied by SLR Consulting Australia Pty Ltd on 23/05/18. Lab Job No.H0640

Analysis requested by Murray Fraser. Your Job: SLR630.12463

10 Kings Road NEW LAMBTON NSW 2305

			Sample 37	Sample 38	Sample 39	Sample 40
		Sample ID:	M14 40-50	M15 0-10	M15 20-30	M15 40-50
		Crop:	Soil	Soil	Soil	Soil
		Client:	Maxwell	Maxwell	Maxwell	Maxwell
	Parameter	**Method reference**	**H0640/37**	**H0640/38**	**H0640/39**	**H0640/40**

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishin
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 Lamonte Soil H
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. Contaminant Guides based on 'Residential with gardens and accessible soil including childrens d preschools, primary schools, town houses or villas' (NSW EPA 1998).
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultu
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 ov
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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ASPAC

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
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ROUTINE AGRICULTURAL SOIL ANALYSIS REPOI

80 samples supplied by SLR Consulting Australia Pty Ltd on 23/05/18. Lab Job No.H0640
Analysis requested by Murray Fraser. Your Job: SLR630.12463
10 Kings Road NEW LAMBTON NSW 2305

		Sample 41	Sample 42	Sample 43	Sample 44
Sample ID:		M15 65-75	M16 0-10	M16 20-30	M16 40-50
Crop:		Soil	Soil	Soil	Soil
Client:		Maxwell	Maxwell	Maxwell	Maxwell
Parameter	**Method reference**	**H0640/41**	**H0640/42**	**H0640/43**	**H0640/44**
pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.69	5.70	7.10	8.27
Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.385	0.100	0.093	0.284
Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	23.73	8.19	11.22	10.33
Exchangeable Calcium (kg/ha)		10652	3678	5036	4636
Exchangeable Calcium (mg/kg)		4755	1642	2248	2069
Exchangeable Magnesium (cmol+/kg)		13.40	5.70	11.70	13.95
Exchangeable Magnesium (kg/ha)		3649	1551	3185	3797
Exchangeable Magnesium (mg/kg)		1629	692	1422	1695
Exchangeable Potassium (cmol+/kg)		0.32	1.31	0.39	0.31
Exchangeable Potassium (kg/ha)		283	1150	343	274
Exchangeable Potassium (mg/kg)		126	513	153	123
Exchangeable Sodium (cmol+/kg)		4.63	0.35	1.59	3.37
Exchangeable Sodium (kg/ha)		2383	183	817	1733
Exchangeable Sodium (mg/kg)		1064	81	365	774
Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.00	0.02	0.02	0.01
Exchangeable Aluminium (kg/ha)		0	3	4	3
Exchangeable Aluminium (mg/kg)		0	1	2	1
Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.00	0.06	0.00	0.00
Exchangeable Hydrogen (kg/ha)		0	1	0	0
Exchangeable Hydrogen (mg/kg)		0	1	0	0
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation - Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	42.09	15.63	24.91	27.97
Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	56.4	52.4	45.0	36.9
Magnesium (%)		31.8	36.4	47.0	49.9
Potassium (%)		0.8	8.4	1.6	1.1
Sodium - ESP (%)		11.0	2.3	6.4	12.0
Aluminium (%)		0.0	0.1	0.1	0.0
Hydrogen		0.0	0.4	0.0	0.0
Calcium/Magnesium Ratio	**Calculation - Calcium / Magnesium (cmol+/kg)	1.8	1.4	1.0	0.7
pH	**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	8.01	5.36	6.44	7.67
Colour (Munsell Soil Colour Classification) - Hue/Colour	**Inhouse	5YR	7.5YR	7.5YR	5YR
Colour (Munsell Soil Colour Classification) - Value/Chroma	**Inhouse	3/4	3/3	3/4	3/3
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion	**Inhouse	None	None	None	None

Environmental Analysis Laboratory

Southern Cross University
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P: +61 2 6620 3678
E: eal@scu.edu.au
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		Sample 41	Sample 42	Sample 43	Sample 44
	Sample ID:	M15 65-75	M16 0-10	M16 20-30	M16 40-50
	Crop:	Soil	Soil	Soil	Soil
	Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter	**Method reference**	H0640/41	H0640/42	H0640/43	H0640/44

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 Publishin
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 Lamonte Soil H
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. Contaminant Guides based on 'Residential with gardens and accessible soil including childrens d preschools, primary schools, town houses or villas' (NSW EPA 1998).
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultu
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 ov
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Agricultural Co-Ordinator KS

EAL Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal
ABN: 41 995 651 524

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Analysis requested by Murray Fraser. Your Job: SLR630.12463
10 Kings Road NEW LAMBTON NSW 2305

			Sample 45	Sample 46	Sample 47	Sample 48
		Sample ID:	M16 65-75	M17 0-10	M17 20-30	M17 40-50
		Crop:	Soil	Soil	Soil	Soil
		Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter		Method reference	H0640/45	H0640/46	H0640/47	H0640/48
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.62	5.10	6.14	6.86
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.708	0.049	0.021	0.025
Exchangeable Calcium	(cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	19.67	5.31	5.22	4.61
	(kg/ha)		8829	2382	2344	2068
	(mg/kg)		3942	1064	1046	923
Exchangeable Magnesium	(cmol+/kg)		15.39	2.75	1.88	2.33
	(kg/ha)		4189	748	513	633
	(mg/kg)		1870	334	229	283
Exchangeable Potassium	(cmol+/kg)		0.30	0.63	0.19	0.13
	(kg/ha)		260	554	163	110
	(mg/kg)		116	247	73	49
Exchangeable Sodium	(cmol+/kg)		5.95	0.47	0.16	0.31
	(kg/ha)		3062	242	81	159
	(mg/kg)		1367	108	36	71
Exchangeable Aluminium	(cmol+/kg)	**Inhouse S37 (KCl)	0.02	0.17	0.01	0.01
	(kg/ha)		3	34	2	2
	(mg/kg)		2	15	1	1
Exchangeable Hydrogen	(cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.00	0.16	0.00	0.00
	(kg/ha)		0	4	0	0
	(mg/kg)		0	2	0	0
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)		**Calculation - Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	41.32	9.48	7.46	7.38
Calcium (%)		**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	47.6	56.0	70.0	62.5
Magnesium (%)			37.2	29.0	25.3	31.5
Potassium (%)			0.7	6.7	2.5	1.7
Sodium - ESP (%)			14.4	5.0	2.1	4.2
Aluminium (%)			0.0	1.8	0.2	0.1
Hydrogen			0.0	1.7	0.0	0.0
Calcium/Magnesium Ratio		**Calculation - Calcium / Magnesium (cmol+/kg)	1.3	1.9	2.8	2.0
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	7.97	4.61	5.75	6.36
Colour (Munsell Soil Colour Classification) - Hue/Colour		**Inhouse	5YR	7.5YR	5YR	5YR
Colour (Munsell Soil Colour Classification) - Value/Chroma		**Inhouse	3/3	3/3	3/4	3/4
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	None	None	None	None

Southern Cross University

ASPAC

Environmental Analysis Laboratory

Southern Cross University
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P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal
ABN: 41 995 651 524

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		Sample 45	Sample 46	Sample 47	Sample 48
	Sample ID:	M16 65-75	M17 0-10	M17 20-30	M17 40-50
	Crop:	Soil	Soil	Soil	Soil
	Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter	**Method reference**	**H0640/45**	**H0640/46**	**H0640/47**	**H0640/48**

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 Publishin
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 Lamonte Soil H
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. Contaminant Guides based on 'Residential with gardens and accessible soil including childrens d preschools, primary schools, town houses or villas' (NSW EPA 1998).
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultu
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 ov
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Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal
ABN: 41 995 651 524

ROUTINE AGRICULTURAL SOIL ANALYSIS REPOI

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Analysis requested by Murray Fraser. Your Job: SLR630.12463
10 Kings Road NEW LAMBTON NSW 2305

		Sample 49	Sample 50	Sample 51	Sample 52
	Sample ID:	**M17 65-75**	**M18 0-10**	**M18 20-30**	**M18 40-50**
	Crop:	**Soil**	**Soil**	**Soil**	**Soil**
	Client:	**Maxwell**	**Maxwell**	**Maxwell**	**Maxwell**
Parameter	**Method reference**	**H0640/49**	**H0640/50**	**H0640/51**	**H0640/52**
pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	7.54	5.76	6.29	6.34
Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.108	0.022	0.143	0.318
Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	7.29	1.43	1.98	1.92
Exchangeable Calcium (kg/ha)		3272	643	889	863
Exchangeable Calcium (mg/kg)		1460	287	397	385
Exchangeable Magnesium (cmol+/kg)		8.01	1.62	6.34	6.24
Exchangeable Magnesium (kg/ha)		2180	442	1725	1699
Exchangeable Magnesium (mg/kg)		973	197	770	759
Exchangeable Potassium (cmol+/kg)		0.22	0.21	0.41	0.36
Exchangeable Potassium (kg/ha)		197	185	359	319
Exchangeable Potassium (mg/kg)		88	83	160	143
Exchangeable Sodium (cmol+/kg)		1.77	0.30	1.65	2.20
Exchangeable Sodium (kg/ha)		910	154	851	1134
Exchangeable Sodium (mg/kg)		406	69	380	506
Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.02	0.04	0.03	0.02
Exchangeable Aluminium (kg/ha)		3	8	6	4
Exchangeable Aluminium (mg/kg)		1	4	3	2
Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.00	0.03	0.01	0.00
Exchangeable Hydrogen (kg/ha)		0	1	0	0
Exchangeable Hydrogen (mg/kg)		0	0	0	0
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation - Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	17.30	3.63	10.41	10.75
Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	42.1	39.4	19.0	17.9
Magnesium (%)		46.3	44.7	60.9	58.1
Potassium (%)		1.3	5.8	3.9	3.4
Sodium - ESP (%)		10.2	8.2	15.9	20.5
Aluminium (%)		0.1	1.1	0.3	0.2
Hydrogen		0.0	0.7	0.1	0.0
Calcium/Magnesium Ratio	**Calculation - Calcium / Magnesium (cmol+/kg)	0.9	0.9	0.3	0.3
pH	**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	6.84	4.95	5.57	5.85
Colour (Munsell Soil Colour Classification) - Hue/Colour	**Inhouse	10YR	10YR	10YR	10YR
Colour (Munsell Soil Colour Classification) - Value/Chroma	**Inhouse	4/4	5/4	5/6	5/8
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion	**Inhouse	None	None	None	None

Environmental Analysis Laboratory

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E: eal@scu.edu.au
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		Sample 49	Sample 50	Sample 51	Sample 52
	Sample ID:	M17 65-75	M18 0-10	M18 20-30	M18 40-50
	Crop:	Soil	Soil	Soil	Soil
	Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter	**Method reference**	**H0640/49**	**H0640/50**	**H0640/51**	**H0640/52**

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 Publishin
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8. Contaminant Guides based on 'Residential with gardens and accessible soil including childrens d
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9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultu
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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ASPAC

Environmental Analysis Laboratory

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P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

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		Sample 53	Sample 54	Sample 55	Sample 56
Sample ID:		M18 65-75	M19 0-10	M19 20-30	M19 40-50
Crop:		Soil	Soil	Soil	Soil
Client:		Maxwell	Maxwell	Maxwell	Maxwell
Parameter	**Method reference**	**H0640/53**	**H0640/54**	**H0640/55**	**H0640/56**
pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.65	5.65	5.98	6.69
Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.907	0.039	0.027	0.046
Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	2.07	10.35	10.43	18.00
Exchangeable Calcium (kg/ha)		930	4645	4683	8079
Exchangeable Calcium (mg/kg)		415	2074	2090	3607
Exchangeable Magnesium (cmol+/kg)		6.97	3.06	2.80	7.11
Exchangeable Magnesium (kg/ha)		1899	833	761	1934
Exchangeable Magnesium (mg/kg)		848	372	340	864
Exchangeable Potassium (cmol+/kg)		0.46	0.72	0.46	0.45
Exchangeable Potassium (kg/ha)		399	632	405	391
Exchangeable Potassium (mg/kg)		178	282	181	174
Exchangeable Sodium (cmol+/kg)		3.36	0.20	0.21	0.48
Exchangeable Sodium (kg/ha)		1733	103	106	249
Exchangeable Sodium (mg/kg)		774	46	47	111
Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.01	0.01	0.01	0.01
Exchangeable Aluminium (kg/ha)		2	2	2	2
Exchangeable Aluminium (mg/kg)		1	1	1	1
Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.00	0.02	0.00	0.00
Exchangeable Hydrogen (kg/ha)		0	1	0	0
Exchangeable Hydrogen (mg/kg)		0	0	0	0
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation - Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	12.88	14.36	13.90	26.04
Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	16.1	72.1	75.0	69.1
Magnesium (%)		54.2	21.3	20.1	27.3
Potassium (%)		3.5	5.0	3.3	1.7
Sodium - ESP (%)		26.1	1.4	1.5	1.9
Aluminium (%)		0.1	0.1	0.1	0.0
Hydrogen		0.0	0.2	0.0	0.0
Calcium/Magnesium Ratio	**Calculation - Calcium / Magnesium (cmol+/kg)	0.3	3.4	3.7	2.5
pH	**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	6.20	5.52	5.48	6.17
Colour (Munsell Soil Colour Classification) - Hue/Colour	**Inhouse	10YR	7.5YR	7.5YR	7.5YR
Colour (Munsell Soil Colour Classification) - Value/Chroma	**Inhouse	5/8	2.5/2	2.5/2	3/3
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion	**Inhouse	None	None	None	None

Environmental Analysis Laboratory

Southern Cross University
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10 Kings Road NEW LAMBTON NSW 2305

		Sample 53	Sample 54	Sample 55	Sample 56
	Sample ID:	M18 65-75	M19 0-10	M19 20-30	M19 40-50
	Crop:	Soil	Soil	Soil	Soil
	Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter	**Method reference**	**H0640/53**	**H0640/54**	**H0640/55**	**H0640/56**

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 Publishin
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 Lamonte Soil H
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. Contaminant Guides based on 'Residential with gardens and accessible soil including childrens d preschools, primary schools, town houses or villas' (NSW EPA 1998).
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultu
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 ov
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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Quality Checked: Kris Saville
Agricultural Co-Ordinator KS

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

ROUTINE AGRICULTURAL SOIL ANALYSIS REPOI

80 samples supplied by SLR Consulting Australia Pty Ltd on 23/05/18. Lab Job No.H0640
Analysis requested by Murray Fraser. Your Job: SLR630.12463
10 Kings Road NEW LAMBTON NSW 2305

		Sample 57	Sample 58	Sample 59	Sample 60
Sample ID:		M19 65-75	M22 0-10	M22 20-30	M22 40-50
Crop:		Soil	Soil	Soil	Soil
Client:		Maxwell	Maxwell	Maxwell	Maxwell
Parameter	**Method reference**	**H0640/57**	**H0640/58**	**H0640/59**	**H0640/60**
pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	7.77	5.59	6.73	7.56
Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.059	0.027	0.120	0.248
Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	22.33	4.07	6.05	4.70
Exchangeable Calcium (kg/ha)		10024	1827	2716	2108
Exchangeable Calcium (mg/kg)		4475	815	1213	941
Exchangeable Magnesium (cmol+/kg)		9.74	1.88	7.55	6.83
Exchangeable Magnesium (kg/ha)		2652	511	2054	1858
Exchangeable Magnesium (mg/kg)		1184	228	917	829
Exchangeable Potassium (cmol+/kg)		0.37	0.66	0.40	0.35
Exchangeable Potassium (kg/ha)		322	582	350	305
Exchangeable Potassium (mg/kg)		144	260	156	136
Exchangeable Sodium (cmol+/kg)		0.81	0.20	1.69	2.66
Exchangeable Sodium (kg/ha)		416	104	871	1368
Exchangeable Sodium (mg/kg)		186	46	389	611
Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.01	0.06	0.02	0.04
Exchangeable Aluminium (kg/ha)		2	12	5	8
Exchangeable Aluminium (mg/kg)		1	5	2	3
Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.00	0.05	0.00	0.00
Exchangeable Hydrogen (kg/ha)		0	1	0	0
Exchangeable Hydrogen (mg/kg)		0	0	0	0
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation - Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	33.26	6.92	15.71	14.56
Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	67.1	58.8	38.5	32.3
Magnesium (%)		29.3	27.1	48.0	46.9
Potassium (%)		1.1	9.6	2.5	2.4
Sodium - ESP (%)		2.4	2.9	10.8	18.2
Aluminium (%)		0.0	0.8	0.1	0.3
Hydrogen		0.0	0.7	0.0	0.0
Calcium/Magnesium Ratio	**Calculation - Calcium / Magnesium (cmol+/kg)	2.3	2.2	0.8	0.7
pH	**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	7.07	4.83	6.03	6.85
Colour (Munsell Soil Colour Classification) - Hue/Colour	**Inhouse	5YR	10YR	10YR	10YR
Colour (Munsell Soil Colour Classification) - Value/Chroma	**Inhouse	3/4	3/4	4/3	4/6
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion	**Inhouse	None	None	None	None

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

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10 Kings Road NEW LAMBTON NSW 2305

			Sample 57	Sample 58	Sample 59	Sample 60
		Sample ID:	M19 65-75	M22 0-10	M22 20-30	M22 40-50
		Crop:	Soil	Soil	Soil	Soil
		Client:	Maxwell	Maxwell	Maxwell	Maxwell
	Parameter	**Method reference**	**H0640/57**	**H0640/58**	**H0640/59**	**H0640/60**

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 Publishin
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 Lamonte Soil H
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9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultu
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12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an ov
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P: +61 2 6620 3678
E: eal@scu.edu.au
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Analysis requested by Murray Fraser. Your Job: SLR630.12463
10 Kings Road NEW LAMBTON NSW 2305

		Sample 61	Sample 62	Sample 63	Sample 64
Sample ID:		M22 65-75	M24 0-10	M24 20-30	M24 40-50
Crop:		Soil	Soil	Soil	Soil
Client:		Maxwell	Maxwell	Maxwell	Maxwell
Parameter	**Method reference**	**H0640/61**	**H0640/62**	**H0640/63**	**H0640/64**
pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	7.47	5.40	6.70	7.71
Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.815	0.095	0.127	0.486
Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	5.42	4.74	8.37	6.80
Exchangeable Calcium (kg/ha)		2432	2128	3758	3050
Exchangeable Calcium (mg/kg)		1086	950	1678	1362
Exchangeable Magnesium (cmol+/kg)		8.08	2.79	5.88	10.20
Exchangeable Magnesium (kg/ha)		2200	759	1601	2776
Exchangeable Magnesium (mg/kg)		982	339	715	1239
Exchangeable Potassium (cmol+/kg)		0.37	0.80	0.82	0.49
Exchangeable Potassium (kg/ha)		325	704	716	430
Exchangeable Potassium (mg/kg)		145	314	320	192
Exchangeable Sodium (cmol+/kg)		4.29	0.56	0.64	3.28
Exchangeable Sodium (kg/ha)		2210	287	329	1687
Exchangeable Sodium (mg/kg)		987	128	147	753
Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.04	0.03	0.02	0.04
Exchangeable Aluminium (kg/ha)		7	6	5	9
Exchangeable Aluminium (mg/kg)		3	3	2	4
Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.00	0.06	0.00	0.00
Exchangeable Hydrogen (kg/ha)		0	1	0	0
Exchangeable Hydrogen (mg/kg)		0	1	0	0
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation - Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	18.20	8.98	15.74	20.80
Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	29.8	52.8	53.2	32.7
Magnesium (%)		44.4	31.0	37.4	49.0
Potassium (%)		2.0	9.0	5.2	2.4
Sodium - ESP (%)		23.6	6.2	4.1	15.8
Aluminium (%)		0.2	0.3	0.2	0.2
Hydrogen		0.0	0.6	0.0	0.0
Calcium/Magnesium Ratio	**Calculation - Calcium / Magnesium (cmol+/kg)	0.7	1.7	1.4	0.7
pH	**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	6.97	4.98	6.22	7.21
Colour (Munsell Soil Colour Classification) - Hue/Colour	**Inhouse	10YR	7.5YR	7.5YR	7.5YR
Colour (Munsell Soil Colour Classification) - Value/Chroma	**Inhouse	4/4	3/4	4/6	4/4
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion	**Inhouse	None	None	None	None

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

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10 Kings Road NEW LAMBTON NSW 2305

			Sample 61	Sample 62	Sample 63	Sample 64
		Sample ID:	M22 65-75	M24 0-10	M24 20-30	M24 40-50
		Crop:	Soil	Soil	Soil	Soil
		Client:	Maxwell	Maxwell	Maxwell	Maxwell
	Parameter	**Method reference**	H0640/61	H0640/62	H0640/63	H0640/64

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 Publishin
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 Lamonte Soil H
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
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8. Contaminant Guides based on 'Residential with gardens and accessible soil including childrens d
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9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultu
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122 mg/kg Magnesium, 200 mg/kg Calcium
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12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an ov
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EAL Environmental Analysis Laboratory

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P: +61 2 6620 3678
E: eal@scu.edu.au
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ROUTINE AGRICULTURAL SOIL ANALYSIS REPOI

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Analysis requested by Murray Fraser. Your Job: SLR630.12463

10 Kings Road NEW LAMBTON NSW 2305

Parameter	Unit	Method reference	Sample 65	Sample 66	Sample 67	Sample 68
		Sample ID:	M24 65-75	M25 0-10	M25 20-30	M25 40-50
		Crop:	Soil	Soil	Soil	Soil
		Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter		**Method reference**	**H0640/65**	**H0640/66**	**H0640/67**	**H0640/68**
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.51	6.11	7.68	8.22
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	1.107	0.096	0.141	0.547
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	17.55	10.12	13.56	13.69
	(kg/ha)		7879	4544	6089	6143
	(mg/kg)		3517	2029	2718	2743
Exchangeable Magnesium	(cmol$_+$/kg)		9.52	5.88	11.62	13.19
	(kg/ha)		2592	1602	3163	3591
	(mg/kg)		1157	715	1412	1603
Exchangeable Potassium	(cmol$_+$/kg)		0.28	1.33	0.73	0.55
	(kg/ha)		243	1164	642	486
	(mg/kg)		108	520	287	217
Exchangeable Sodium	(cmol$_+$/kg)		5.02	0.49	2.88	5.59
	(kg/ha)		2584	253	1482	2877
	(mg/kg)		1153	113	662	1284
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.05	0.02	0.02	0.02
	(kg/ha)		10	4	5	5
	(mg/kg)		5	2	2	2
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.00	0.04	0.00	0.00
	(kg/ha)		0	1	0	0
	(mg/kg)		0	0	0	0
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation - Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	32.42	17.89	28.82	33.04
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	54.1	56.6	47.1	41.4
Magnesium (%)			29.4	32.9	40.3	39.9
Potassium (%)			0.9	7.4	2.5	1.7
Sodium - ESP (%)			15.5	2.7	10.0	16.9
Aluminium (%)			0.2	0.1	0.1	0.1
Hydrogen			0.0	0.2	0.0	0.0
Calcium/Magnesium Ratio		**Calculation - Calcium / Magnesium (cmol$_+$/kg)	1.8	1.7	1.2	1.0
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	7.96	6.02	6.78	7.64
Colour (Munsell Soil Colour Classification) - Hue/Colour		**Inhouse	10YR	10YR	10YR	10YR
Colour (Munsell Soil Colour Classification) - Value/Chroma		**Inhouse	5/6	3/2	3/4	4/2
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	7.5YR, 5/6, 20%	None	None	None

Southern Cross University

ASPAC

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal
ABN: 41 995 651 524

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10 Kings Road NEW LAMBTON NSW 2305

		Sample 65	Sample 66	Sample 67	Sample 68
	Sample ID:	M24 65-75	M25 0-10	M25 20-30	M25 40-50
	Crop:	Soil	Soil	Soil	Soil
	Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter	**Method reference**	H0640/65	H0640/66	H0640/67	H0640/68

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 Publishin
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 Lamonte Soil H
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Environmental Analysis Laboratory

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P: +61 2 6620 3678
E: eal@scu.edu.au
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ABN: 41 995 651 524

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Analysis requested by Murray Fraser. Your Job: SLR630.12463
10 Kings Road NEW LAMBTON NSW 2305

		Sample 69	Sample 70	Sample 71	Sample 72
	Sample ID:	M25 65-75	M26 0-10	M26 20-30	M26 40-50
	Crop:	Soil	Soil	Soil	Soil
	Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter	**Method reference**	**H0640/69**	**H0640/70**	**H0640/71**	**H0640/72**
pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.56	6.37	8.67	8.87
Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	1.012	0.089	0.388	0.908
Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	18.39	7.84	24.50	21.72
Exchangeable Calcium (kg/ha)		8253	3521	11000	9751
Exchangeable Calcium (mg/kg)		3684	1572	4911	4353
Exchangeable Magnesium (cmol+/kg)		11.41	5.48	16.17	17.54
Exchangeable Magnesium (kg/ha)		3105	1493	4402	4776
Exchangeable Magnesium (mg/kg)		1386	667	1965	2132
Exchangeable Potassium (cmol+/kg)		0.41	0.99	0.97	0.70
Exchangeable Potassium (kg/ha)		357	864	852	609
Exchangeable Potassium (mg/kg)		159	386	380	272
Exchangeable Sodium (cmol+/kg)		7.27	0.99	4.44	8.76
Exchangeable Sodium (kg/ha)		3742	509	2288	4513
Exchangeable Sodium (mg/kg)		1670	227	1021	2015
Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.02	0.02	0.02	0.01
Exchangeable Aluminium (kg/ha)		5	5	5	3
Exchangeable Aluminium (mg/kg)		2	2	2	1
Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.00	0.00	0.00	0.00
Exchangeable Hydrogen (kg/ha)		0	0	0	0
Exchangeable Hydrogen (mg/kg)		0	0	0	0
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation - Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	37.49	15.32	46.11	48.74
Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	49.0	51.2	53.1	44.6
Magnesium (%)		30.4	35.8	35.1	36.0
Potassium (%)		1.1	6.4	2.1	1.4
Sodium - ESP (%)		19.4	6.4	9.6	18.0
Aluminium (%)		0.1	0.1	0.1	0.0
Hydrogen		0.0	0.0	0.0	0.0
Calcium/Magnesium Ratio	**Calculation - Calcium / Magnesium (cmol+/kg)	1.6	1.4	1.5	1.2
pH	**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	8.12	6.08	7.93	8.24
Colour (Munsell Soil Colour Classification) - Hue/Colour	**Inhouse	10YR	10YR	10YR	10YR
Colour (Munsell Soil Colour Classification) - Value/Chroma	**Inhouse	5/4	3/2	4/1	4/2
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion	**Inhouse	None	None	None	10YR, 5/3, 40%

Environmental Analysis Laboratory

Southern Cross University
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P: +61 2 6620 3678
E: eal@scu.edu.au
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10 Kings Road NEW LAMBTON NSW 2305

		Sample 69	Sample 70	Sample 71	Sample 72
	Sample ID:	M25 65-75	M26 0-10	M26 20-30	M26 40-50
	Crop:	Soil	Soil	Soil	Soil
	Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter	**Method reference**	H0640/69	H0640/70	H0640/71	H0640/72

Notes:

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Parameter		Method reference	Sample 73	Sample 74	Sample 75	Sample 76
Sample ID:			M26 65-75	M27 0-10	M27 20-30	M27 40-50
Crop:			Soil	Soil	Soil	Soil
Client:			Maxwell	Maxwell	Maxwell	Maxwell
			H0640/73	H0640/74	H0640/75	H0640/76
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.85	5.83	7.31	8.06
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	1.105	0.061	0.333	0.852
Exchangeable Calcium	(cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	21.43	5.16	6.83	4.75
	(kg/ha)		9622	2315	3067	2134
	(mg/kg)		4295	1034	1369	953
Exchangeable Magnesium	(cmol+/kg)		17.22	2.32	7.91	8.40
	(kg/ha)		4688	632	2154	2287
	(mg/kg)		2093	282	962	1021
Exchangeable Potassium	(cmol+/kg)		0.64	0.83	0.85	0.53
	(kg/ha)		560	726	741	465
	(mg/kg)		250	324	331	208
Exchangeable Sodium	(cmol+/kg)		9.81	0.26	2.02	4.24
	(kg/ha)		5053	135	1038	2186
	(mg/kg)		2256	60	464	976
Exchangeable Aluminium	(cmol+/kg)	**Inhouse S37 (KCl)	0.03	0.04	0.04	0.04
	(kg/ha)		5	7	9	8
	(mg/kg)		2	3	4	4
Exchangeable Hydrogen	(cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.00	0.00	0.00	0.00
	(kg/ha)		0	0	0	0
	(mg/kg)		0	0	0	0
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)		**Calculation - Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	49.13	8.61	17.65	17.97
Calcium (%)		**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	43.6	59.9	38.7	26.5
Magnesium (%)			35.1	27.0	44.8	46.8
Potassium (%)			1.3	9.6	4.8	3.0
Sodium - ESP (%)			20.0	3.1	11.4	23.6
Aluminium (%)			0.1	0.4	0.2	0.2
Hydrogen			0.0	0.0	0.0	0.0
Calcium/Magnesium Ratio		**Calculation - Calcium / Magnesium (cmol+/kg)	1.2	2.2	0.9	0.6
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	8.22	5.54	6.90	7.69
Colour (Munsell Soil Colour Classification) - Hue/Colour		**Inhouse	10YR	7.5YR	7.5YR	7.5YR
Colour (Munsell Soil Colour Classification) - Value/Chroma		**Inhouse	4/4	3/4	4/6	5/6
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	None	None	None	None

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal
ABN: 41 995 651 524

80 samples supplied by SLR Consulting Australia Pty Ltd on 23/05/18. Lab Job No.H0640
Analysis requested by Murray Fraser. Your Job: SLR630.12463
10 Kings Road NEW LAMBTON NSW 2305

		Sample 73	Sample 74	Sample 75	Sample 76
	Sample ID:	M26 65-75	M27 0-10	M27 20-30	M27 40-50
	Crop:	Soil	Soil	Soil	Soil
	Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter	**Method reference**	H0640/73	H0640/74	H0640/75	H0640/76

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 Publishin
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 Lamonte Soil H
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. Contaminant Guides based on 'Residential with gardens and accessible soil including childrens d
preschools, primary schools, town houses or villas' (NSW EPA 1998).
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultu
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 ov
13. ** NATA accreditation does not cover the performance of this service.
14. Analysis conducted between sample arrival date and reporting date.
15. This report is not to be reproduced except in full.

Quality Checked: Kris Saville
Agricultural Co-Ordinator KS

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

ROUTINE AGRICULTURAL SOIL ANALYSIS REPOI

80 samples supplied by SLR Consulting Australia Pty Ltd on 23/05/18. Lab Job No.H0640

Analysis requested by Murray Fraser. Your Job: SLR630.12463

10 Kings Road NEW LAMBTON NSW 2305

		Sample 77	Sample 78	Sample 79	Sample 80
Sample ID:		M30 0-10	M30 20-30	M30 40-50	M30 65-75
Crop:		Soil	Soil	Soil	Soil
Client:		Maxwell	Maxwell	Maxwell	Maxwell
Parameter	**Method reference**	**H0640/77**	**H0640/78**	**H0640/79**	**H0640/80**
pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.04	8.07	8.58	8.62
Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.113	0.156	0.400	0.568
Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	12.76	12.58	9.75	7.13
Exchangeable Calcium (kg/ha)		5729	5647	4377	3201
Exchangeable Calcium (mg/kg)		2558	2521	1954	1429
Exchangeable Magnesium (cmol+/kg)		8.00	12.03	11.39	10.64
Exchangeable Magnesium (kg/ha)		2179	3275	3100	2896
Exchangeable Magnesium (mg/kg)		973	1462	1384	1293
Exchangeable Potassium (cmol+/kg)		1.39	0.55	0.45	0.45
Exchangeable Potassium (kg/ha)		1214	481	397	395
Exchangeable Potassium (mg/kg)		542	215	177	176
Exchangeable Sodium (cmol+/kg)		0.68	3.84	5.78	6.66
Exchangeable Sodium (kg/ha)		349	1976	2975	3431
Exchangeable Sodium (mg/kg)		156	882	1328	1532
Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.01	0.03	0.03	0.02
Exchangeable Aluminium (kg/ha)		2	7	7	4
Exchangeable Aluminium (mg/kg)		1	3	3	2
Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.03	0.00	0.00	0.00
Exchangeable Hydrogen (kg/ha)		1	0	0	0
Exchangeable Hydrogen (mg/kg)		0	0	0	0
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation - Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	22.87	29.03	27.40	24.90
Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	55.8	43.3	35.6	28.6
Magnesium (%)		35.0	41.4	41.6	42.7
Potassium (%)		6.1	1.9	1.7	1.8
Sodium - ESP (%)		3.0	13.2	21.1	26.8
Aluminium (%)		0.1	0.1	0.1	0.1
Hydrogen		0.1	0.0	0.0	0.0
Calcium/Magnesium Ratio	**Calculation - Calcium / Magnesium (cmol+/kg)	1.6	1.0	0.9	0.7
pH	**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	5.68	7.12	7.76	7.85
Colour (Munsell Soil Colour Classification) - Hue/Colour	**Inhouse	7.5YR	7.5YR	7.5YR	7.5YR
Colour (Munsell Soil Colour Classification) - Value/Chroma	**Inhouse	3/2	4/4	4/4	4/4
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion	**Inhouse	None	None	None	None

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

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Analysis requested by Murray Fraser. Your Job: SLR630.12463
10 Kings Road NEW LAMBTON NSW 2305

			Sample 77	Sample 78	Sample 79	Sample 80
		Sample ID:	M30 0-10	M30 20-30	M30 40-50	M30 65-75
		Crop:	Soil	Soil	Soil	Soil
		Client:	Maxwell	Maxwell	Maxwell	Maxwell
	Parameter	**Method reference**	H0640/77	H0640/78	H0640/79	H0640/80

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishin
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 Lamonte Soil H
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. Contaminant Guides based on 'Residential with gardens and accessible soil including childrens d preschools, primary schools, town houses or villas' (NSW EPA 1998).
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultu
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 ov
13. ** NATA accreditation does not cover the performance of this service.
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Quality Checked: Kris Saville
Agricultural Co-Ordinator KS

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

ROUTINE AGRICULTURAL SOIL ANALYSIS REPOI

80 samples supplied by SLR Consulting Australia Pty Ltd on 23/05/18. Lab Job No.H0640

Analysis requested by Murray Fraser. Your Job: SLR630.12463

10 Kings Road NEW LAMBTON NSW 2305

Parameter		Method reference	Heavy Soil	Medium Soil	Light Soil	Sandy Soil
		Sample ID:				
		Crop:				
		Client:	*Clay*	*Clay Loam*	*Loam*	*Loamy Sand*
Parameter		**Method reference**	**Indicative guidelines only- refer Note 6**			
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 (%) / **Hydrogen**			6.0	7.1	10.5	12.1
Calcium/Magnesium Ratio		**Calculation - Calcium / Magnesium (cmol$_+$/kg)	6.5	6.4	4.2	3.2
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	..			
Colour (Munsell Soil Colour Classification) - Hue/Colour		**Inhouse	..			
Colour (Munsell Soil Colour Classification) - Value/Chroma		**Inhouse	..			
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	..			

Southern Cross University

CRICOS Provider: 01241G

ASPAC

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

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Analysis requested by Murray Fraser. Your Job: SLR630.12463
10 Kings Road NEW LAMBTON NSW 2305

			Heavy Soil	Medium Soil	Light Soil	Sandy Soil
		Sample ID:				
		Crop:				
		Client:	Clay	Clay Loam	Loam	Loamy Sand
	Parameter	Method reference	Indicative guidelines only- refer Note 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 Publishin
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 Lamonte Soil H
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. Contaminant Guides based on 'Residential with gardens and accessible soil including childrens d preschools, primary schools, town houses or villas' (NSW EPA 1998).
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultu
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 o
13. ** NATA accreditation does not cover the performance of this service.
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Agricultural Co-Ordinator KS

GRAIN SIZE ANALYSIS (hydrometer and sieving techniques)

80 soil samples supplied by SLR Consulting on 23rd May, 2018 - Lab Job No. H0640.
Analysis requested by Murray Fraser
(10 Kings Road NEW LAMBTON 2305)

SAMPLE ID	Lab Code	MOISTURE CONTENT (% of water in air-dry 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)
M1 0-10	H0640/1	2.4%	0.5%	10.8%	34.2%	38.7%	15.9%
M1 20-30	H0640/2	3.3%	0.0%	7.6%	27.2%	28.6%	36.6%
M1 40-50	H0640/3	2.5%	0.4%	9.7%	34.3%	29.2%	26.3%
M1 65-75	H0640/4	3.0%	0.2%	9.8%	32.9%	17.9%	39.2%
M3 0-10	H0640/5	0.9%	0.0%	26.2%	60.3%	12.8%	0.7%
M3 20-30	H0640/6	0.8%	0.0%	19.1%	68.0%	10.7%	2.2%
M3 40-50	H0640/7	2.7%	0.0%	14.4%	49.7%	8.6%	27.3%
M5 0-10	H0640/8	4.4%	0.5%	5.0%	27.6%	22.2%	44.8%
M5 20-30	H0640/9	4.3%	3.1%	5.5%	25.9%	7.3%	58.1%
M5 40-50	H0640/10	4.3%	2.0%	3.5%	12.7%	10.1%	71.8%
M5 65-75	H0640/11	3.4%	0.7%	4.6%	24.2%	13.1%	57.4%
M6 0-5	H0640/12	1.1%	2.8%	34.6%	36.1%	23.9%	2.6%
M6 10-20	H0640/13	1.1%	2.1%	37.1%	34.2%	20.4%	6.2%
M6 30-40	H0640/14	3.1%	0.6%	27.4%	17.6%	17.5%	37.0%
M6 50-60	H0640/15	2.9%	0.8%	40.6%	14.3%	12.1%	32.2%
M7 0-10	H0640/16	1.8%	0.3%	19.3%	43.1%	20.5%	16.8%
M7 20-30	H0640/17	2.4%	0.0%	9.0%	22.8%	20.8%	47.4%
M7 40-50	H0640/18	0.0%	0.0%	8.6%	41.3%	11.3%	38.8%
M8 0-10	H0640/19	4.0%	0.8%	5.7%	43.7%	17.7%	32.0%
M8 20-30	H0640/20	15.2%	0.4%	4.3%	4.5%	25.2%	65.5%
M8 40-50	H0640/21	3.4%	0.0%	3.9%	30.9%	15.3%	49.8%
M8 65-75	H0640/22	1.4%	0.3%	4.7%	17.8%	19.9%	57.4%
M9 0-10	H0640/23	2.9%	0.6%	6.7%	26.3%	37.6%	28.7%
M9 20-30	H0640/24	3.0%	0.2%	3.6%	19.8%	30.9%	45.4%
M9 40-50	H0640/25	3.0%	1.4%	2.8%	26.4%	21.8%	47.7%
M9 65-75	H0640/26	3.0%	0.4%	2.9%	14.0%	17.2%	65.4%
M11 0-10	H0640/27	2.3%	0.1%	8.3%	39.3%	23.8%	28.6%
M11 20-30	H0640/28	4.0%	0.0%	4.5%	20.6%	15.6%	59.3%
M11 40-50	H0640/29	3.2%	0.0%	3.0%	31.9%	14.2%	50.9%
M11 65-75	H0640/30	3.5%	0.1%	2.5%	25.7%	22.3%	49.5%
M12 0-10	H0640/31	6.1%	1.2%	7.7%	21.5%	25.8%	43.7%
M12 20-30	H0640/32	5.2%	2.8%	5.5%	19.5%	22.2%	50.1%
M12 40-50	H0640/33	6.4%	1.6%	11.9%	18.8%	18.4%	49.4%
M12 65-75	H0640/34	5.8%	6.8%	11.9%	24.7%	12.6%	44.0%
M14 0-10	H0640/35	1.8%	0.3%	15.4%	65.6%	6.9%	12.0%
M14 20-30	H0640/36	2.1%	0.0%	4.1%	37.4%	18.7%	39.8%
M14 40-50	H0640/37	2.0%	0.0%	1.5%	18.7%	36.7%	43.1%
M15 0-10	H0640/38	1.6%	0.4%	17.6%	38.3%	29.9%	13.9%
M15 20-30	H0640/39	2.6%	0.5%	11.5%	29.5%	7.5%	50.9%
M15 40-50	H0640/40	4.5%	0.0%	18.0%	22.7%	28.4%	30.9%
M15 65-75	H0640/41	2.7%	3.9%	22.6%	28.5%	15.3%	29.7%
M16 0-10	H0640/42	1.9%	0.0%	15.9%	27.7%	25.7%	30.7%
M16 20-30	H0640/43	2.6%	0.0%	9.7%	24.8%	9.4%	56.1%
M16 40-50	H0640/44	2.7%	0.0%	10.4%	18.1%	18.3%	53.2%
M16 65-75	H0640/45	3.1%	0.3%	2.3%	33.8%	11.9%	51.7%
M17 0-10	H0640/46	1.9%	0.0%	25.5%	57.3%	7.4%	9.7%
M17 20-30	H0640/47	1.5%	0.4%	28.5%	42.1%	19.1%	9.9%
M17 40-50	H0640/48	1.2%	8.2%	25.7%	54.7%	10.2%	1.2%
M17 65-75	H0640/49	6.5%	1.2%	15.5%	28.9%	16.6%	37.9%
M18 0-10	H0640/50	0.4%	0.1%	6.7%	70.0%	20.7%	2.5%
M18 20-30	H0640/51	0.0%	0.9%	7.8%	40.2%	17.6%	33.6%
M18 40-50	H0640/52	0.0%	0.5%	7.8%	54.4%	9.0%	28.3%
M18 65-75	H0640/53	0.0%	0.7%	9.7%	51.1%	12.5%	26.1%
M19 0-10	H0640/54	0.0%	0.0%	20.2%	42.7%	20.3%	16.8%
M19 20-30	H0640/55	0.0%	0.0%	19.1%	34.8%	26.1%	20.0%
M19 40-50	H0640/56	1.1%	0.0%	12.2%	39.4%	17.9%	30.5%
M19 65-75	H0640/57	0.5%	0.0%	15.6%	38.4%	16.1%	29.8%
M22 0-10	H0640/58	0.0%	0.7%	7.4%	51.6%	32.6%	7.7%
M22 20-30	H0640/59	0.0%	0.2%	7.0%	54.0%	16.1%	22.8%
M22 40-50	H0640/60	0.0%	0.0%	3.4%	42.7%	31.9%	22.1%
M22 65-75	H0640/61	1.6%	0.0%	2.8%	52.1%	16.9%	28.2%
M24 0-10	H0640/62	1.7%	0.5%	3.0%	47.7%	29.5%	19.3%
M24 20-30	H0640/63	1.6%	0.0%	1.3%	35.4%	18.8%	44.4%
M24 40-50	H0640/64	1.5%	0.0%	0.8%	32.7%	22.9%	43.6%
M24 65-75	H0640/65	2.9%	9.7%	1.5%	31.8%	23.5%	33.5%
M25 0-10	H0640/66	3.3%	0.0%	6.5%	47.7%	25.7%	20.1%
M25 20-30	H0640/67	1.2%	0.0%	3.4%	26.5%	22.8%	47.3%
M25 40-50	H0640/68	1.7%	0.8%	2.7%	18.1%	20.7%	57.6%
M25 65-75	H0640/69	2.3%	5.3%	3.9%	23.3%	32.0%	35.5%
M26 0-10	H0640/70	8.5%	4.9%	15.9%	25.7%	38.4%	15.1%
M26 20-30	H0640/71	3.7%	3.9%	8.9%	37.0%	14.3%	35.9%
M26 40-50	H0640/72	3.8%	13.9%	7.9%	18.5%	26.8%	32.9%
M26 65-75	H0640/73	4.1%	5.5%	9.5%	25.2%	11.9%	48.0%
M27 0-10	H0640/74	1.0%	0.4%	5.0%	65.3%	14.2%	15.2%
M27 20-30	H0640/75	1.4%	0.0%	2.0%	38.0%	17.1%	42.9%
M27 40-50	H0640/76	1.8%	0.0%	3.4%	38.2%	14.1%	44.3%
M30 0-10	H0640/77	8.2%	1.0%	12.6%	31.6%	4.0%	50.7%
M30 20-30	H0640/78	13.8%	0.6%	11.5%	29.0%	5.7%	53.2%
M30 40-50	H0640/79	12.9%	3.8%	15.1%	25.9%	9.3%	45.9%
M30 65-75	H0640/80	8.8%	12.1%	24.6%	21.5%	8.4%	33.5%

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)

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

TOC

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

ROUTINE AGRICULTURAL SOIL ANALYSIS REPORT

4 samples supplied by SLR Consulting Australia Pty Ltd on 28/05/18. Lab Job No.H0793

Analysis requested by Murray Fraser. Your Job: SLR630.12463

10 Kings Road NEW LAMBTON NSW 2305

	Sample 1	Sample 2	Sample 3	Sample 4
Sample ID:	D18 0-10	D18 20-30	D18 40-50	D18 65-75
Crop:	Soil	Soil	Soil	Soil
Client:	Maxwell	Maxwell	Maxwell	Maxwell

Parameter		Method reference	H0793/1	H0793/2	H0793/3	H0793/4
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.93	7.95	8.64	8.56
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.269	0.332	1.161	1.583
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	5.76	11.73	23.33	23.35
	(kg/ha)		2585	5264	10471	10483
	(mg/kg)		1154	2350	4675	4680
Exchangeable Magnesium	(cmol$_+$/kg)		5.02	17.43	22.94	24.44
	(kg/ha)		1366	4744	6245	6653
	(mg/kg)		610	2118	2788	2970
Exchangeable Potassium	(cmol$_+$/kg)		0.62	0.61	0.62	0.74
	(kg/ha)		541	531	544	647
	(mg/kg)		242	237	243	289
Exchangeable Sodium	(cmol$_+$/kg)		0.93	5.24	11.65	13.47
	(kg/ha)		481	2700	5999	6935
	(mg/kg)		215	1205	2678	3096
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.02	0.02	0.03	0.02
	(kg/ha)		4	3	6	3
	(mg/kg)		2	1	3	1
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.02	0.00	0.00	0.00
	(kg/ha)		0	0	0	0
	(mg/kg)		0	0	0	0
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation - Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	12.37	35.02	58.57	62.01
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	46.6	33.5	39.8	37.7
Magnesium (%)			40.6	49.8	39.2	39.4
Potassium (%)			5.0	1.7	1.1	1.2
Sodium - ESP (%)			7.6	15.0	19.9	21.7
Aluminium (%)			0.2	0.0	0.1	0.0
Hydrogen			0.2	0.0	0.0	0.0
Calcium/Magnesium Ratio		**Calculation - Calcium / Magnesium (cmol$_+$/kg)	1.1	0.7	1.0	1.0
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	5.63	7.28	8.07	8.07
Colour (Munsell Soil Color Classification)		**Inhouse	5YR	5YR	2.5YR	5YR
Colour (Munsell Soil Colour Classification) - Value/Chroma		**Inhouse	3/3	3/4	2.5/4	3/4
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	None	None	None	None

Southern Cross University

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

4 samples supplied by SLR Consulting Australia Pty Ltd on 28/05/18. Lab Job No.H0793

Analysis requested by Murray Fraser. Your Job: SLR630.12463

10 Kings Road NEW LAMBTON NSW 2305

		Sample 1	Sample 2	Sample 3	Sample 4
	Sample ID:	D18 0-10	D18 20-30	D18 40-50	D18 65-75
	Crop:	Soil	Soil	Soil	Soil
	Client:	Maxwell	Maxwell	Maxwell	Maxwell
Parameter	**Method reference**	H0793/1	H0793/2	H0793/3	H0793/4

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 Lamonte 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. Contaminant Guides based on 'Residential with gardens and accessible soil including childrens daycare centres, preschools, primary schools, town houses or villas' (NSW EPA 1998).
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil results'.
10. Conversions for 1 $cmol_+/kg$ = 230 mg/kg Sodium, 390 mg/kg Potassium, 122 mg/kg Magnesium, 200 mg/kg Calcium
11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimate
13. ** NATA accreditation does not cover the performance of this service.
14. Analysis conducted between sample arrival date and reporting date.
15. This report is not to be reproduced except in full.

Quality Checked: Kris Saville
Agricultural Co-Ordinator KS

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

ROUTINE AGRICULTURAL SOIL ANALYSIS REPOI

4 samples supplied by SLR Consulting Australia Pty Ltd on 28/05/18. Lab Job No.H0793

Analysis requested by Murray Fraser. Your Job: SLR630.12463

10 Kings Road NEW LAMBTON NSW 2305

Sample ID:			***Heavy Soil***	***Medium Soil***	***Light Soil***	***Sandy Soil***
Crop:						
Client:			*Clay*	*Clay Loam*	*Loam*	*Loamy Sand*
Parameter		**Method reference**	**Indicative guidelines only- refer Note 6**			
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 (%) **Hydrogen**			6.0	7.1	10.5	12.1
Calcium/Magnesium Ratio		**Calculation - Calcium / Magnesium (cmol$_+$/kg)	6.5	6.4	4.2	3.2
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	..			
Colour (Munsell Soil Color Classification)		**Inhouse	..			
Colour (Munsell Soil Colour Classification) - Value/Chroma		**Inhouse	..			
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	..			

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

4 samples supplied by SLR Consulting Australia Pty Ltd on 28/05/18. Lab Job No.H0793

Analysis requested by Murray Fraser. Your Job: SLR630.12463

10 Kings Road NEW LAMBTON NSW 2305

		Heavy Soil	Medium Soil	Light Soil	Sandy Soil
	Sample ID:				
	Crop:				
	Client:	*Clay*	*Clay Loam*	*Loam*	*Loamy Sand*
Parameter	**Method reference**	**Indicative guidelines only- refer Note 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 Publishin

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 Lamonte Soil H

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. Contaminant Guides based on 'Residential with gardens and accessible soil including childrens d
preschools, primary schools, town houses or villas' (NSW EPA 1998).

9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultu

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 o

13. ** NATA accreditation does not cover the performance of this service.

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

15. This report is not to be reproduced except in full.

Quality Checked: Kris Saville
Agricultural Co-Ordinator KS

GRAIN SIZE ANALYSIS (hydrometer and sieving techniques)

4 soil samples supplied by SLR Consulting on 28th May, 2018 - Lab Job No. H0485.
Analysis requested by Murray Fraser. Your Project: Maxwell BSAL 630.12463.
(10 Kings Road NEW LAMBTON 2305)

SAMPLE ID	Lab Code	**MOISTURE CONTENT** (% of water in air-dry 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)
D18 0-10	H0793/1	2.5%	0.8%	12.2%	34.1%	21.5%	31.4%	100.0%
D18 20-30	H0793/2	4.6%	0.1%	4.9%	28.0%	2.6%	64.5%	100.0%
D18 40-50	H0793/3	4.1%	2.1%	7.0%	21.2%	9.6%	60.1%	100.0%
D18 65-75	H0793/4	4.0%	1.0%	5.3%	26.1%	3.7%	64.0%	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)

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

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1447699**	Page	: 1 of 18
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: MS ADELE CALANDRA	Contact	: Customer Services EB
Address	: LEVEL 1, 241 DENNISON STREET BROADMEADOW NSW 2292	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: acalandra@slrconsulting.com	E-mail	: ALSEnviro.Brisbane@alsglobal.com
Telephone	: +61 02 4920 3000	Telephone	: +61-7-3243 7222
Facsimile	: +61 02 4961 3360	Facsimile	: +61-7-3243 7218
Project	: 630.11145	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 03-Dec-2014 13:40
C-O-C number	: ----	Date Analysis Commenced	: 08-Dec-2014
Sampler	: ----	Issue Date	: 12-Dec-2014 18:35
Site	: ----		
		No. of samples received	: 80
Quote number	: ----	No. of samples analysed	: 80

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA

WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Andrew Epps	Senior Inorganic Chemist	Brisbane Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

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

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

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

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

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

- **ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl (Method 15G1) is a more suitable method for the determination of exchange acidity (H^+ + Al^{3+}).**
- **ED008 (Exchangeable Cations) Sample EB1447699069 shows poor duplicate results due to sample heterogeneity. Confirmed by visual inspection.**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 1 0-10 cm	Site 1 20-30 cm	Site 1 50-60 cm	Site 1 80-90 cm	Site 2 0-10 cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447699-001	EB1447699-002	EB1447699-003	EB1447699-004	EB1447699-005
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**5.8**	**6.8**	**8.1**	**8.7**	**6.1**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**61**	**35**	**159**	**492**	**85**
ED008: Exchangeable Cations								
^ **Exchangeable Calcium**	----	0.1	meq/100g	**4.5**	**4.4**	**9.3**	**12.2**	**5.5**
^ **Exchangeable Magnesium**	----	0.1	meq/100g	**1.9**	**2.8**	**10.8**	**12.6**	**6.3**
^ **Exchangeable Potassium**	----	0.1	meq/100g	**0.8**	**0.4**	**0.2**	**0.1**	**0.8**
^ **Exchangeable Sodium**	----	0.1	meq/100g	<0.1	**0.2**	**2.3**	**3.4**	<0.1
^ **Cation Exchange Capacity**	----	0.1	meq/100g	**7.3**	**7.9**	**22.6**	**28.5**	**12.9**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			*Client sample ID*	Site 2 10-20 cm	Site 2 50-60 cm	Site 2 80-90 cm	Site 3 0-10 cm	Site 3 20-30 cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	*CAS Number*	*LOR*	*Unit*	EB1447699-006	EB1447699-007	EB1447699-008	EB1447699-009	EB1447699-010
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	6.7	8.2	8.2	6.2	6.9
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	89	727	926	62	36
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	6.0	5.2	2.6	16.4	22.9
^ Exchangeable Magnesium	----	0.1	meq/100g	8.6	12.9	7.5	6.5	9.9
^ Exchangeable Potassium	----	0.1	meq/100g	0.7	<0.1	<0.1	0.9	0.2
^ Exchangeable Sodium	----	0.1	meq/100g	0.3	2.2	1.7	<0.1	0.1
^ Cation Exchange Capacity	----	0.1	meq/100g	15.7	20.5	11.9	24.0	33.3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 3 50-60 cm	Site 4 0-10 cm	Site 4 20-30 cm	Site 4 50-60 cm	Site 4 80-90 cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	*CAS Number*	*LOR*	*Unit*	EB1447699-011	EB1447699-012	EB1447699-013	EB1447699-014	EB1447699-015
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	7.6	6.6	8.4	8.8	8.8
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	102	126	357	916	1060
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	33.4	5.2	11.0	21.6	9.3
^ Exchangeable Magnesium	----	0.1	meq/100g	11.6	7.6	14.5	11.3	12.0
^ Exchangeable Potassium	----	0.1	meq/100g	0.1	0.7	0.3	0.1	0.2
^ Exchangeable Sodium	----	0.1	meq/100g	0.2	0.5	2.7	1.8	2.6
^ Cation Exchange Capacity	----	0.1	meq/100g	45.4	14.0	28.7	34.9	24.1

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 5 0-5 cm	Site 5 20-30 cm	Site 5 40-50 cm	Site 7 0-5 cm	Site 7 10-20 cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447699-016	EB1447699-017	EB1447699-018	EB1447699-019	EB1447699-020
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**6.7**	**7.2**	**7.9**	**5.6**	**6.6**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**102**	**52**	**236**	**51**	**80**
ED008: Exchangeable Cations								
^ **Exchangeable Calcium**	----	0.1	meq/100g	**9.7**	**12.9**	**13.1**	**1.4**	**1.4**
^ **Exchangeable Magnesium**	----	0.1	meq/100g	**3.8**	**10.0**	**7.7**	**0.7**	**1.2**
^ **Exchangeable Potassium**	----	0.1	meq/100g	**1.1**	**0.7**	**0.5**	**0.5**	**0.4**
^ **Exchangeable Sodium**	----	0.1	meq/100g	<0.1	**0.8**	**0.3**	<0.1	**0.3**
^ **Cation Exchange Capacity**	----	0.1	meq/100g	**14.7**	**24.5**	**21.7**	**2.8**	**3.3**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 7 50-60 cm	Site 7 80-90 cm	Site 8 0-10 cm	Site 8 20-30 cm	Site 8 50-60 cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	*CAS Number*	*LOR*	*Unit*	EB1447699-021	EB1447699-022	EB1447699-023	EB1447699-024	EB1447699-025
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**8.6**	**8.6**	**6.4**	**7.4**	**8.5**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**494**	**518**	**98**	**113**	**275**
ED008: Exchangeable Cations								
^ **Exchangeable Calcium**	----	0.1	meq/100g	**7.2**	**5.4**	**23.7**	**27.4**	**41.8**
^ **Exchangeable Magnesium**	----	0.1	meq/100g	**6.7**	**6.7**	**10.2**	**13.1**	**13.1**
^ **Exchangeable Potassium**	----	0.1	meq/100g	**0.1**	**0.2**	**1.0**	**0.2**	**0.1**
^ **Exchangeable Sodium**	----	0.1	meq/100g	**3.2**	**3.4**	**0.1**	**1.0**	**0.9**
^ **Cation Exchange Capacity**	----	0.1	meq/100g	**17.2**	**15.8**	**35.1**	**41.8**	**55.9**

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

			Client sample ID	Site 9 0-5 cm	Site 9 20-30 cm	Site 9 50-60 cm	Site 9 80-90 cm	Site 10 0-10 cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447699-026	EB1447699-027	EB1447699-028	EB1447699-029	EB1447699-030
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	6.3	7.6	7.8	8.8	6.8
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	109	229	763	781	42
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	4.8	4.4	5.7	3.6	18.3
^ Exchangeable Magnesium	----	0.1	meq/100g	5.9	6.1	16.4	12.3	7.6
^ Exchangeable Potassium	----	0.1	meq/100g	0.7	0.3	0.2	0.2	1.4
^ Exchangeable Sodium	----	0.1	meq/100g	0.4	1.0	5.2	4.4	<0.1
^ Cation Exchange Capacity	----	0.1	meq/100g	11.9	11.8	27.5	20.5	27.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 10 20-30 cm	Site 10 50-60 cm	Site 10 80-90 cm	Site 11 0-5 cm	Site 11 5-15 cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447699-031	EB1447699-032	EB1447699-033	EB1447699-034	EB1447699-035
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	7.8	8.1	8.0	7.2	7.8
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	58	167	233	81	82
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	20.6	35.8	34.2	15.4	12.9
^ Exchangeable Magnesium	----	0.1	meq/100g	11.7	15.4	15.4	6.2	6.7
^ Exchangeable Potassium	----	0.1	meq/100g	0.3	0.2	0.2	0.9	0.3
^ Exchangeable Sodium	----	0.1	meq/100g	0.1	0.4	0.3	0.1	0.7
^ Cation Exchange Capacity	----	0.1	meq/100g	32.8	51.9	50.1	22.6	20.6

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 11 50-60 cm	Site 11 80-90 cm	Site 12 0-10 cm	Site 12 20-30 cm	Site 12 40-50 cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447699-036	EB1447699-037	EB1447699-038	EB1447699-039	EB1447699-040
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.6	8.5	5.8	6.7	7.6
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	701	1180	57	43	198
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	13.2	31.2	5.4	4.4	9.0
^ Exchangeable Magnesium	----	0.1	meq/100g	16.1	16.4	3.3	3.4	15.7
^ Exchangeable Potassium	----	0.1	meq/100g	0.3	0.2	1.0	0.7	0.9
^ Exchangeable Sodium	----	0.1	meq/100g	3.9	3.9	<0.1	0.2	2.9
^ Cation Exchange Capacity	----	0.1	meq/100g	33.6	51.7	9.8	8.9	28.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 12 80-90 cm	Site 13 0-8 cm	Site 13 20-30 cm	Site 13 50-60 cm	Site 13 80-90 cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447699-041	EB1447699-042	EB1447699-043	EB1447699-044	EB1447699-045
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.0	6.5	8.2	8.5	8.8
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	916	111	225	984	1160
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	22.1	8.8	13.9	34.3	32.1
^ Exchangeable Magnesium	----	0.1	meq/100g	14.3	7.2	15.6	19.7	20.5
^ Exchangeable Potassium	----	0.1	meq/100g	0.1	1.1	0.5	0.3	0.3
^ Exchangeable Sodium	----	0.1	meq/100g	3.6	0.2	2.8	3.7	4.9
^ Cation Exchange Capacity	----	0.1	meq/100g	40.3	17.4	32.8	58.0	57.8

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	Site 14 0-5 cm	Site 14 20-30 cm	Site 14 50-60 cm	Site 14 80-90 cm	Site 16 0-10 cm
Client sampling date / time				[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
				EB1447699-046	EB1447699-047	EB1447699-048	EB1447699-049	EB1447699-050
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	6.3	7.8	8.7	8.9	7.1
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	47	148	649	904	83
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	6.2	10.3	31.8	29.2	10.2
^ Exchangeable Magnesium	----	0.1	meq/100g	4.4	11.3	16.1	17.3	5.1
^ Exchangeable Potassium	----	0.1	meq/100g	0.8	0.4	0.2	0.2	1.1
^ Exchangeable Sodium	----	0.1	meq/100g	<0.1	1.5	2.2	2.6	<0.1
^ Cation Exchange Capacity	----	0.1	meq/100g	11.5	23.6	50.4	49.4	16.6

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 16 20-30 cm	Site 16 50-60 cm	Site 20 0-10 cm	Site 20 20-30 cm	Site 20 50-60 cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447699-051	EB1447699-052	EB1447699-053	EB1447699-054	EB1447699-055
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.2	8.9	7.2	8.5	8.8
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	98	320	156	200	481
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	11.1	34.2	5.6	20.2	25.0
^ Exchangeable Magnesium	----	0.1	meq/100g	8.2	11.8	4.6	11.4	11.2
^ Exchangeable Potassium	----	0.1	meq/100g	0.4	0.2	0.7	0.4	0.2
^ Exchangeable Sodium	----	0.1	meq/100g	0.9	1.2	<0.1	0.6	1.1
^ Cation Exchange Capacity	----	0.1	meq/100g	20.7	47.6	11.0	32.6	37.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 20 80-90 cm	Site 21 0-8 cm	Site 21 20-30 cm	Site 21 50-60 cm	Site 22 0-10 cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447699-056	EB1447699-057	EB1447699-058	EB1447699-059	EB1447699-060
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.9	6.7	8.7	8.8	8.2
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	732	110	274	391	170
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	23.4	8.3	12.4	32.0	45.9
^ Exchangeable Magnesium	----	0.1	meq/100g	11.8	5.8	13.0	12.3	7.0
^ Exchangeable Potassium	----	0.1	meq/100g	0.2	1.0	0.3	0.2	1.2
^ Exchangeable Sodium	----	0.1	meq/100g	1.5	0.2	1.6	1.4	<0.1
^ Cation Exchange Capacity	----	0.1	meq/100g	37.0	15.3	27.5	46.0	54.3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 22 20-30 cm	Site 22 50-60 cm	Site 23 0-10 cm	Site 23 20-30 cm	Site 23 50-60 cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447699-061	EB1447699-062	EB1447699-063	EB1447699-064	EB1447699-065
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.4	8.6	6.7	8.4	8.8
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	158	209	96	274	474
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	38.4	35.1	8.0	18.0	29.2
^ Exchangeable Magnesium	----	0.1	meq/100g	11.5	15.4	4.4	15.2	15.8
^ Exchangeable Potassium	----	0.1	meq/100g	0.3	0.3	1.0	0.5	0.3
^ Exchangeable Sodium	----	0.1	meq/100g	0.1	0.7	0.2	2.8	3.2
^ Cation Exchange Capacity	----	0.1	meq/100g	50.5	51.6	13.6	36.6	48.6

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 24 0-10 cm	Site 24 20-30 cm	Site 24 50-60 cm	Site 25 0-10 cm	Site 25 20-30 cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447699-066	EB1447699-067	EB1447699-068	EB1447699-069	EB1447699-070
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	6.7	7.0	7.9	6.4	6.5
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	89	36	69	60	46
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	6.2	2.8	7.7	7.1	8.0
^ Exchangeable Magnesium	----	0.1	meq/100g	1.9	1.2	4.3	3.4	9.3
^ Exchangeable Potassium	----	0.1	meq/100g	0.9	0.8	1.6	1.1	0.7
^ Exchangeable Sodium	----	0.1	meq/100g	<0.1	<0.1	<0.1	<0.1	0.5
^ Cation Exchange Capacity	----	0.1	meq/100g	9.2	5.0	13.8	11.7	18.6

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 26 0-10 cm	Site 26 20-30 cm	Site 26 50-60 cm	Site 27 0-10 cm	Site 27 20-30 cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447699-071	EB1447699-072	EB1447699-073	EB1447699-074	EB1447699-075
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**6.1**	**7.2**	**7.3**	**6.4**	**7.3**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**39**	**18**	**41**	**92**	**56**
ED008: Exchangeable Cations								
^ **Exchangeable Calcium**	----	0.1	meq/100g	**3.4**	**2.4**	**7.8**	**9.2**	**14.1**
^ **Exchangeable Magnesium**	----	0.1	meq/100g	**1.0**	**0.4**	**3.1**	**5.3**	**11.8**
^ **Exchangeable Potassium**	----	0.1	meq/100g	**0.7**	**0.3**	**0.7**	**1.1**	**0.4**
^ **Exchangeable Sodium**	----	0.1	meq/100g	<0.1	<0.1	<0.1	<0.1	**0.3**
^ **Cation Exchange Capacity**	----	0.1	meq/100g	**5.2**	**3.3**	**11.7**	**15.6**	**26.7**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 27 50-60 cm	Site 28 0-10 cm	Site 28 20-30 cm	Site 28 50-60 cm	Site 28 80-90 cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447699-076	EB1447699-077	EB1447699-078	EB1447699-079	EB1447699-080
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	7.3	6.3	7.0	6.9	7.9
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	219	31	17	11	47
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	34.9	2.5	2.3	1.3	3.5
^ Exchangeable Magnesium	----	0.1	meq/100g	15.3	0.7	0.4	0.3	2.3
^ Exchangeable Potassium	----	0.1	meq/100g	0.2	0.5	0.4	0.3	0.3
^ Exchangeable Sodium	----	0.1	meq/100g	0.5	<0.1	<0.1	<0.1	<0.1
^ Cation Exchange Capacity	----	0.1	meq/100g	50.9	3.8	3.3	1.9	6.4

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1447707**	Page	: 1 of 18
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: MS ADELE CALANDRA	Contact	: Customer Services EB
Address	: LEVEL 1, 241 DENNISON STREET BROADMEADOW NSW 2292	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: acalandra@slrconsulting.com	E-mail	: ALSEnviro.Brisbane@alsglobal.com
Telephone	: +61 02 4920 3000	Telephone	: +61-7-3243 7222
Facsimile	: +61 02 4961 3360	Facsimile	: +61-7-3243 7218
Project	: 630.11145	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 03-Dec-2014 13:40
C-O-C number	: ----	Date Analysis Commenced	: 08-Dec-2014
Sampler	: ----	Issue Date	: 12-Dec-2014 12:41
Site	: ----		
		No. of samples received	: 81
Quote number	: ----	No. of samples analysed	: 76

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

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

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

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

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

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

- **ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl (Method 15G1) is a more suitable method for the determination of exchange acidity (H+ + Al3+).**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 29 0-10cm	Site 29 20-30cm	Site 29 50-60cm	Site 29 80-90cm	Site 30 0-10cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447707-001	EB1447707-002	EB1447707-003	EB1447707-004	EB1447707-005
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**6.2**	**7.2**	**7.6**	**6.1**	**6.4**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**31**	**34**	**282**	**575**	**28**
ED008: Exchangeable Cations								
^ **Exchangeable Calcium**	----	0.1	meq/100g	**2.4**	**1.2**	**0.5**	**1.0**	**3.7**
^ **Exchangeable Magnesium**	----	0.1	meq/100g	**1.0**	**1.2**	**1.5**	**3.2**	**2.8**
^ **Exchangeable Potassium**	----	0.1	meq/100g	**0.5**	**0.2**	<0.1	<0.1	**0.7**
^ **Exchangeable Sodium**	----	0.1	meq/100g	<0.1	**0.2**	**0.8**	**1.4**	<0.1
^ **Cation Exchange Capacity**	----	0.1	meq/100g	**4.0**	**2.8**	**2.9**	**5.8**	**7.4**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 30 20-30cm	Site 30 50-60cm	Site 30 90-100cm	Site 31 0-10cm	Site 31 20-30cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447707-006	EB1447707-007	EB1447707-008	EB1447707-009	EB1447707-010
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	7.3	8.6	8.1	5.9	7.1
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	158	860	798	35	213
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	8.2	19.2	2.3	5.4	8.3
^ Exchangeable Magnesium	----	0.1	meq/100g	6.8	11.4	11.0	3.0	13.5
^ Exchangeable Potassium	----	0.1	meq/100g	0.2	0.3	0.2	0.6	0.2
^ Exchangeable Sodium	----	0.1	meq/100g	1.2	2.1	3.7	<0.1	2.6
^ Cation Exchange Capacity	----	0.1	meq/100g	16.7	33.1	17.3	9.2	24.7

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

			Client sample ID	Site 31 50-60cm	Site 31 80-90cm	Site 32 0-10cm	Site 32 20-30cm	Site 32 50-60cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447707-011	EB1447707-012	EB1447707-013	EB1447707-014	EB1447707-015
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.7	8.9	6.7	7.1	9.0
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	779	839	45	39	199
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	8.7	27.3	7.9	11.0	24.7
^ Exchangeable Magnesium	----	0.1	meq/100g	18.0	15.6	6.1	11.0	13.0
^ Exchangeable Potassium	----	0.1	meq/100g	0.3	0.2	1.0	0.8	0.2
^ Exchangeable Sodium	----	0.1	meq/100g	4.4	3.0	<0.1	0.4	0.8
^ Cation Exchange Capacity	----	0.1	meq/100g	31.4	46.2	15.2	23.4	38.8

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 33 0-10cm	Site 33 40-50cm	Site 34 0-10cm	Site 34 20-30cm	Site 34 50-60cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447707-016	EB1447707-017	EB1447707-018	EB1447707-019	EB1447707-020
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	7.0	8.8	5.9	6.9	8.2
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	51	339	26	36	141
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	7.1	17.4	8.2	9.0	9.6
^ Exchangeable Magnesium	----	0.1	meq/100g	11.3	17.4	4.8	5.0	6.1
^ Exchangeable Potassium	----	0.1	meq/100g	1.0	0.4	0.6	0.2	0.2
^ Exchangeable Sodium	----	0.1	meq/100g	0.4	1.4	0.1	0.6	1.9
^ Cation Exchange Capacity	----	0.1	meq/100g	19.9	36.7	13.9	15.0	18.0

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 34 80-90cm	Site 35 0-10cm	Site 35 20-30cm	Site 35 50-60cm	Site 36 0-10cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447707-021	EB1447707-022	EB1447707-023	EB1447707-024	EB1447707-025
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**8.8**	**6.8**	**8.2**	**8.8**	**6.0**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**665**	**86**	**86**	**705**	**22**
ED008: Exchangeable Cations								
^ **Exchangeable Calcium**	----	0.1	meq/100g	**7.1**	**10.0**	**16.3**	**27.6**	**3.4**
^ **Exchangeable Magnesium**	----	0.1	meq/100g	**7.6**	**5.9**	**16.0**	**16.6**	**0.9**
^ **Exchangeable Potassium**	----	0.1	meq/100g	**0.2**	**1.8**	**1.0**	**0.6**	**0.4**
^ **Exchangeable Sodium**	----	0.1	meq/100g	**3.2**	<0.1	**1.5**	**1.7**	<0.1
^ **Cation Exchange Capacity**	----	0.1	meq/100g	**18.3**	**17.9**	**34.9**	**46.6**	**4.8**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 36 30-40cm	Site 36 50-60cm	Site 36 80-90cm	Site 38 0-10cm	Site 38 20-30cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447707-026	EB1447707-027	EB1447707-028	EB1447707-029	EB1447707-030
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	6.9	7.4	7.8	6.7	7.4
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	9	33	55	86	90
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	2.1	9.1	12.1	7.6	9.3
^ Exchangeable Magnesium	----	0.1	meq/100g	0.8	6.8	10.9	4.7	12.6
^ Exchangeable Potassium	----	0.1	meq/100g	0.3	0.7	1.1	0.8	0.5
^ Exchangeable Sodium	----	0.1	meq/100g	<0.1	0.2	0.4	<0.1	0.8
^ Cation Exchange Capacity	----	0.1	meq/100g	3.2	16.9	24.6	13.2	23.3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 38 50-60cm	Site 39 0-10cm	Site 39 30-40cm	Site 40 0-10cm	Site 40 20-30cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447707-031	EB1447707-032	EB1447707-033	EB1447707-034	EB1447707-035
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**8.8**	**6.4**	**7.2**	**6.9**	**8.3**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**388**	**56**	**64**	**51**	**267**
ED008: Exchangeable Cations								
^ **Exchangeable Calcium**	----	0.1	meq/100g	**27.5**	**8.2**	**11.9**	**6.8**	**8.4**
^ **Exchangeable Magnesium**	----	0.1	meq/100g	**14.9**	**4.0**	**10.6**	**4.8**	**14.8**
^ **Exchangeable Potassium**	----	0.1	meq/100g	**0.2**	**0.8**	**0.4**	**0.8**	**0.6**
^ **Exchangeable Sodium**	----	0.1	meq/100g	**1.0**	<0.1	**0.6**	<0.1	**2.7**
^ **Cation Exchange Capacity**	----	0.1	meq/100g	**43.6**	**13.3**	**23.7**	**12.7**	**26.7**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 40 50-60cm	Site 42 0-5cm	Site 42 20-30cm	Site 42 50-60cm	Site 43 0-10cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447707-036	EB1447707-037	EB1447707-038	EB1447707-039	EB1447707-040
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.8	6.6	7.5	8.8	6.6
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	962	76	204	747	30
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	25.5	7.6	8.4	15.6	2.1
^ Exchangeable Magnesium	----	0.1	meq/100g	20.0	5.4	12.3	19.9	1.9
^ Exchangeable Potassium	----	0.1	meq/100g	0.3	1.0	0.7	0.4	0.4
^ Exchangeable Sodium	----	0.1	meq/100g	3.3	<0.1	1.3	2.5	<0.1
^ Cation Exchange Capacity	----	0.1	meq/100g	49.2	14.3	22.8	38.4	4.4

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			*Client sample ID*	Site 43 20-30cm	Site 43 50-60cm	Site 43 80-90cm	Site 46 0-10cm	Site 46 20-30cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	*CAS Number*	*LOR*	*Unit*	EB1447707-041	EB1447707-042	EB1447707-043	EB1447707-044	EB1447707-045
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	7.8	9.0	9.1	6.6	7.9
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	104	450	467	83	230
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	3.3	1.6	2.2	7.2	13.0
^ Exchangeable Magnesium	----	0.1	meq/100g	10.1	7.1	6.6	4.0	8.9
^ Exchangeable Potassium	----	0.1	meq/100g	0.3	0.2	0.1	0.5	0.2
^ Exchangeable Sodium	----	0.1	meq/100g	1.7	2.3	2.1	0.3	2.4
^ Cation Exchange Capacity	----	0.1	meq/100g	15.6	11.4	11.1	12.2	24.6

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 46 50-60cm	Site 46 80-90cm	Site 48 0-10cm	Site 48 20-30cm	Site 48 60-70cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447707-046	EB1447707-047	EB1447707-048	EB1447707-049	EB1447707-050
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.1	7.6	6.3	6.1	5.1
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	816	674	71	20	342
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	17.2	6.6	5.7	0.6	3.3
^ Exchangeable Magnesium	----	0.1	meq/100g	10.4	6.7	1.7	0.6	5.6
^ Exchangeable Potassium	----	0.1	meq/100g	0.2	0.2	0.5	0.3	<0.1
^ Exchangeable Sodium	----	0.1	meq/100g	2.8	2.4	<0.1	<0.1	1.2
^ Cation Exchange Capacity	----	0.1	meq/100g	30.8	16.0	8.0	1.8	10.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 48 100-110cm	Site 49 0-10cm	Site 49 20-30cm	Site 49 60-70cm	Site 49 90-100cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447707-051	EB1447707-052	EB1447707-053	EB1447707-054	EB1447707-055
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	7.5	7.5	8.7	9.0	8.9
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	383	225	168	693	1120
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	5.3	24.5	38.7	32.1	30.4
^ Exchangeable Magnesium	----	0.1	meq/100g	7.7	6.8	13.6	19.8	20.4
^ Exchangeable Potassium	----	0.1	meq/100g	0.1	1.2	0.2	0.2	0.1
^ Exchangeable Sodium	----	0.1	meq/100g	2.0	<0.1	0.2	2.3	3.3
^ Cation Exchange Capacity	----	0.1	meq/100g	15.3	32.6	52.8	54.5	54.2

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

			Client sample ID	Site 51 0-10cm	Site 51 10-20cm	Site 51 50-60cm	Site 51 90-100cm	Site 53 0-10cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447707-060	EB1447707-061	EB1447707-062	EB1447707-063	EB1447707-064
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	6.5	6.8	7.7	8.2	6.2
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	32	23	194	329	82
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	2.8	1.8	3.4	2.6	4.5
^ Exchangeable Magnesium	----	0.1	meq/100g	1.2	1.4	6.5	5.4	2.6
^ Exchangeable Potassium	----	0.1	meq/100g	0.5	0.3	0.3	0.3	0.6
^ Exchangeable Sodium	----	0.1	meq/100g	<0.1	<0.1	1.0	1.0	<0.1
^ Cation Exchange Capacity	----	0.1	meq/100g	4.5	3.6	11.4	9.6	7.8

Analytical Results

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

			Client sample ID	**Site 53 10-20cm**	**Site 53 20-30cm**	**Site 53 50-60cm**	**Site 53 90-100cm**	**Site 54 0-10cm**
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	*CAS Number*	*LOR*	*Unit*	**EB1447707-065**	**EB1447707-066**	**EB1447707-067**	**EB1447707-068**	**EB1447707-069**
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**6.9**	**7.4**	**8.0**	**8.7**	**6.2**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**32**	**149**	**577**	**1030**	**35**
ED008: Exchangeable Cations								
^ **Exchangeable Calcium**	----	0.1	meq/100g	**1.5**	**3.0**	**1.8**	**12.7**	**4.1**
^ **Exchangeable Magnesium**	----	0.1	meq/100g	**1.2**	**5.6**	**7.3**	**11.6**	**1.4**
^ **Exchangeable Potassium**	----	0.1	meq/100g	**0.4**	**0.4**	**0.2**	**0.2**	**0.7**
^ **Exchangeable Sodium**	----	0.1	meq/100g	**0.1**	**1.2**	**2.2**	**2.0**	<0.1
^ **Cation Exchange Capacity**	----	0.1	meq/100g	**3.2**	**10.3**	**11.5**	**26.6**	**6.3**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 54 20-30cm	Site 54 50-60cm	Site 56 0-10cm	Site 56 20-30cm	Site 57 0-10cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447707-070	EB1447707-071	EB1447707-072	EB1447707-073	EB1447707-074
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**7.4**	**8.9**	**7.0**	**8.2**	**6.4**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**42**	**335**	**159**	**221**	**93**
ED008: Exchangeable Cations								
^ **Exchangeable Calcium**	----	0.1	meq/100g	**10.6**	**31.4**	**8.4**	**18.3**	**7.6**
^ **Exchangeable Magnesium**	----	0.1	meq/100g	**6.9**	**9.2**	**4.4**	**6.0**	**3.2**
^ **Exchangeable Potassium**	----	0.1	meq/100g	**0.6**	**0.2**	**0.8**	**0.6**	**0.8**
^ **Exchangeable Sodium**	----	0.1	meq/100g	**1.0**	**1.0**	<0.1	**0.2**	<0.1
^ **Cation Exchange Capacity**	----	0.1	meq/100g	**19.2**	**42.0**	**13.8**	**25.2**	**11.7**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 57 30-40cm	Site 58 0-10cm	Site 58 20-30cm	Site 59 0-10cm	Site 59 20-30cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1447707-075	EB1447707-076	EB1447707-077	EB1447707-078	EB1447707-079
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.6	6.8	8.1	6.8	7.9
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	282	83	92	72	169
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	31.0	9.2	10.0	8.2	16.2
^ Exchangeable Magnesium	----	0.1	meq/100g	13.2	4.8	12.5	3.6	9.2
^ Exchangeable Potassium	----	0.1	meq/100g	0.3	0.9	0.3	0.9	0.5
^ Exchangeable Sodium	----	0.1	meq/100g	1.5	<0.1	1.1	<0.1	0.3
^ Cation Exchange Capacity	----	0.1	meq/100g	46.1	15.0	24.0	12.9	26.3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 59 50-60cm	----	----	----	----
			Client sampling date / time	[03-Dec-2014]	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1447707-080	--------	--------	--------	--------
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**8.9**	----	----	----	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**321**	----	----	----	----
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	**31.7**	----	----	----	----
^ Exchangeable Magnesium	----	0.1	meq/100g	**11.9**	----	----	----	----
^ Exchangeable Potassium	----	0.1	meq/100g	**0.2**	----	----	----	----
^ Exchangeable Sodium	----	0.1	meq/100g	**0.9**	----	----	----	----
^ Cation Exchange Capacity	----	0.1	meq/100g	**44.7**	----	----	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1510282**	Page	: 1 of 2
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: MS ADELE CALANDRA	Contact	: Customer Services EB
Address	: LEVEL 1, 241 DENNISON STREET BROADMEADOW NSW 2292	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: acalandra@slrconsulting.com	E-mail	: ALSEnviro.Brisbane@alsglobal.com
Telephone	: +61 02 4920 3000	Telephone	: +61-7-3243 7222
Facsimile	: +61 02 4961 3360	Facsimile	: +61-7-3243 7218
Project	: 630.11145	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 08-Jan-2015 08:05
C-O-C number	: ----	Date Analysis Commenced	: 09-Jan-2015
Sampler	: ----	Issue Date	: 15-Jan-2015 16:27
Site	: ----		
		No. of samples received	: 5
Quote number	: ----	No. of samples analysed	: 5

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA

WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Andrew Epps	Senior Inorganic Chemist	Brisbane Inorganics
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

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

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

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

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

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

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 40 80-90cm	Site 52 0-10cm	Site 52 20-30cm	Site 52 50-60cm	Site 52 90-100cm
			Client sampling date / time	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]	[03-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1510282-001	EB1510282-002	EB1510282-003	EB1510282-004	EB1510282-005
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**8.9**	**7.1**	**8.2**	**8.7**	**9.0**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**893**	**142**	**455**	**1040**	**1140**
ED008: Exchangeable Cations								
^ **Exchangeable Calcium**	----	0.1	meq/100g	**18.0**	**6.0**	**20.5**	**26.6**	**30.9**
^ **Exchangeable Magnesium**	----	0.1	meq/100g	**18.4**	**5.1**	**11.7**	**15.1**	**12.2**
^ **Exchangeable Potassium**	----	0.1	meq/100g	**0.2**	**0.8**	**0.3**	**0.3**	**0.3**
^ **Exchangeable Sodium**	----	0.1	meq/100g	**2.2**	**0.2**	**1.3**	**3.2**	**2.4**
^ **Cation Exchange Capacity**	----	0.1	meq/100g	**38.9**	**12.2**	**34.0**	**45.2**	**46.0**

SOIL TEST REPORT

Scone Research Centre

REPORT NO:	SCO14/252R1
REPORT TO:	Adele Calandra SLR Consulting 10 Kings Road New Lambton NSW 2305
REPORT ON:	One hundred and sixty soil samples Your ref: 630.11145
PRELIMINARY RESULTS ISSUED:	Not issued
REPORT STATUS:	Final
DATE REPORTED:	15 December 2014
METHODS:	Information on test procedures can be obtained from Scone Research Centre

TESTING CARRIED OUT ON SAMPLE AS RECEIVED
THIS DOCUMENT MAY NOT BE REPRODUCED EXCEPT IN FULL

SR Young
(Laboratory Manager)

SOIL CONSERVATION SERVICE
Scone Research Centre

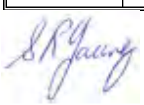
Report No: SCO14/252R1
Client Reference: Adele Calandra
SLR Consulting
10 Kings Road
New Lambton NSW 2305

Lab No	Method	P7B/2 Particle Size Analysis (%)					Colour	
	Sample Id	clay	silt	f sand	c sand	gravel	Dry	Moist
1	Site 1 0-10 cm	15	22	41	22	<1	7.5YR 4/4	7.5YR 3/3
2	Site 1 20-30 cm	17	14	28	22	19	7.5YR 5/3	7.5YR 4/2
3	Site 1 50-60 cm	58	13	20	9	<1	7.5YR 4/6	7.5YR 3/4
4	Site 1 80-90 cm	54	12	23	11	<1	7.5YR 4/6	7.5YR 3/4
5	Site 2 0-10 cm	39	11	29	13	8	10YR 5/2	10YR 3/2
6	Site 2 10-20 cm	50	13	23	13	1	10YR 5/2	10YR 3/2
7	Site 2 50-60 cm	48	11	26	13	2	10YR 5/2	10YR 4/2
8	Site 2 80-90 cm	46	11	26	13	4	10YR 5/3	10YR 4/3
9	Site 3 0-10 cm	34	28	33	5	<1	7.5YR 4/3	7.5YR 3/2
10	Site 3 20-30 cm	59	18	20	3	<1	5YR 4/4	5YR 3/4
11	Site 3 50-60 cm	42	18	26	13	1	5YR 4/4	7.5YR 3/3
12	Site 4 0-10 cm	29	10	36	20	5	7.5YR 5/2	7.5YR 4/1
13	Site 4 20-30 cm	53	9	23	14	1	10YR 5/2	10YR 4/2
14	Site 4 50-60 cm	40	6	29	18	7	10YR 5/3	10YR 4/3
15	Site 4 80-90 cm	48	9	22	16	5	10YR 6/4	10YR 5/4
16	Site 5 0-5 cm	21	12	34	29	4	7.5YR 5/3	7.5YR 3/2
17	Site 5 20-30 cm	42	14	21	23	<1	10YR 5/4	10YR 4/4
18	Site 5 40-50 cm	43	15	18	24	<1	10YR 4/4	10YR 4/4
19	Site 7 0-5 cm	3	17	45	30	5	10YR 5/3	10YR 3/3
20	Site 7 10-20 cm	12	17	37	30	4	10YR 6/3	10 R 4/3
21	Site 7 50-60 cm	27	22	28	22	1	10YR 6/4	10YR 5/4
22	Site 7 80-90 cm	35	23	16	24	2	10YR 5/4	10YR 4/4
23	Site 8 0-10 cm	44	25	26	5	<1	7.5YR 3/3	7.5 R 3/3
24	Site 8 20-30 cm	61	20	17	2	<1	7.5YR 3/4	7.5YR 3/4
25	Site 8 50-60 cm	49	18	22	10	1	7.5YR 5/3	7.5YR 4/4
26	Site 9 0-5 cm	13	30	45	11	1	10YR 4/4	10YR 3/3
27	Site 9 20-30 cm	17	35	36	12	<1	10YR 5/3	10YR 3/3
28	Site 9 50-60 cm	65	18	13	4	0	7.5YR 4/3	10YR 4/4
29	Site 9 80-90 cm	51	23	21	5	<1	7.5YR 4/6	7.5YR 4/6

SOIL CONSERVATION SERVICE
Scone Research Centre

Report No: SCO14/252R1
Client Reference: Adele Calandra
SLR Consulting
10 Kings Road
New Lambton NSW 2305

Lab No	Method	P7B/2 Particle Size Analysis (%)					Colour	
	Sample Id	clay	silt	f sand	c sand	gravel	Dry	Moist
30	Site 10 0-10 cm	34	29	30	7	<1	10YR 4/3	10YR 3/3
31	Site 10 20-30 cm	54	23	19	4	0	7.5YR 3/4	7.5YR 3/4
32	Site 10 50-60 cm	58	25	14	3	<1	7.5YR 4/4	7.5YR 3/4
33	Site 10 80-90 cm	56	13	18	12	1	7.5YR 4/4	7.5YR 4/4
34	Site 11 0-10 cm	38	14	32	15	1	10YR 4/3	10YR 3/3
35	Site 11 20-30 cm	41	16	27	15	1	10YR 4/3	10YR 3/3
36	Site 11 50-60 cm	58	12	19	10	1	10YR 4/3	10YR 3/3
37	Site 11 80-90 cm	61	22	10	7	<1	10YR 6/4	10YR 5/6
38	Site 12 0-5 cm	19	21	40	18	2	10YR 5/3	10YR 3/3
39	Site 12 5-15 cm	22	24	33	18	3	10YR 5/3	10YR 3/3
40	Site 12 40-50 cm	58	13	20	9	<1	10YR 5/3	10YR 4/3
41	Site 12 80-90 cm	46	21	32	1	<1	10YR 6/3	10YR 5/4
42	Site 13 0-8 cm	26	11	46	15	2	10YR 4/3	10YR 3/3
43	Site 13 20-30 cm	61	8	24	7	<1	10YR 4/3	10YR 3/3
44	Site 13 50-60 cm	62	11	18	8	1	7.5YR 5/4	7.5YR 4/6
45	Site 13 80-90 cm	68	8	16	8	<1	7.5YR 5/4	7.5YR 4/6
46	Site 14 0-5 cm	20	16	44	19	1	10YR 4/3	10YR 3/3
47	Site 14 20-30 cm	44	8	29	19	<1	10YR 4/3	10YR 4/3
48	Site 14 50-60 cm	51	11	24	13	1	7.5YR 5/4	7.5YR 4/6
49	Site 14 80-90 cm	49	14	25	12	<1	7.5YR 6/4	7.5YR 5/6
50	Site 16 0-10 cm	29	16	39	15	1	7.5YR 4/4	7.5YR 3/4
51	Site 16 20-30 cm	43	18	26	12	1	10YR 6/4	10YR 4/6
52	Site 16 50-60 cm	47	13	24	15	1	10YR 5/4	10YR 4/6
53	Site 20 0-10 cm	20	14	26	32	8	10YR 4/3	10YR 3/3
54	Site 20 20-30 cm	35	13	25	26	1	10YR 5/4	10YR 4/4
55	Site 20 50-60 cm	33	13	23	28	3	7.5YR 5/4	7.5YR 4/6
56	Site 20 80-90 cm	40	13	21	25	1	10YR 6/4	10YR 5/6
57	Site 21 0-8 cm	24	17	41	17	1	7.5YR 4/3	7.5YR 3/4
58	Site 21 20-30 cm	45	14	26	15	<1	7.5YR 4/4	7.5YR 4/4
59	Site 21 50-60 cm	30	21	37	12	<1	7.5YR 5/4	7.5YR 4/6



SOIL CONSERVATION SERVICE

Scone Research Centre

Report No: SCO14/252R1

Client Reference: Adele Calandra
SLR Consulting
10 Kings Road
New Lambton NSW 2305

Lab No	Method	P7B/2 Particle Size Analysis (%)					Colour	
	Sample Id	clay	silt	f sand	c sand	gravel	Dry	Moist
60	Site 22 0-10 cm	35	18	34	12	1	10YR 4/3	10YR 3/3
61	Site 22 20-30 cm	43	31	18	7	1	10YR 6/4	10YR 5/4
62	Site 22 50-60 cm	46	26	21	6	1	10YR 6/4	10YR 4/6
63	Site 23 0-10 cm	15	26	38	14	7	10YR 5/3	10YR 3/3
64	Site 23 20-30 cm	58	19	17	6	<1	10YR 4/2	10YR 3/3
65	Site 23 50-60 cm	55	17	16	9	3	2.5Y 4/2	2.5Y 3/3
66	Site 24 0-10 cm	10	15	35	40	<1	7.5YR 4/3	7.5YR 3/3
67	Site 24 20-30 cm	12	17	38	32	1	5YR 6/3	5YR 4/4
68	Site 24 50-60 cm	46	13	21	20	0	5YR 5/6	5YR 4/6
69	Site 25 0-10 cm	14	21	46	15	4	10YR 4/4	10YR 3/3
70	Site 25 20-30 cm	51	16	24	9	<1	7.5YR 5/6	7.5YR 4/6
71	Site 26 0-10 cm	10	13	31	46	<1	10YR 5/3	10YR 3/3
72	Site 26 20-30 cm	10	12	33	43	2	7.5YR 6/3	7.5YR 4/4
73	Site 26 50-60 cm	41	12	15	31	1	7.5YR 5/6	7.5YR 5/6
74	Site 27 0-10 cm	18	20	50	11	1	7.5YR 4/4	7.5YR 2.5/3
75	Site 27 20-30 cm	49	11	34	6	0	7.5YR 4/4	7.5YR 3/4
76	Site 27 50-60 cm	42	26	24	7	1	7.5YR 5/6	7.5YR 4/6
77	Site 28 0-10 cm	4	11	19	65	1	10YR 5/3	10YR 3/3
78	Site 28 20-30 cm	5	14	18	60	3	10YR 5/3	10YR 3/3
79	Site 28 50-60 cm	5	12	16	54	13	10YR 7/2	10YR 6/4
80	Site 28 80-90 cm	32	8	16	30	14	2.5Y 7/4	2.5Y 6/4
81	Site 29 0-10 cm	12	15	32	38	3	10YR 5/3	10YR 3/3
82	Site 29 20-30 cm	13	16	31	36	4	10YR 7/2	10YR 6/2
83	Site 29 50-60 cm	34	9	25	28	4	10YR 7/3	10YR 6/3
84	Site 29 80-90 cm	31	3	36	30	<1	7.5YR 5/6	7.5YR 4/6
85	Site 30 0-10 cm	21	12	32	29	6	10YR 5/2	10YR 3/2
86	Site 30 20-30 cm	31	11	25	27	6	10YR 5/2	10YR 3/2
87	Site 30 50-60 cm	54	9	16	18	3	10YR 5/3	10YR 4/3
88	Site 30 90-100 cm	58	29	11	2	0	2.5Y 7/4	2.5Y 6/4

SOIL CONSERVATION SERVICE
Scone Research Centre

Report No: SCO14/252R1
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SLR Consulting
10 Kings Road
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Lab No	Method	P7B/2 Particle Size Analysis (%)					Colour	
	Sample Id	clay	silt	f sand	c sand	gravel	Dry	Moist
89	Site 31 0-10 cm	20	20	42	17	1	10YR 4/3	10YR 3/3
90	Site 31 20-30 cm	64	8	21	7	<1	7.5YR 4/4	7.5YR 3/4
91	Site 31 50-60 cm	65	9	17	8	1	7.5YR 4/6	5YR 4/4
92	Site 31 80-90 cm	65	8	17	10	<1	7.5YR 5/6	7.5YR 5/6
93	Site 32 0-10 cm	33	29	25	12	1	7.5YR 5/3	7.5YR 4/3
94	Site 32 20-30 cm	55	27	12	6	<1	10YR 5/3	10YR 4/3
95	Site 32 50-60 cm	45	30	12	7	6	10YR 5/3	10YR 4/3
96	Site 33 0-10 cm	42	22	25	7	4	10YR 4/4	10YR 3/3
97	Site 33 40-50 cm	58	23	13	4	2	10YR 5/4	10YR 4/3
98	Site 34 0-10 cm	27	30	35	8	<1	10YR 5/2	10YR 3/2
99	Site 34 20-30 cm	29	18	37	16	<1	10YR 5/3	10YR 4/2
100	Site 34 50-60 cm	28	21	28	23	<1	7.5YR 5/1	7.5YR 3/1
101	Site 34 80-90 cm	41	11	21	27	<1	10YR 6/4	10YR 5/4
102	Site 35 0-10 cm	27	20	27	16	10	7.5YR 5/2	7.5YR 3/2
103	Site 35 20-30 cm	54	14	19	11	2	7.5YR 5/3	7.5 YR 4/2
104	Site 35 50-60 cm	58	12	18	10	2	7.5YR 5/3	7.5YR 4/3
105	Site 36 0-10 cm	5	15	30	47	3	7.5YR 5/2	7.5YR 3/2
106	Site 36 30-40 cm	8	15	33	31	13	7.5YR 7/2	7.5YR 5/2
107	Site 36 50-60 cm	36	13	27	23	1	10YR 6/4	10YR 5/4
108	Site 36 80-90 cm	48	13	24	14	1	10YR 6/3	10YR 5/3
109	Site 38 0-10 cm	19	36	36	8	1	7.5YR 4/3	7.5YR 3/3
110	Site 38 20-30 cm	58	23	15	3	1	7.5YR 5/4	5YR 4/3
111	Site 38 50-60 cm	48	26	16	7	3	7.5YR 5/4	7.5YR 4/4
112	Site 39 0-10 cm	22	31	38	9	<1	7.5YR 4/3	7.5YR 3/3
113	Site 39 30-40 cm	60	23	14	3	<1	5YR 5/4	5YR 4/3
114	Site 40 0-10 cm	22	24	41	11	2	7.5YR 5/3	7.5YR 3/3
115	Site 40 20-30 cm	53	16	24	7	<1	7.5YR 5/4	7.5YR 4/4
116	Site 40 50-60 cm	57	15	22	6	<1	5YR 5/4	5YR 4/4

S R Young

SOIL CONSERVATION SERVICE

Scone Research Centre

Report No: SCO14/252R1

Client Reference: Adele Calandra
SLR Consulting
10 Kings Road
New Lambton NSW 2305

Lab No	Method	P7B/2 Particle Size Analysis (%)					Colour	
	Sample Id	clay	silt	f sand	c sand	gravel	Dry	Moist
117	Site 42 0-5 cm	24	21	36	15	4	10YR 5/2	10YR 4/2
118	Site 42 20-30 cm	52	21	20	5	2	7.5YR 5/3	7.5YR 4/2
119	Site 42 50-60 cm	71	20	7	2	<1	10YR 6/2	10YR 5/2
120	Site 43 0-10 cm	10	18	34	37	1	7.5YR 6/2	7.5YR 4/2
121	Site 43 20-30 cm	34	14	22	30	<1	10YR 6/3	10YR 5/3
122	Site 43 50-60 cm	32	14	23	31	<1	10YR 6/4	10YR 5/4
123	Site 43 80-90 cm	34	10	24	28	4	7.5YR 5/4	7.5YR 4/4
124	Site 46 0-10 cm	20	29	40	11	<1	10YR 5/3	10YR 4/2
125	Site 46 20-30 cm	56	21	19	4	0	10YR 5/3	10YR 4/3
126	Site 46 50-60 cm	55	21	20	4	<1	10YR 5/4	10YR 4/4
127	Site 46 80-90 cm	49	23	24	4	0	7.5YR 5/3	7.5YR 4/3
128	Site 48 0-10 cm	9	16	28	45	2	7.5YR 5/2	7.5YR 3/2
129	Site 48 20-30 cm	8	11	27	45	9	10YR 7/2	10YR 5/3
130	Site 48 60-70 cm	39	7	25	27	2	2.5Y 7/4	2.5Y 6/4
131	Site 48 100-110 cm	34	9	28	26	3	10YR 5/4	10YR 4/4
132	Site 49 0-10 cm	39	18	29	13	1	10YR 4/2	10YR 3/2
133	Site 49 20-30 cm	63	17	15	5	<1	2.5Y 6/3	2.5Y 5/3
134	Site 49 60-70 cm	64	13	16	6	1	2.5Y 6/3	2.5Y 5/4
135	Site 49 90-100 cm	65	15	15	5	<1	10YR 6/3	10YR 5/4
136	Site 50 0-10 cm	nt	nt	nt	nt	nt	nt	nt
137	Site 50 20-30 cm	nt	nt	nt	nt	nt	nt	nt
138	Site 50 50-60 cm	nt	nt	nt	nt	nt	nt	nt
139	Site 50 80-90 cm	nt	nt	nt	nt	nt	nt	nt
140	Site 51 0-10 cm	7	11	49	32	1	10YR 5/4	10YR 4/4
141	Site 51 10-20 cm	13	12	50	25	<1	7.5YR 6/4	7.5YR 5/6
142	Site 51 50-60 cm	46	9	31	14	<1	5YR 5/6	5YR 5/6
143	Site 51 90-100 cm	28	3	42	27	<1	5YR 5/6	5YR 5/6

nt-not tested

S R Young

SOIL CONSERVATION SERVICE
Scone Research Centre

Report No: SCO14/252R1
Client Reference: Adele Calandra
SLR Consulting
10 Kings Road
New Lambton NSW 2305

Lab No	Method	P7B/2 Particle Size Analysis (%)					Colour	
	Sample Id	clay	silt	f sand	c sand	gravel	Dry	Moist
144	Site 53 0-10 cm	14	16	44	25	1	10YR 5/4	10YR 4/4
145	Site 53 10-20 cm	15	23	42	19	1	10YR 6/3	10YR 4/4
146	Site 53 20-30 cm	62	11	18	9	<1	5YR 4/6	5YR 4/6
147	Site 53 50-60 cm	66	9	17	6	2	5YR 4/6	5YR 4/6
148	Site 53 90-100 cm	47	12	29	12	<1	10YR 4/6	10YR 4/6
149	Site 54 0-10 cm	14	14	47	22	3	10YR 4/4	10YR 3/4
150	Site 54 20-30 cm	55	11	25	9	<1	7.5YR 4/4	7.5YR 4/4
151	Site 54 50-60 cm	44	30	15	10	1	7.5YR 5/6	7.5YR 4/6
152	Site 56 0-10 cm	29	20	35	12	4	7.5YR 5/4	7.5YR 4/4
153	Site 56 20-30 cm	55	16	23	5	1	10YR 5/4	10YR 4/4
154	Site 57 0-10 cm	19	22	35	22	2	10YR 4/2	10YR 3/2
155	Site 57 30-40 cm	57	15	12	10	6	10YR 5/4	10YR 4/4
156	Site 58 0-10 cm	21	18	34	17	10	10YR 5/3	10YR 3/3
157	Site 58 20-30 cm	57	17	18	7	1	10YR 5/4	10YR 4/4
158	Site 59 0-10 cm	24	19	37	18	2	10YR 4/3	10YR 3/3
159	Site 59 20-30 cm	52	13	22	11	2	10YR 5/4	10YR 4/4
160	Site 59 50-60 cm	47	22	17	11	3	7.5YR 5/4	7.5YR 4/6
161	Site 40 80-90 cm	40	51	7	2	0	10YR 7/3	10YR 6/4
162	Site 52 0-10 cm	26	18	37	17	2	7.5YR 5/3	7.5YR 3/4
163	Site 52 20-30 cm	58	15	18	9	<1	7.5YR 4/4	7.5YR 4/4
164	Site 52 50-60 cm	56	13	20	10	1	7.5YR 4/6	7.5YR 4/6
165	Site 52 90-100 cm	54	30	12	4	<1	10YR 6/4	10YR 5/6

SR Young

END OF TEST REPORT

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1511046**	Page	: 1 of 12
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: MR A KOPPERS	Contact	: Customer Services EB
Address	: LEVEL 1, 241 DENNISON STREET BROADMEADOW NSW 2292	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: akoppers@slrconsulting.com	E-mail	: ALSEnviro.Brisbane@alsglobal.com
Telephone	: +61 02 4908 4500	Telephone	: +61-7-3243 7222
Facsimile	: +61 02 4908 4501	Facsimile	: +61-7-3243 7218
Project	: 630.11145_2015	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 20-Jan-2015 13:05
C-O-C number	: ----	Date Analysis Commenced	: 22-Jan-2015
Sampler	: ----	Issue Date	: 31-Jan-2015 19:27
Site	: ----		
		No. of samples received	: 49
Quote number	: ----	No. of samples analysed	: 49

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA

WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Greg Vogel	Laboratory Manager	Brisbane Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

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

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

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

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

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

- **ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl (Method 15G1) is a more suitable method for the determination of exchange acidity (H+ + Al3+).**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 15 0-10 cm	Site 15 20-30 cm	Site 15 50-60 cm	Site 15 80-90 cm	Site 45 0-10 cm
			Client sampling date / time	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]
Compound	CAS Number	LOR	Unit	EB1511046-001	EB1511046-002	EB1511046-003	EB1511046-004	EB1511046-005
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	6.4	7.2	8.0	8.5	7.3
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	74	80	591	858	113
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	13.1	17.4	17.4	26.1	13.5
^ Exchangeable Magnesium	----	0.1	meq/100g	8.0	13.2	16.2	17.0	11.4
^ Exchangeable Potassium	----	0.1	meq/100g	1.1	0.8	0.4	0.2	0.4
^ Exchangeable Sodium	----	0.1	meq/100g	<0.1	1.0	2.3	2.9	1.5
^ Cation Exchange Capacity	----	0.1	meq/100g	22.2	32.3	36.4	46.3	26.8

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

			Client sample ID	Site 45 20-30 cm	Site 45 50-60 cm	Site 55 0-10 cm	Site 55 20-30 cm	Site 55 50-60 cm
			Client sampling date / time	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]
Compound	CAS Number	LOR	Unit	EB1511046-006	EB1511046-007	EB1511046-008	EB1511046-009	EB1511046-010
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	6.5	8.5	6.4	7.5	8.0
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	45	768	164	67	605
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	8.4	29.5	8.3	9.3	26.6
^ Exchangeable Magnesium	----	0.1	meq/100g	6.1	12.3	3.5	5.5	6.7
^ Exchangeable Potassium	----	0.1	meq/100g	0.7	0.1	1.1	0.8	0.2
^ Exchangeable Sodium	----	0.1	meq/100g	0.2	1.7	<0.1	0.3	0.8
^ Cation Exchange Capacity	----	0.1	meq/100g	15.4	43.7	12.9	15.9	34.3

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

			Client sample ID	Site 61 0-10 cm	Site 61 20-30 cm	Site 61 45-55 cm	Site 62 0-10 cm	Site 62 20-30 cm
			Client sampling date / time	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]
Compound	CAS Number	LOR	Unit	EB1511046-011	EB1511046-012	EB1511046-013	EB1511046-014	EB1511046-015
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	7.2	7.9	8.5	6.4	7.4
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	31	131	416	70	47
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	9.1	11.8	16.4	7.1	4.6
^ Exchangeable Magnesium	----	0.1	meq/100g	8.0	14.8	18.1	5.3	3.5
^ Exchangeable Potassium	----	0.1	meq/100g	1.2	0.6	0.2	0.6	0.2
^ Exchangeable Sodium	----	0.1	meq/100g	0.1	1.0	2.2	0.2	0.4
^ Cation Exchange Capacity	----	0.1	meq/100g	18.5	28.3	37.0	13.2	8.6

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	Site 62 35-45 cm	Site 62 70-80 cm	Site 63 0-5 cm	Site 63 10-20 cm	Site 63 40-50 cm
Client sampling date / time				[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]
				EB1511046-016	EB1511046-017	EB1511046-018	EB1511046-019	EB1511046-020
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	7.4	8.6	6.2	6.3	8.6
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	152	856	29	55	774
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	5.0	5.6	3.7	2.4	5.7
^ Exchangeable Magnesium	----	0.1	meq/100g	5.6	11.4	2.2	2.4	10.1
^ Exchangeable Potassium	----	0.1	meq/100g	0.2	0.3	0.5	0.1	0.2
^ Exchangeable Sodium	----	0.1	meq/100g	0.8	3.6	<0.1	0.4	3.4
^ Cation Exchange Capacity	----	0.1	meq/100g	11.6	20.8	6.4	5.3	19.5

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

			Client sample ID	Site 63 80-90 cm	Site 65 0-10 cm	Site 65 40-50 cm	Site 65 60-70 cm	Site 65 80-90 cm
			Client sampling date / time	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]
Compound	CAS Number	LOR	Unit	EB1511046-021	EB1511046-022	EB1511046-023	EB1511046-024	EB1511046-025
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.7	6.9	8.1	8.4	8.6
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	873	61	527	1190	1310
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	16.2	8.6	10.1	24.7	18.6
^ Exchangeable Magnesium	----	0.1	meq/100g	12.2	5.8	10.8	15.9	20.0
^ Exchangeable Potassium	----	0.1	meq/100g	0.3	0.6	0.3	0.2	0.1
^ Exchangeable Sodium	----	0.1	meq/100g	3.3	0.4	3.0	4.4	7.1
^ Cation Exchange Capacity	----	0.1	meq/100g	31.9	15.5	24.2	45.1	45.8

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

				Client sample ID	Site 68 0-10 cm	Site 68 15-25 cm	Site 68 50-60 cm	Site 68 75-85 cm	Site 70 0-10 cm
				Client sampling date / time	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]
Compound	CAS Number	LOR	Unit		EB1511046-026	EB1511046-027	EB1511046-028	EB1511046-029	EB1511046-030
					Result	Result	Result	Result	Result
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		6.9	7.6	8.4	8.7	7.2
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		66	30	740	1060	20
ED008: Exchangeable Cations									
^ Exchangeable Calcium	----	0.1	meq/100g		5.9	1.7	12.7	28.5	3.4
^ Exchangeable Magnesium	----	0.1	meq/100g		2.4	0.8	12.6	13.7	1.8
^ Exchangeable Potassium	----	0.1	meq/100g		0.6	0.3	0.4	0.3	0.5
^ Exchangeable Sodium	----	0.1	meq/100g		<0.1	<0.1	3.2	2.9	<0.1
^ Cation Exchange Capacity	----	0.1	meq/100g		9.0	3.0	29.0	45.5	5.8

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 70 10-20 cm	Site 70 50-60 cm	Site 70 80-90 cm	Site 71 0-10 cm	Site 71 20-30 cm
			Client sampling date / time	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]
Compound	CAS Number	LOR	Unit	EB1511046-031	EB1511046-032	EB1511046-033	EB1511046-034	EB1511046-035
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	7.7	8.9	9.0	7.2	7.2
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	21	580	720	44	53
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	1.9	11.0	23.0	6.9	13.6
^ Exchangeable Magnesium	----	0.1	meq/100g	1.1	8.0	8.4	6.0	12.6
^ Exchangeable Potassium	----	0.1	meq/100g	0.2	0.3	0.3	0.7	0.4
^ Exchangeable Sodium	----	0.1	meq/100g	0.1	2.4	1.8	0.2	1.5
^ Cation Exchange Capacity	----	0.1	meq/100g	3.4	21.8	33.7	13.8	28.1

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

Client sample ID				Site 71 50-60 cm	Site 71 75-85 cm	Site 74 0-10 cm	Site 74 12-20 cm	Site 74 35-45 cm
Client sampling date / time				[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]
Compound	CAS Number	LOR	Unit	EB1511046-036	EB1511046-037	EB1511046-038	EB1511046-039	EB1511046-040
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.0	8.9	6.3	6.9	7.9
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	602	855	27	26	293
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	27.5	24.6	4.4	3.3	6.0
^ Exchangeable Magnesium	----	0.1	meq/100g	14.0	12.3	2.3	2.7	8.4
^ Exchangeable Potassium	----	0.1	meq/100g	0.2	0.2	0.6	0.2	0.2
^ Exchangeable Sodium	----	0.1	meq/100g	2.6	2.4	<0.1	0.3	1.6
^ Cation Exchange Capacity	----	0.1	meq/100g	44.3	39.6	7.4	6.7	16.4

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			*Client sample ID*	Site 74 75-85 cm	Site 75 0-10 cm	Site 75 20-30 cm	Site 75 45-55 cm	Site 75 70-80 cm
			Client sampling date / time	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]
Compound	*CAS Number*	*LOR*	*Unit*	EB1511046-041	EB1511046-042	EB1511046-043	EB1511046-044	EB1511046-045
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	7.5	6.3	6.7	6.4	6.6
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	768	58	25	54	24
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	6.9	6.2	3.3	10.2	6.0
^ Exchangeable Magnesium	----	0.1	meq/100g	11.4	3.8	2.2	6.1	3.4
^ Exchangeable Potassium	----	0.1	meq/100g	0.2	0.8	0.4	0.5	0.2
^ Exchangeable Sodium	----	0.1	meq/100g	2.8	<0.1	<0.1	0.1	<0.1
^ Cation Exchange Capacity	----	0.1	meq/100g	21.5	11.0	6.0	17.0	9.8

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Site 76 0-10 cm	Site 76 20-30 cm	Site 76 50-60 cm	Site 76 70-80 cm	----
			Client sampling date / time	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]	[20-Jan-2015]	----
Compound	CAS Number	LOR	Unit	EB1511046-046	EB1511046-047	EB1511046-048	EB1511046-049	--------
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	6.1	8.2	7.6	8.9	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	33	345	241	1090	----
ED008: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	3.2	4.0	4.3	14.9	----
^ Exchangeable Magnesium	----	0.1	meq/100g	2.6	8.8	9.3	12.3	----
^ Exchangeable Potassium	----	0.1	meq/100g	0.8	0.2	0.2	0.3	----
^ Exchangeable Sodium	----	0.1	meq/100g	0.1	3.4	3.4	3.8	----
^ Cation Exchange Capacity	----	0.1	meq/100g	6.9	16.5	17.4	31.4	----

Department of Primary Industries
Soil Conservation Service

SOIL TEST REPORT

Scone Research Centre

REPORT NO:	SCO15/007R1
REPORT TO:	Adam Koppers SLR Consulting 10 Kings Road New Lambton NSW 2305
REPORT ON:	Forty-nine soil samples Your ref: #630.11145
PRELIMINARY RESULTS ISSUED:	Not issued
REPORT STATUS:	Final
DATE REPORTED:	30 January 2015
METHODS:	Information on test procedures can be obtained from Scone Research Centre

TESTING CARRIED OUT ON SAMPLE AS RECEIVED
THIS DOCUMENT MAY NOT BE REPRODUCED EXCEPT IN FULL

SOIL CONSERVATION SERVICE
Scone Research Centre

Report No: SCO15/007R1

Client Reference: Adam Koppers
SLR Consulting
10 Kings Road
New Lambton NSW 2305

Lab No	Method	P7B/2 Particle Size Analysis (%)					Colour	
	Sample Id	clay	silt	f sand	c sand	gravel	Dry	Moist
1	Site 15 0-10 cm	36	19	29	16	<1	10YR 4/3	10YR 3/2
2	Site 15 20-30 cm	59	12	19	9	1	10YR 3/3	10YR 3/3
3	Site 15 50-60 cm	58	16	17	9	<1	10YR 4/2	10YR 3/3
4	Site 15 80-90 cm	62	26	7	4	1	10YR 6/4	10YR 5/6
5	Site 45 0-10 cm	31	15	37	14	3	7.5YR 4/4	7.5YR 3/4
6	Site 45 20-30 cm	55	12	25	8	<1	7.5YR 5/4	7.5YR 4/4
7	Site 45 50-60 cm	43	20	34	3	<1	10YR 6/4	10YR 5/4
8	Site 55 0-10 cm	31	18	33	18	<1	7.5YR 5/3	7.5YR 3/3
9	Site 55 20-30 cm	58	19	15	8	<1	7.5YR 6/4	7.5YR 4/4
10	Site 55 50-60 cm	50	25	17	6	2	7.5YR 7/3	7.5YR 5/4
11	Site 61 0-10 cm	34	36	23	7	<1	7.5YR 5/3	7.5YR 3/2
12	Site 61 20-30 cm	60	28	10	2	<1	7.5YR 5/3	7.5YR 4/3
13	Site 61 45-55 cm	59	31	8	2	<1	10YR 6/4	10YR 5/4
14	Site 62 0-10 cm	25	14	44	16	1	10YR 5/3	10YR 4/2
15	Site 62 20-30 cm	20	9	43	23	5	7.5YR 5/3	7.5YR 3/3
16	Site 62 35-45 cm	32	9	37	21	1	7.5YR 5/3	7.5YR 4/3
17	Site 62 70-80 cm	41	10	33	15	1	7.5YR 5/4	7.5YR 4/3
18	Site 63 0-5 cm	14	8	41	34	3	7.5YR 5/3	7.5YR 3/2
19	Site 63 10-20 cm	14	12	41	30	3	7.5YR 6/2	7.5YR 3/2
20	Site 63 40-50 cm	46	10	24	19	1	5YR 4/6	5YR 4/6
21	Site 63 80-90 cm	49	9	24	18	<1	5YR 4/6	5YR 4/6
22	Site 65 0-10 cm	28	16	39	15	2	7.5YR 5/2	7.5YR 3/2
23	Site 65 40-50 cm	42	15	31	12	1	7.5YR 5/2	7.5YR 3/2
24	Site 65 60-70 cm	56	12	22	10	<1	10YR 4/2	10YR 3/2
25	Site 65 80-90 cm	76	10	11	3	<1	10YR 5/2	10YR 5/3

SOIL CONSERVATION SERVICE
Scone Research Centre

Report No: SCO15/007R1

Client Reference: Adam Koppers
SLR Consulting
10 Kings Road
New Lambton NSW 2305

Lab No	Method	P7B/2 Particle Size Analysis (%)					Colour	
	Sample Id	clay	silt	f sand	c sand	gravel	Dry	Moist
26	Site 68 0-10 cm	12	15	37	30	6	7.5YR 4/3	7.5YR 3/3
27	Site 68 15-25 cm	10	13	40	31	6	7.5YR 6/2	7.5YR 4/3
28	Site 68 50-60 cm	58	8	20	13	1	10YR 4/6	7.5YR 5/4
29	Site 68 75-85 cm	57	13	20	8	2	7.5YR 5/6	7.5YR 4/6
30	Site 70 0-10 cm	17	12	32	35	4	7.5YR 4/3	7.5YR 3/3
31	Site 70 10-20 cm	10	13	34	37	6	7.5YR 6/2	7.5YR 4/3
32	Site 70 50-60 cm	42	10	22	24	2	7.5YR 4/6	5YR 4/4
33	Site 70 80-90 cm	10	41	17	30	2	10YR 5/4	7.5YR 5/4
34	Site 71 0-10 cm	26	17	33	22	2	10YR 4/3	10YR 3/3
35	Site 71 20-30 cm	54	15	16	15	<1	10YR 4/4	10YR 3/4
36	Site 71 50-60 cm	45	17	20	17	1	10YR 5/4	10YR 4/4
37	Site 71 75-85 cm	36	11	26	24	3	10YR 5/4	10YR 4/4
38	Site 74 0-10 cm	17	36	39	8	<1	10YR 5/3	10YR 3/3
39	Site 74 12-20 cm	17	30	43	10	<1	10YR 6/2	10YR 4/3
40	Site 74 35-45 cm	46	25	26	3	0	10YR 5/4	10YR 4/4
41	Site 74 75-85 cm	52	20	26	2	0	10YR 5/4	10YR 3/6
42	Site 75 0-10 cm	26	12	30	32	<1	10YR 4/4	10YR 3/3
43	Site 75 20-30 cm	15	6	13	64	2	10YR 4/4	10YR 3/4
44	Site 75 45-55 cm	40	19	30	11	<1	10YR 3/3	10YR 3/4
45	Site 75 70-80 cm	24	9	40	27	<1	10YR 5/4	10YR 3/4
46	Site 76 0-10 cm	19	17	35	21	8	7.5YR 4/3	7.5YR 3/3
47	Site 76 20-30 cm	48	12	24	16	<1	10YR 4/4	10YR 4/4
48	Site 76 50-60 cm	53	11	24	12	<1	7.5YR 5/4	7.5YR 4/6
49	Site 76 70-80 cm	56	8	23	12	1	7.5YR 5/4	7.5YR 4/6

END OF TEST REPORT

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Appendix F

Soil Salinity Criteria Calculations

Table 1 Maxwell Project Soil Salinity Criteria Calculations

Site	Sample Depth (m)	EC 1:5 (dS/m)	PSA Texture	Multiplier Factor	ECe
1	0.0 – 0.10	0.049	Silty Loam	9.5	0.5
	0.20 – 0.30	0.137	Silty Clay Loam	8.6	1.2
	0.40 – 0.50	0.481	Silty Clay Loam	8.6	4.1
	0.65 – 0.75	1.064	Light Clay	8.6	9.2
2	0.0 – 0.05	0.090	Loamy Sand	23	2.1
	0.05 – 0.10	0.035	Loam	9.5	0.3
	0.20 – 0.30	0.070	Light Clay	8.6	0.6
	0.40 – 0.50	0.088	Clay Loam	8.6	0.8
3	0.0 – 0.10	0.023	Loamy Sand	23	0.5
	0.20 – 0.30	0.010	Loamy Sand	23	0.2
	0.40 – 0.50	0.040	Clay Loam	8.6	0.3
4	0.0 – 0.10	0.101	Light-Medium Clay	8.6	0.9
	0.20 – 0.30	0.213	Heavy Clay	5.8	1.2
	0.50 – 0.60	0.801	Heavy Clay	5.8	4.6
5	0.0 – 0.10	0.121	Light-Medium Clay	8.6	1.0
	0.20 – 0.30	0.164	Heavy Clay	5.8	1.0
	0.40 – 0.50	0.497	Heavy Clay	5.8	2.9
	0.65 – 0.75	0.635	Heavy Clay	5.8	3.7
6	0.0 – 0.10	0.031	Loamy Sand	23	0.7
	0.10 – 0.20	0.039	Loamy Sand	23	0.9
	0.30 – 0.40	0.058	Light Clay	8.6	0.5
	0.50 – 0.60	0.058	Clay Loam	8.6	0.5
7	0.0 – 0.10	0.052	Loam	9.5	0.5
	0.20 – 0.30	0.087	Medium Clay	7.5	0.7
	0.40 – 0.50	0.264	Light Clay	8.6	2.3
8	0.0 – 0.10	0.098	Silty Clay	8.6	0.8
	0.20 – 0.30	0.363	Silty Clay	8.6	3.1
	0.40 – 0.50	1.075	Medium Clay	7.5	8.1
	0.65 – 0.75	1.332	Heavy Clay	5.8	7.7
9	0.0 – 0.10	0.070	Silty Clay	8.6	0.6
	0.20 – 0.30	0.192	Silty Clay	8.6	1.7
	0.40 – 0.50	0.826	Medium Clay	7.5	6.2
	0.65 – 0.75	0.961	Heavy Clay	5.8	5.6
10	0.0 – 0.10	0.077	Loam	9.5	0.7
	0.20 – 0.30	0.055	Light-Medium Clay	8.6	0.5
	0.40 – 0.50	0.087	Clay Loam	8.6	0.7
11	0.0 – 0.10	0.395	Clay Loam	8.6	3.4
	0.20 – 0.30	0.136	Heavy Clay	5.8	0.8
	0.40 – 0.50	0.328	Heavy Clay	5.8	1.9
	0.65 – 0.75	0.475	Medium Clay	7.5	3.6
12	0.0 – 0.10	0.187	Silty Clay	8.6	1.6
	0.20 – 0.30	0.154	Heavy Clay	5.8	0.9
	0.40 – 0.50	0.261	Medium Clay	7.5	2.0
	0.65 – 0.75	0.491	Medium Clay	7.5	3.7

Site	Sample Depth (m)	EC 1:5 (dS/m)	PSA Texture	Multiplier Factor	ECe
14	0.0 – 0.10	0.124	Sandy Loam	14	1.7
	0.20 – 0.30	0.221	Light Clay	8.6	1.9
	0.40 – 0.50	0.592	Silty Clay	8.6	5.1
15	0.0 – 0.10	0.094	Silty Loam	9.5	0.9
	0.20 – 0.30	0.060	Heavy Clay	5.8	0.3
	0.40 – 0.50	0.131	Silty Clay Loam	8.6	1.1
	0.65 – 0.75	0.385	Clay Loam	8.6	3.3
16	0.0 – 0.10	0.100	Silty Clay Loam	8.6	0.9
	0.20 – 0.30	0.093	Heavy Clay	5.8	0.5
	0.40 – 0.50	0.284	Heavy Clay	5.8	1.6
	0.65 – 0.75	0.284	Heavy Clay	5.8	1.6
17	0.0 – 0.10	0.049	Sandy Loam	14	0.7
	0.20 – 0.30	0.021	Loamy Sand	23	0.5
	0.40 – 0.50	0.025	Loamy Sand	23	0.6
	0.65 – 0.75	0.108	Light Clay	8.6	0.9
18	0.0 – 0.10	0.022	Loamy Sand	23	0.5
	0.20 – 0.30	0.143	Clay Loam	8.6	1.2
	0.40 – 0.50	0.318	Clay Loam	8.6	2.7
	0.65 – 0.75	0.907	Clay Loam	8.6	7.8
19	0.0 – 0.10	0.039	Loam	9.5	0.4
	0.20 – 0.30	0.027	Silty Loam	9.5	0.3
	0.40 – 0.50	0.046	Clay Loam	8.6	0.4
	0.65 – 0.75	0.059	Clay Loam	8.6	0.5
22	0.0 – 0.10	0.027	Silty Loam	9.5	0.3
	0.20 – 0.30	0.120	Clay Loam	8.6	1.0
	0.40 – 0.50	0.248	Clay Loam	8.6	2.1
	0.65 – 0.75	0.815	Clay Loam	8.6	7.0
24	0.0 – 0.10	0.095	Silty Loam	9.5	0.9
	0.20 – 0.30	0.127	Light-Medium Clay	8.6	1.1
	0.40 – 0.50	0.486	Light-Medium Clay	8.6	4.2
	0.65 – 0.75	1.107	Silty Clay Loam	8.6	9.5
25	0.0 – 0.10	0.096	Silty Loam	9.5	0.9
	0.20 – 0.30	0.141	Medium Clay	7.5	1.1
	0.40 – 0.50	0.547	Heavy Clay	5.8	3.2
	0.65 – 0.75	1.012	Silty Clay Loam	8.6	8.7
26	0.0 – 0.10	0.089	Silty Loam	9.5	0.8
	0.20 – 0.30	0.388	Light Clay	8.6	3.3
	0.40 – 0.50	0.908	Silty Clay Loam	8.6	7.8
	0.65 – 0.75	1.105	Heavy Clay	5.8	6.4
27	0.0 – 0.10	0.061	Loam	9.5	0.6
	0.20 – 0.30	0.333	Light-Medium Clay	8.6	2.9
	0.40 – 0.50	0.852	Light-Medium Clay	8.6	7.3
30	0.0 – 0.10	0.113	Heavy Clay	5.8	0.7
	0.20 – 0.30	0.156	Heavy Clay	5.8	0.9
	0.40 – 0.50	0.400	Medium Clay	7.5	3.0

Site	Sample Depth (m)	EC 1:5 (dS/m)	PSA Texture	Multiplier Factor	ECe
	0.65 – 0.75	0.568	Light Clay	8.6	4.9
31	0.0 – 0.10	0.075	Sandy Loam	14	1.0
	0.20 – 0.30	0.170	Light Clay	8.6	1.5
	0.40 – 0.50	0.781	Medium Clay	7.5	5.9
	0.65 – 0.75	1.013	Silty Clay	8.6	8.7
32	0.0 – 0.10	0.049	Loamy Sand	23	1.1
	0.20 – 0.30	0.025	Loamy Sand	23	0.6
	0.40 – 0.50	0.352	Clay Loam	8.6	3.0
	0.65 – 0.75	0.455	Sandy Clay Loam	9.5	4.3
33	0.0 – 0.10	0.065	Clay Loam	8.6	0.6
	0.20 – 0.30	0.346	Heavy Clay	5.8	2.0
	0.40 – 0.50	0.477	Medium Clay	7.5	3.6
	0.65 – 0.75	1.059	Medium Clay	7.5	8.0
34	0.0 – 0.10	0.119	Silty Clay Loam	8.6	1.0
	0.20 – 0.30	0.122	Silty Clay	8.6	1.0
	0.40 – 0.50	0.129	Silty Clay Loam	8.6	1.1
	0.65 – 0.75	0.118	Silty Clay Loam	8.6	1.0
35	0.0 – 0.10	0.138	Loam	9.5	1.3
	0.20 – 0.30	0.614	Light-Medium Clay	8.6	5.3
	0.40 – 0.50	1.072	Medium Clay	7.5	8.0
	0.65 – 0.75	1.201	Heavy Clay	5.8	7.0
36	0.0 – 0.10	0.069	Silty Loam	9.5	0.7
	0.20 – 0.30	0.038	Heavy Clay	5.8	0.2
	0.40 – 0.50	0.047	Light-Medium Clay	8.6	0.4
37	0.0 – 0.10	0.060	Heavy Clay	5.8	0.3
	0.20 – 0.30	0.208	Light-Medium Clay	8.6	1.8
	0.40 – 0.50	0.592	Light Clay	8.6	5.1
	0.60 – 0.70	0.802	Clay Loam	8.6	6.9
38	0.0 – 0.10	0.079	Silty Loam	9.5	0.8
	0.20 – 0.30	0.070	Heavy Clay	5.8	0.4
	0.40 – 0.50	0.197	Heavy Clay	5.8	1.1
39	0.0 – 0.10	0.105	Silty Loam	9.5	1.0
	0.20 – 0.30	0.131	Silty Clay	8.6	1.1
	0.40 – 0.50	0.130	Light-Medium Clay	8.6	1.1
D17 SLR (2015)	0.0 – 0.10	0.126	Loam	9.5	1.2
	0.20 – 0.30	0.148	Light-Medium Clay	8.6	1.3
	0.40 – 0.50	0.819	Light Clay	8.6	7.0
	0.65 – 0.75	0.853	Silty Clay Loam	8.6	7.3
D18 SLR (2015)	0.0 – 0.10	0.269	Clay Loam	8.6	2.3
	0.20 – 0.30	0.332	Heavy Clay	5.8	1.9
	0.40 – 0.50	1.161	Heavy Clay	5.8	6.7
	0.65 – 0.75	1.583	Heavy Clay	5.8	9.2

Table 2 SLR (2015) Soil Salinity Criteria Calculations

SLR (2015)	Horizon Depth (cm)	EC1:5 (dS/m)	PSA Texture	Multiplier Factor	ECe
Site 1	0-10	0.061	Loam	9.5	0.6
	10-35	0.035	Loam	9.5	0.3
	35-65	0.159	Heavy Clay	5.8	0.9
	65-95	0.492	Heavy Clay	5.8	2.9
Site 2	0-10	0.085	Light-Medium Clay	8.6	0.7
	10-20	0.089	Heavy Clay	5.8	0.5
	20-60	0.727	Medium Clay	7.5	5.5
	60-90	0.926	Medium Clay	7.5	6.9
Site 3	0-10	0.062	Silty Clay Loam	8.6	0.5
	10-40	0.036	Heavy Clay	5.8	0.2
	40-60	0.102	Light-Medium Clay	8.6	0.9
Site 4	0-10	0.126	Clay Loam	8.6	1.1
	10-30	0.357	Heavy Clay	5.8	2.1
	30-60	0.916	Light-medium Clay	8.6	7.9
	60-100	1.060	Heavy Clay	5.8	6.1
Site 5	0-5	0.102	Loam	9.5	1.0
	5-30	0.052	Light-Medium Clay	8.6	0.4
	30-50	0.236	Light-Medium Clay	8.6	2.0
Site 7	0-5	0.051	Loamy Sand	23	1.2
	5-20	0.080	Loam	9.5	0.8
	20-60	0.494	Clay Loam	8.6	4.2
	60-100	0.518	Clay Loam	8.6	4.5
Site 8	0-10	0.098	Silty Clay	8.6	0.8
	10-40	0.113	Heavy Clay	5.8	0.7
	40-70	0.275	Medium Clay	7.5	2.1
Site 9	0-5	0.109	Silty Loam	9.5	1.0
	5-30	0.229	Silty Loam	9.5	2.2
	30-65	0.763	Heavy Clay	5.8	4.4
	65-120	0.781	Heavy Clay	5.8	4.5
Site 10	0-10	0.042	Silty Clay Loam	8.6	0.4
	10-40	0.058	Heavy Clay	5.8	0.3
	40-80	0.167	Silty Clay	8.6	1.4
	80-100	0.233	Heavy Clay	5.8	1.4
Site 11	0-10	0.081	Light Clay	8.6	0.7
	10-40	0.082	Light-Medium Clay	8.6	0.7
	40-70	0.701	Heavy Clay	5.8	4.1
	70-100	1.180	Heavy Clay	5.8	6.8
Site 12	0-5	0.057	Loam	9.5	0.5
	5-15	0.043	Loam	9.5	0.4
	15-50	0.198	Heavy Clay	5.8	1.1
	50-100	0.916	Medium Clay	7.5	6.9
Site 13	0-8	0.111	Clay Loam	8.6	1.0
	8-50	0.225	Heavy Clay	5.8	1.3
	50-60	0.984	Heavy Clay	5.8	5.7

SLR (2015)	Horizon Depth (cm)	EC1:5 (dS/m)	PSA Texture	Multiplier Factor	ECe
	60-100	1.160	Heavy Clay	5.8	6.7
Site 14	0-5	0.047	Loam	9.5	0.4
	5-40	0.148	Light-Medium Clay	8.6	1.3
	40-65	0.649	Heavy Clay	5.8	3.8
	65-90	0.904	Medium Clay	7.5	6.8
Site 15	0-10	0.074	Clay Loam	8.6	0.6
	10-60	0.080	Heavy Clay	5.8	0.5
		0.591	Heavy Clay	5.8	3.4
	60-100	0.858	Silty Clay	8.6	7.4
Site 16	0-10	0.083	Clay Loam	8.6	0.7
	10-45	0.098	Light-Medium Clay	8.6	0.8
	45-90	0.320	Medium Clay	7.5	2.4
Site 20	0-10	0.156	Loam	9.5	1.5
	10-30	0.200	Light Clay	8.6	1.7
	30-60	0.481	Clay Loam	8.6	4.1
	60-90	0.732	Light-Medium Clay	8.6	6.3
Site 21	0-8	0.110	Clay Loam	8.6	0.9
	8-45	0.274	Light-Medium Clay	8.6	2.4
	45-75	0.391	Clay Loam	8.6	3.4
Site 22	0-10	0.170	Clay Loam	8.6	1.5
	10-50	0.158	Silty Clay	8.6	1.4
	50-90	0.209	Silty Clay	8.6	1.8
Site 23	0-12	0.096	Silty Loam	9.5	0.9
	12-30	0.274	Heavy Clay	5.8	1.6
	30-60	0.474	Heavy Clay	5.8	2.7
Site 24	0-15	0.089	Loamy Sand	23	2.0
	15-35	0.036	Loam	9.5	0.3
	35-60	0.069	Medium Clay	7.5	0.5
Site 25	0-15	0.060	Loam	9.5	0.6
	15-50	0.046	Heavy Clay	5.8	0.3
Site 26	0-15	0.039	Loamy Sand	23	0.9
	15-45	0.018	Sandy Loam	14	0.3
	45-65	0.041	Light-Medium Clay	8.6	0.4
Site 27	0-10	0.092	Loam	9.5	0.9
	10-45	0.056	Medium Clay	7.5	0.4
	45-80	0.219	Silty Clay	8.6	1.9
Site 28	0-20	0.031	Loamy Sand	23	0.7
	20-40	0.017	Loamy Sand	23	0.4
	40-65	0.011	Loamy Sand	23	0.3
	65-120	0.047	Light Clay	8.6	0.4
Site 29	0-10	0.031	Loam	9.5	0.3
	10-35	0.034	Loam	9.5	0.3
	35-60	0.282	Light Clay	8.6	2.4
	60-100	0.575	Sandy Clay	8.6	4.9
Site 30	0-10	0.028	Clay Loam	8.6	0.2

SLR (2015)	Horizon Depth (cm)	EC1:5 (dS/m)	PSA Texture	Multiplier Factor	ECe
	10-30	0.158	Clay Loam	8.6	1.4
	30-60	0.860	Heavy Clay	5.8	5.0
	60-110	0.798	Silty Clay	8.6	6.9
Site 31	0-15	0.035	Loam	9.5	0.3
	15-35	0.213	Heavy Clay	5.8	1.2
	35-60	0.779	Heavy Clay	5.8	4.5
	60-100	0.839	Heavy Clay	5.8	4.9
Site 32	0-10	0.045	Silty Clay Loam	8.6	0.4
	10-40	0.039	Silty Clay	8.6	0.3
	40-60	0.199	Silty Clay	8.6	1.7
Site 33	0-10	0.051	Light-Medium Clay	8.6	0.4
	10-60	0.339	Heavy Clay	5.8	2.0
Site 34	0-15	0.026	Silty Clay Loam	8.6	0.2
	15-30	0.036	Clay Loam	8.6	0.3
	30-60	0.141	Clay Loam	8.6	1.2
	60-130	0.665	Light-Medium Clay	8.6	5.7
Site 35	0-10	0.086	Clay Loam	8.6	0.7
	10-50	0.086	Heavy Clay	5.8	0.5
	50-70	0.705	Heavy Clay	5.8	4.1
Site 36	0-25	0.022	Loamy Sand	23	0.5
	25-45	0.009	Loamy Sand	23	0.2
	45-65	0.033	Light Clay	8.6	0.3
	65-90	0.055	Medium Clay	7.5	0.4
Site 38	0-15	0.086	Silty Loam	9.5	0.8
	15-45	0.090	Heavy Clay	5.8	0.5
	45-65	0.388	Silty Clay	8.6	3.3
Site 39	0-10	0.056	Silty Loam	9.5	0.5
	10-50	0.064	Heavy Clay	5.8	0.4
Site 40	0-10	0.051	Loam	9.5	0.5
	10-35	0.267	Heavy Clay	5.8	1.5
	35-70	0.962	Heavy Clay	5.8	5.6
	70-110	0.893	Silty Clay Loam	8.6	7.7
Site 42	0-5	0.076	Clay Loam	8.6	0.7
	5-30	0.204	Heavy Clay	5.8	1.2
	30-65	0.747	Heavy Clay	5.8	4.3
Site 43	0-15	0.030	Loamy Sand	23	0.7
	15-50	0.104	Clay Loam	8.6	0.9
	50-75	0.450	Clay Loam	8.6	3.9
	75-120	0.467	Light Clay	8.6	4.0
Site 45	0-10	0.113	Clay Loam	8.6	1.0
	10-45	0.045	Heavy Clay	5.8	0.3
	45-60	0.768	Light-Medium Clay	8.6	6.6
Site 46	0-12	0.083	Silty Loam	9.5	0.8
	12-35	0.230	Heavy Clay	5.8	1.3
	35-75	0.816	Heavy Clay	5.8	4.7

SLR (2015)	Horizon Depth (cm)	EC1:5 (dS/m)	PSA Texture	Multiplier Factor	ECe
	75-120	0.674	Medium Clay	7.5	5.1
Site 48	0-10	0.071	Loamy Sand	23	1.6
	10-50	0.020	Loamy Sand	23	0.5
	50-100	0.342	Light Clay	8.6	2.9
	100-120	0.383	Light Clay	8.6	3.3
Site 49	0-10	0.225	Light Clay	8.6	1.9
	10-60	0.168	Heavy Clay	5.8	1.0
	60-90	0.693	Heavy Clay	5.8	4.0
	90-120	1.120	Heavy Clay	5.8	6.5
Site 51	0-10	0.032	Loamy Sand	23	0.7
	10-20	0.023	Loam	9.5	0.2
	20-70	0.194	Medium Clay	7.5	1.5
	70-120	0.329	Sandy Clay Loam	9.5	3.1
Site 52	0-20	0.142	Clay Loam	8.6	1.2
	20-50	0.455	Heavy Clay	5.8	2.6
	50-90	1.040	Heavy Clay	5.8	6.0
	90-120	1.140	Silty Clay	8.6	9.8
Site 53	0-10	0.082	Loam	9.5	0.8
	10-20	0.032	Loam	9.5	0.3
	20-50	0.149	Heavy Clay	5.8	0.9
	50-90	0.577	Heavy Clay	5.8	3.3
	90-130	1.030	Medium Clay	7.5	7.7
Site 54	0-15	0.035	Loam	9.5	0.3
	15-50	0.042	Heavy Clay	5.8	0.2
	50-90	0.335	Silty Clay	8.6	2.9
Site 55	0-10	0.164	Clay Loam	8.6	1.4
	10-50	0.067	Heavy Clay	5.8	0.4
	50-95	0.605	Silty Clay	8.6	5.2
Site 56	0-10	0.159	Clay Loam	8.6	1.4
	10-40	0.221	Heavy Clay	5.8	1.3
Site 57	0-10	0.093	Loam	9.5	0.9
	10-40	0.282	Heavy Clay	5.8	1.6
Site 58	0-10	0.083	Loam	9.5	0.8
	10-40	0.092	Heavy Clay	5.8	0.5
Site 59	0-15	0.072	Clay Loam	8.6	0.6
	15-35	0.169	Heavy Clay	5.8	1.0
	35-70	0.321	Medium Clay	7.5	2.4
Site 61	0-15	0.031	Silty Clay Loam	8.6	0.3
	15-35	0.131	Silty Clay	8.6	1.1
	35-55	0.416	Silty Clay	8.6	3.6
Site 62	0-15	0.070	Clay Loam	8.6	0.6
	15-30	0.047	Clay Loam	8.6	0.4
	30-70	0.152	Clay Loam	8.6	1.3
	70-100	0.856	Light-Medium Clay	8.6	7.4
Site 63	0-5	0.029	Sandy Loam	14	0.4

SLR (2015)	Horizon Depth (cm)	EC1:5 (dS/m)	PSA Texture	Multiplier Factor	ECe
	5-20	0.055	Loam	9.5	0.5
	20-75	0.774	Medium Clay	7.5	5.8
	75-100	0.873	Medium Clay	7.5	6.5
Site 65	0-30	0.061	Clay Loam	8.6	0.5
	30-50	0.527	Light-Medium Clay	8.6	4.5
	50-75	1.190	Heavy Clay	5.8	6.9
	75-110	1.310	Heavy Clay	5.8	7.6
Site 68	0-12	0.066	Loam	9.5	0.6
	12-30	0.030	Loam	9.5	0.3
	30-70	0.740	Heavy Clay	5.8	4.3
	70-110	1.060	Heavy Clay	5.8	6.1
Site 70	0-10	0.020	Loam	9.5	0.2
	10-20	0.021	Loam	9.5	0.2
	20-70	0.580	Light-Medium Clay	8.6	5.0
	70-120	0.720	Silty Loam	9.5	6.8
Site 71	0-10	0.044	Clay Loam	8.6	0.4
	10-30	0.053	Heavy Clay	5.8	0.3
	30-75	0.602	Medium Clay	7.5	4.5
	75-110	0.855	Light Clay	8.6	7.4
Site 74	0-12	0.027	Silty Loam	9.5	0.3
	12-20	0.026	Silty Loam	9.5	0.2
	20-50	0.293	Silty Clay	8.6	2.5
	50-100	0.768	Heavy Clay	5.8	4.5
Site 75	0-20	0.058	Clay Loam	8.6	0.5
	20-30	0.025	Sandy Loam	14	0.4
	30-55	0.054	Light Clay	8.6	0.5
	55-100	0.024	Clay Loam	8.6	0.2
Site 76	0-20	0.033	Loam	9.5	0.3
	20-40	0.345	Medium Clay	7.5	2.6
	40-60	0.241	Heavy Clay	5.8	1.4
	60-95	1.090	Heavy Clay	5.8	6.3

Attachment B - Land and Soil Capability Assessment

27th March 2019

SLR Ref: 630.12463.002 v3

Maxwell Project Land & Soil Capability Assessment

The Maxwell Project Land & Soil Capability (LSC) Assessment has been undertaken according to *The Land and Soil Capability Assessment Scheme: Second Approximation* (OEH, 2012). Soil information for this LSC Assessment was collected during the *Refined Maxwell Project Biophysical Strategic Agricultural Land (BSAL) Verification Assessment* (SLR, 2019). Additional sites described for this assessment, which were within the BSAL Exclusion Areas of SLR (2019), are detailed in **Appendix A** with full laboratory analysis shown in **Appendix B.**

Four LSC Classes were identified, dominated by 1,605 hectares of LSC Class 4, and are summarised in **Table 1** and shown on **Figure 1**. The major assessment points are listed below.

LSC Class 3 is considered to have high agricultural capability with moderate production 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. LSC Class 3 is predominantly associated with the Vertosols found on the foot slopes of the grazing areas and comprises 15% of the Study Area.

LSC Class 4 is considered to have moderate agricultural capability with moderate to high limitations for high-impact land uses which restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. LSC Class 4 is associated with the Dermosols, Vertosols, Chromosols and Sodosols found on the mid slopes of the grazing areas and comprises 50% of the Study Area.

LSC Class 5 is considered to have moderate-low agricultural capability and has severe limitations for high impact land management uses such as cropping. This land is generally more suitable for grazing with some limitations or very occasional cultivation for pasture establishment. LSC Class 5 is associated with the Vertosols, Chromosols and Sodosols found on the mid and upper slopes of the grazing areas and comprises 6% of the Study Area.

LSC Class 6 is considered to have low agricultural capability and has very high limitations for high-impact land uses. Land use is restricted to low-impact land uses such as grazing, forestry and nature conservation. LSC Class 6 is associated with the Chromosols and Sodosol on areas of greater than 20% slope in the grazing areas and comprises 29% of the Study Area.

Within the Study Area, 85% of the land is considered to have moderate to low agricultural capability according to definitions given in *The Land and Soil Capability Assessment Scheme: Second Approximation* (OEH, 2012). The remainder has high agricultural capability.

SLR Consulting Australia Pty Ltd 10 Kings Road New Lambton
Murray Fraser 0458 404 384

Table 1 Maxwell Project Land and Soil Capability

LSC Class	Agricultural Capability Rating	Hectares
3	High	471
4	Moderate	1,605
5	Moderate-Low	195
6	Low	944
	Total	**3,215**

Table 2 summarises the LSC Assessment for the SLR 2018-2019 sites, while **Table 3** summarises the LSC Assessment for the SLR 2015 sites. Full LSC Assessment tables are shown in **Appendix C.**

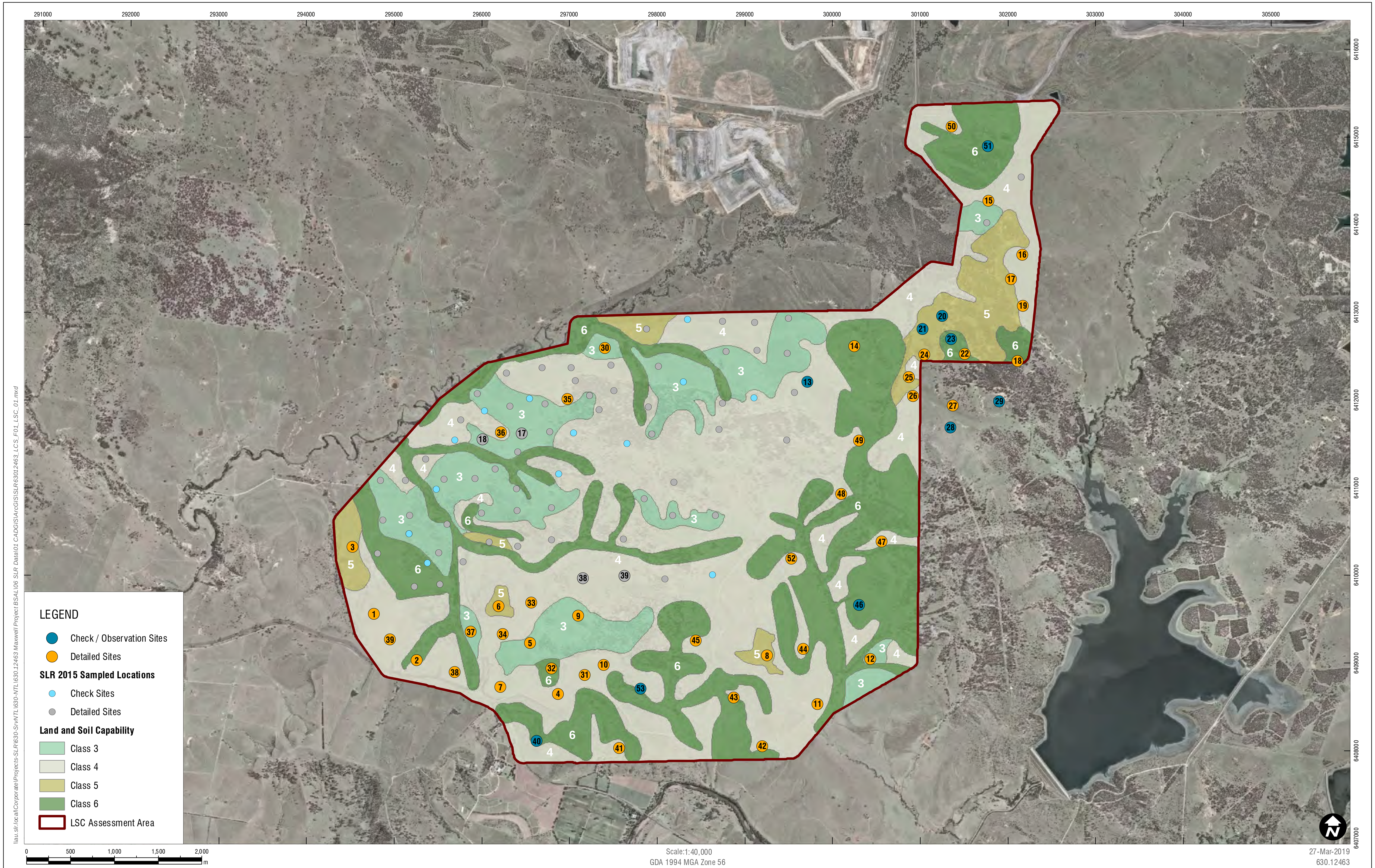
Table 2 Summary Land & Soil Capability Assessment (SLR 2018-2019)

LSC Class	Sites	Dominant ASC Types	Major Limitations
3	5, 9, 12, 30, 37	Vertosol	Water Erosion, Salinity, Structure, Soil Depth
4	1, 4, 10, 7, 11, 15, 16, 19, 26, 31, 33, 34, 35, 36, 38, 39, 41, 42, 43, 44, 45, 47, 48, 49, 50, 52	Dermosol, Chromosol, Sodosol, Vertosol	Water Erosion, Structure, Acidification, Soil Depth
5	3, 6, 8, 17, 24, 25	Vertosol, Sodosol, Chromosol	Water Erosion, Wind Erosion, Acidification
6	2, 14, 18, 22, 27, 32, 40, 46, 51, 53	Sodosol	Water Erosion, Waterlogging

Note: Sites 40 to 53 were sites conducted solely for the purpose of this LSC Assessment.

Table 3 Summary Land & Soil Capability Assessment (SLR 2015)

LSC Class	Sites	Dominant ASC Types	Major Limitations
3	2, 3, 8, 10, 11, 15, 16, 17, 18, 20, 21, 22, 24, 25, 26, 27, 32, 33, 36, 45, 49, 52, 54, 55, 59, 61, 70, 71, 75	Dermosol, Chromosol, Vertosol, Calcarosol	Structure, Acidification, Salinity, Soil Depth, Water Erosion, Wind Erosion, Waterlogging
4	1, 4, 5, 9, 12, 13, 14, 23, 29, 30, 31, 34, 35, 38, 39, 40, 42, 43, 46, 48, 53, 62, 63, 65, 68, 74, 76	Sodosol, Chromosol, Vertosol, Kurosol	Structure, Acidification
5	7, 28	Dermosol, Chromosol	Wind Erosion
6	56, 57, 58	Chromosol	Soil Depth



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Land & Soil Capability

FIGURE 1

Regards,

Murray Fraser
SLR Associate Agronomist

Appendix A

BSAL Exclusion Area Site Descriptions

Land & Soil Capability Site Descriptions

Site 40 – Red Chromosol

Table 1 Summary: Red Chromosol (Site 40)

Overview

Landscape Site 40

ASC Name	Red Chromosol
Representative Site	Site 40
Survey Type	EIS Observation Site
Dominant Topography	Upper Slope
Dominant Land Use	Grazing
Vegetation	White Box, Kurrajong, Wire Grass, Red Grass
Inherent Soil Fertility	Moderately Low
Slope	12%
Aspect	West
Site Verified	BSAL Exclusion Zone
Land & Soil Capability Class	6

Table 2 Profile: Red Chromosol (Site 40)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.05	Brown (7.5YR 4/3) loam, weak crumb structured 2-5 mm peds with weak consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and wavy boundary. Not Sampled
	A2 0.05 – 0.15	Brown (7.5YR 4/4) sandy loam, weakly structured 5-10 mm blocky peds with weak consistence and a rough fabric. Nil mottling, 20% sandstone <20 mm, abundant fine roots. Well drained with an abrupt and wavy boundary. Not Sampled
	B2 +0.15	Reddish brown (5YR 4/3) light clay, strongly structured 20-40 mm blocky peds with strong consistence and a rough fabric. 20% soft calcium nodules <10 mm Nil mottling, 50% sandstone >50 mm, well drained. Not Sampled

Table 3 Field Parameters: Red Chromosol (Site 40)

Layer	Field pH		Field Dispersion
	Unit	Rating	Rating
A1	6.5	Slightly Acidic	Non Dispersive
A2	8.0	Moderately Alkaline	Non Dispersive
B2	8.5	Strongly Alkaline	Slightly Dispersive

Site 41 – Epipedal Red Vertosol

Table 4 Summary: Epipedal Red Vertosol (Site 41)

Overview

Landscape Site 41

ASC Name	Epipedal Red Vertosol
Representative Site	Site 41
Survey Type	Detailed
Dominant Topography	Mid Slope
Dominant Land Use	Cattle Grazing
Vegetation	White Box, Casuarina, Wire Grass, Red Grass, Saffron Thistle
Inherent Soil Fertility	Moderately High
Slope	14%
Aspect	South-West
Site Verified	BSAL Exclusion Zone
Land & Soil Capability Class	4

Table 5 Profile: Epipedal Red Vertosol (Site 41)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Dark brown (7.5YR 3/3) clay loam, strongly structured 20-40 mm blocky peds with strong consistence and a smooth fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.0 – 0.10
	B21 0.15 – 0.40	Reddish brown (7.5YR 4/3) medium clay, strongly structured 40-60 mm blocky peds with strong consistence and a smooth fabric. Nil mottling, 5% pebbles 10-20 mmm, coarse roots common. Well drained with a gradual and wavy boundary. Sampled 0.20 – 0.30
	B22 0.40 – 0.90	Brown (7.5YR 4/3) silty clay, massive structure. 10% soft calcium nodules 5-10 mm. Nil mottling; 5% pebbles 5-10 mm, coarse roots common. Well drained with a gradual and wavy boundary. Sampled 0.40 – 0.50 and 0.65-0.75
	BC +0.90	Sandstone Not Sampled

Table 6 Chemical Parameters: Epipedal Red Vertosol (Site 41)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.6	Neutral	0.7	Non Sodic	0.7	Non-Saline	2.4	Low
B21	6.8	Neutral	0.9	Non Sodic	0.3	Non-Saline	1.4	Low
B22	8.6	Strongly Alkaline	1.0	Non Sodic	1.1	Non-Saline	1.9	Low
B22	8.8	Strongly Alkaline	2.0	Non Sodic	1.3	Non-Saline	1.9	Low

Site 42 – Eutrophic Black Chromosol

Table 7 Summary: Eutrophic Black Chromosol (Site 42)

Overview

Landscape Site 42

ASC Name	Eutrophic Black Chromosol
Representative Site	Site 42
Survey Type	Detailed
Dominant Topography	Upper Slope
Dominant Land Use	Grazing
Vegetation	White Box, Kurrajong, Red Grass, Wire Grass
Inherent Soil Fertility	Moderately High
Slope	13%
Aspect	South
Site Verified	BSAL Exclusion Zone
Land & Soil Capability Class	4

Table 8 Profile: Eutrophic Black Chromosol (Site 42)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Dark brown (7.5YR 3/2) loam, moderately structured 10-20 mm blocky peds with weak consistence and a rough fabric. Nil mottling, 5% pebbles 5-10 mm, abundant fine roots. Moderately drained with an abrupt and even boundary. Sampled 0.0 – 0.10
	B21 0.20 – 0.40	Dark brown (7.5YR 3/2) light clay, strongly structured 20-40 mm subangular blocky peds with moderate consistence and a rough fabric. 10% faint grey mottles, nil stone content, coarse roots common. Moderately drained with a gradual and even boundary. Sampled 0.20 – 0.30
	B22 0.40 – 0.70	Yellowish brown (10YR 5/4) light clay strongly structured 10-30 mm subangular blocky peds with moderate consistence and a rough fabric. <5% soft calcium nodules <5 mm. 20% faint grey mottles, nil stone content, coarse roots common. Moderately drained with a clear and wavy boundary. Sampled 0.40 – 0.50
	BC +0.70	Sandstone Not sampled.

Table 9 Chemical Parameters: Eutrophic Black Chromosol (Site 42)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.3	Slightly Acidic	0.5	Non Sodic	0.5	Non-Saline	4.0	Balanced
B21	7.2	Neutral	0.9	Non Sodic	0.4	Non-Saline	3.6	Low
B22	8.6	Strongly Alkaline	1.0	Non Sodic	0.9	Non-Saline	4.6	Balanced

Site 43 – Eutrophic Red Dermosol

Table 10 Summary: Eutrophic Red Dermosol (Site 43)

Overview

Landscape Site 43

ASC Name	Eutrophic Red Dermosol
Representative Site	Site 43
Survey Type	Detail
Dominant Topography	Upper Slope
Dominant Land Use	Cattle Grazing
Vegetation	White Box, Kurrajong, Wire Grass, Red Grass
Inherent Soil Fertility	Moderately High
Slope	16%
Aspect	South East
Verified	BSAL Exclusion Zone
Land & Soil Capability Class	4

Table 11 Profile: Eutrophic Red Dermosol (Site 43)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Dark reddish brown (5YR 3/3) clay loam, strongly structured 20-40 mm blocky peds with strong consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and wavy boundary. Sampled 0.0 – 0.10
	B21 0.10– 0.40	Dark reddish brown (2.5YR 3/4) light clay, strongly structured 40-50 mm blocky peds with strong consistence and a smooth fabric. Nil mottling; 5% pebbles 5-10 mm, coarse roots common. Well drained with a gradual and wavy boundary. Sampled 0.20 – 0.30
	B22 0.40 – 0.60	Dark reddish brown (2.5YR 3/4) clay loam, strongly structured 40-50 mm subangular blocky peds with strong consistence and a smooth fabric. 10% soft calcium nodules 5-10 mm. Nil mottling; nil stone content, coarse roots common. Well drained with a gradual and wavy boundary. Sampled 0.40 – 0.50
	B23 +0.60	Dark reddish brown (2.5YR 3/4) clay loam, strongly structured >50 mm subangular blocky peds with strong consistence and a smooth fabric. 20% soft calcium nodules 5-10 mm. Nil mottling, nil stone content, few coarse roots. Well drained with layer continuing beyond sampling depth. Sampled 0.65 – 0.75

Table 12 Chemical Parameters: Eutrophic Red Dermosol (Site 43)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.4	Slightly Acidic	0.4	Non Sodic	0.6	Non-Saline	2.2	Low
B21	8.1	Moderately Alkaline	0.8	Non Sodic	1.7	Non Saline	2.3	Low
B22	8.8	Strongly Alkaline	1.8	Non Sodic	1.3	Non-Saline	2.3	Low
B23	9.1	Strongly Alkaline	4.9	Non Sodic	2.0	Non-Saline	1.6	Low

Site 44 – Eutrophic Black Dermosol

Table 13 Summary: Eutrophic Black Dermosol (Site 44)

Overview	
 Landscape Site 44	
ASC Name	Eutrophic Black Dermosol
Representative Site	Site 44
Survey Type	Detail
Dominant Topography	Upper Slope
Dominant Land Use	Grazing
Vegetation	Wire Grass, Red Grass
Inherent Soil Fertility	Moderately High
Slope	14%
Aspect	South
Verified	BSAL Exclusion Zone
Land & Soil Capability Class	4

Table 14 Profile: Eutrophic Black Dermosol (Site 44)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Dark reddish brown (5YR 3/3) loam, moderately structured 10-20 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.0 – 0.10
	B21 0.10– 0.30	Dusky red (2.5YR 3/2) clay loam, moderately structured 20-40 mm blocky peds with moderate consistence and a rough fabric. Nil mottling; <5% pebbles 5-10 mm, coarse fine roots. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30
	B22 0.30 – 0.60	Dark reddish brown (5YR 3/3) silty clay loam, moderately structured 20-40 mm subangular blocky peds with moderate consistence and a rough fabric. Nil mottling; nil stone content, coarse roots common. Well drained with a clear and even boundary. Sampled 0.40 – 0.50
	BC +0.60	Sandstone Not Sampled

Table 15 Chemical Parameters: Eutrophic Black Dermosol (Site 44)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.1	Slightly Acidic	0.6	Non Sodic	0.5	Non-Saline	4.1	Balanced
B21	6.3	Slightly Acidic	0.7	Non Sodic	0.3	Non-Saline	3.8	Low
B22	7.1	Neutral	0.9	Non Sodic	0.5	Non-Saline	3.4	Low

Site 45 – Epipedal Red Vertosol

Table 16 Summary: Epipedal Red Vertosol (Site 45)

Overview

Landscape Site 45

ASC Name	Epipedal Red Vertosol
Representative Site	Site 45
Survey Type	Detail
Dominant Topography	Mid Slope
Dominant Land Use	Grazing
Vegetation	Acacia, Wire Grass, Red Grass
Inherent Soil Fertility	Moderately High
Slope	11%
Aspect	North West
Verified	BSAL Exclusion Zone
Land & Soil Capability Class	4

Table 17 Profile: Epipedal Red Vertosol (Site 45)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Reddish brown (5YR 4/4) light clay, strongly structured 10-20 mm blocky peds with strong consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.0 – 0.10
	B21 0.10– 0.40	Reddish brown (5YR 4/4) medium clay, strongly structured 20-40 mm subangular blocky peds with moderate consistence and a rough fabric. Nil mottling; nil stone content, coarse roots common. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30
	B22 0.40 – 0.90	Brown (7.5YR 5/4) silty clay strongly structured 30-60 mm subangular blocky peds with moderate consistence and a rough fabric. 10% soft calcium nodules 10-20 mm. Nil mottling; nil stone content, coarse roots common. Well drained with a gradual and even boundary. Sampled 0.40 – 0.50 and 0.65-0.75
	BC +0.90	Sandstone Not Sampled

Table 18 Chemical Parameters: Epipedal Red Vertosol (Site 45)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.4	Slightly Acidic	2.0	Non Sodic	0.4	Non-Saline	1.0	Low
B21	7.4	Mildly Alkaline	2.6	Non Sodic	0.3	Non-Saline	0.9	Very Low
B22	9.0	Strongly Alkaline	3.4	Non Sodic	1.6	Non-Saline	2.0	Low
B22	9.2	Strongly Alkaline	7.2	Marginally Sodic	3.2	Slightly Saline	1.5	Low

Site 46 – Shallow Brown Vertosol

Table 19 Summary: Shallow Brown Vertosol (Site 46)

Overview

Landscape Site 46

ASC Name	Shallow Brown Vertosol
Representative Site	Site 46
Survey Type	EIS Observation Site
Dominant Topography	Upper Slope
Dominant Land Use	Grazing
Vegetation	Wire Grass, Red Grass
Inherent Soil Fertility	Moderately High
Slope	16%
Aspect	North
Verified	BSAL Exclusion Zone
Land & Soil Capability Class	6

Table 20 Profile: Shallow Brown Vertosol (Site 46)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.25	Dark brown (7.5YR 3/2) silty clay, strongly structured 10-20 mm blocky peds with a strong consistence and rough fabric. Nil mottling, 60% Sandstone >60 m, abundant fine roots. Well drained with a gradual and wavy boundary. Not Sampled
	BC +0.25	Weathered Sandstone Not Sampled

Table 21 Field Parameters: Shallow Brown Vertosol (Site 46)

Layer	Field pH		Field Dispersion
	Unit	Rating	Rating
A1	7.0	Neutral	Non Dispersive

Site 47 – Eutrophic Black Dermosol

Table 22 Summary: Eutrophic Black Dermosol (Site 47)

Overview

Landscape Site 47

ASC Name	Eutrophic Black Dermosol
Representative Site	Site 47
Survey Type	Detail
Dominant Topography	Mid Slope
Dominant Land Use	Cattle Grazing
Vegetation	White Box, Kurrajong, Wire Grass, Red Grass
Inherent Soil Fertility	Moderately High
Slope	12%
Aspect	North
Verified	BSAL Exclusion Zone
Land & Soil Capability Class	4

Table 23 Profile: Eutrophic Black Dermosol (Site 47)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Black (5YR 2.5/1) clay loam, strongly structured 10 mm subangular blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Moderately drained with a gradual and even boundary. Sampled 0.0 – 0.10
	B21 0.15– 0.30	Dark reddish brown (5YR 3/2) medium clay moderately structured 10-20 mm subangular blocky peds with moderate consistence and a rough fabric. Nil mottling; nil stone content, coarse roots common. Moderately drained with a gradual and even boundary. Sampled 0.20 – 0.30
	B22 0.30 – 0.50	Dark yellowish brown (10YR 3/4) clay loam, moderately structured 10-20 mm subangular blocky peds with moderate consistence and a rough fabric. Nil mottling; nil stone content, coarse roots common. Moderately drained with a gradual and even boundary. Sampled 0.40 – 0.50
	BC +0.50	Weathered Sandstone Not Sampled

Table 24 Chemical Parameters: Eutrophic Black Dermosol (Site 47)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.7	Neutral	0.6	Non Sodic	0.7	Non-Saline	2.3	Low
B21	7.3	Mildly Alkaline	0.9	Non Sodic	0.3	Non-Saline	2.1	Low
B22	8.0	Moderately Alkaline	1.5	Non Sodic	0.9	Non-Saline	2.3	Low

Site 48 – Eutrophic Red Chromosol

Table 25 Summary: Eutrophic Red Chromosol (Site 48)

Overview	
 Landscape Site 48	
ASC Name	Eutrophic Red Chromosol
Representative Site	Site 48
Survey Type	Detail
Dominant Topography	Upper Slope
Dominant Land Use	Grazing
Vegetation	White Box, Kurrajong, Wire Grass, Red Grass, Corkscrew Grass
Inherent Soil Fertility	Moderately High
Slope	12%
Aspect	West
Verified	BSAL Exclusion Zone
Land & Soil Capability Class	4

Table 26 Profile: Eutrophic Red Chromosol (Site 48)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Dark brown (7.5YR 3/3) loam, weakly structured 10-20 mm subangular blocky peds with moderate consistence and a sandy fabric. Nil mottling, nil stone content, abundant fine roots. Poorly drained with a gradual and even boundary. Sampled 0.0 – 0.10
	A2 0.15– 0.35	Brown (7.5YR 4/3) loam, very weakly structured <10 mm blocky peds with moderate consistence and a rough fabric. Nil mottling; nil stone content, abundant fine roots. Poorly drained with a clear and even boundary. Sampled 0.20 – 0.30
	B2 0.35 – 0.60	Reddish brown (5YR 4/4) light clay, massive structure. Nil mottling; 10% gravel 5-10 mm, coarse roots common. Poorly drained with a gradual and even boundary. Sampled 0.40 – 0.50
	BC +0.60	Weathered Sandstone Not Sampled

Table 27 Chemical Parameters: Eutrophic Red Chromosol (Site 48)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.2	Slightly Acidic	0.6	Non Sodic	0.3	Non-Saline	4.1	Balanced
B21	6.1	Slightly Acidic	0.7	Non Sodic	0.2	Non-Saline	4.4	Balanced
B22	6.9	Neutral	1.0	Non Sodic	0.3	Non-Saline	4.4	Balanced

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Site 49 – Eutrophic Red Chromosol

Table 28 Summary: Eutrophic Red Chromosol (Site 49)

Overview	
 **Landscape Site 49**	
ASC Name	Eutrophic Red Chromosol
Representative Site	Site 49
Survey Type	Detail
Dominant Topography	Upper Slope
Dominant Land Use	Cattle Grazing
Vegetation	White Box, Wire Grass, Corkscrew Grass
Inherent Soil Fertility	Moderately High
Slope	16%
Aspect	South East
Verified	BSAL Exclusion Zone
Land & Soil Capability Class	4

Table 29 Profile: Eutrophic Red Chromosol (Site 49)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.30	Dark brown (7.5YR 3/2) loam, strongly structured 20-50 mm subangular blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.0 – 0.10
	B2 0.30– 0.60	Dark brown (7.5YR 3/2) clay loam, strongly structured 50-100 mm blocky peds with moderate consistence and a rough fabric. Nil mottling; nil stone content, coarse roots common. Well drained with a clear and even boundary. Sampled 0.20 – 0.30 and 0.40 – 0.50
	BC +0.60	Weathered Basalt Not Sampled

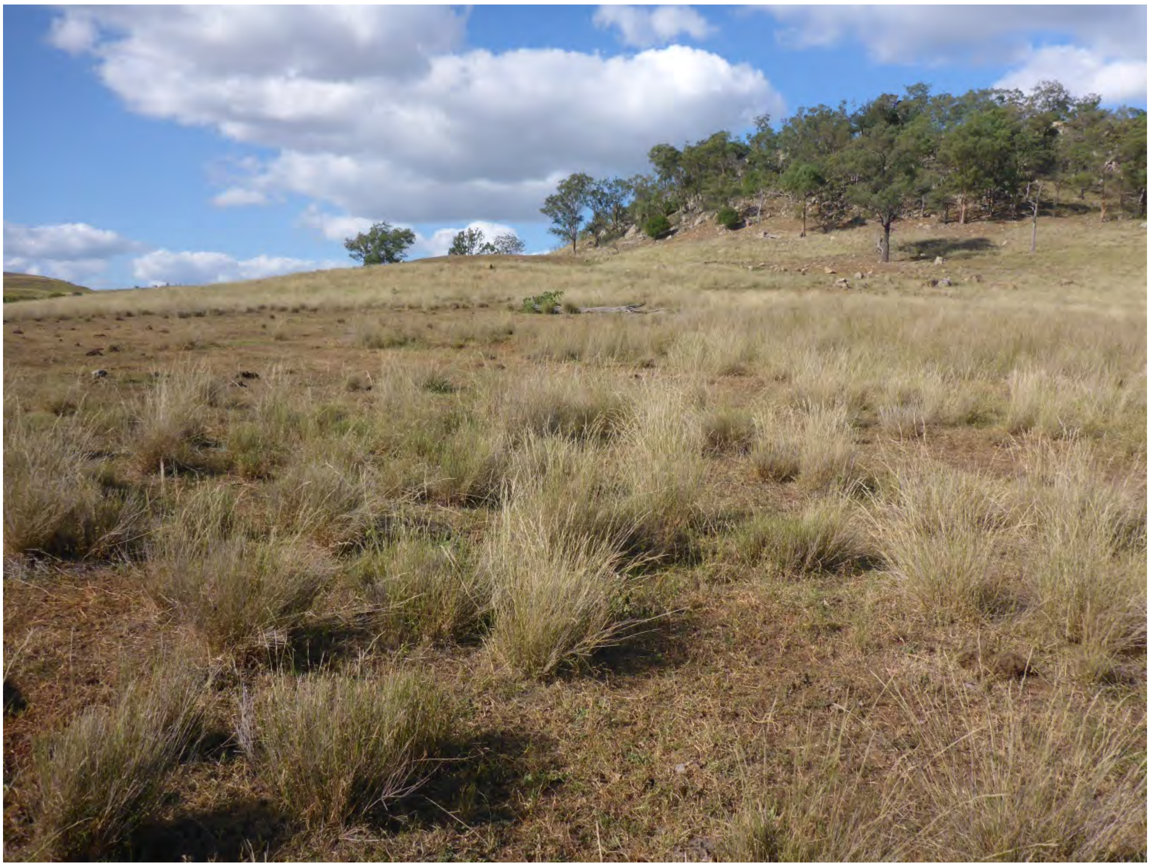
Table 30 Chemical Parameters: Eutrophic Red Chromosol (Site 49)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.1	Slightly Acidic	0.4	Non Sodic	0.4	Non-Saline	5.4	Balanced
B2	6.6	Neutral	1.3	Non Sodic	0.2	Non-Saline	5.0	Balanced
B2	7.2	Neutral	1.3	Non Sodic	0.3	Non-Saline	3.9	Low

Site 50 – Eutrophic Red Chromosol

Table 31 Summary: Eutrophic Red Chromosol (Site 50)

Overview



Landscape Site 50

ASC Name	Eutrophic Red Chromosol
Representative Site	Site 50
Survey Type	Detail
Dominant Topography	Mid Slope
Dominant Land Use	Grazing
Vegetation	Ironbark
Inherent Soil Fertility	Moderately High
Slope	5%
Aspect	West
Verified	BSAL Exclusion Zone
Land & Soil Capability Class	4

Table 32 Profile: Eutrophic Red Chromosol (Site 50)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Dark reddish brown (5YR 3/4) loamy sand, moderately structured 10-20 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.0 – 0.10
	B21 0.15 – 0.50	Dark reddish brown (2.5YR 3/3) clay loam, strongly structured 20-100 mm subangular blocky peds with strong consistence and a rough fabric. Nil mottling; nil stone content, coarse roots common. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30 and 0.40 – 0.50
	B22 +0.50	Reddish brown (5YR 4/3) light clay moderately structured 20-40 mm subangular blocky peds with moderate consistence and a rough fabric. Nil mottling; nil stone content, coarse roots common. Well drained with layer continuing beyond sampling depth. Sampled 0.65 – 0.75

Table 33 Chemical Parameters: Eutrophic Red Chromosol (Site 50)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	5.7	Moderately Acidic	1.8	Non Sodic	1.6	Non-Saline	3.0	Low
B21	6.6	Neutral	2.7	Non Sodic	0.4	Non-Saline	2.4	Low
B21	7.3	Neutral	2.8	Non Sodic	0.5	Non-Saline	1.7	Low
B22	7.7	Mildly Alkaline	2.9	Non Sodic	1.0	Non-Saline	1.2	Low

Site 51 – Shallow Brown Sodosol

Table 34 Summary: Shallow Brown Sodosol (Site 51)

Overview

Landscape Site 51

ASC Name	Shallow Brown Sodosol
Representative Site	Site 51
Survey Type	EIS Observation Site
Dominant Topography	Hill Crest
Dominant Land Use	Grazing
Vegetation	White Box, Kurrajong, Red Grass
Inherent Soil Fertility	Moderately Low
Slope	20%
Aspect	South West
Verified	BSAL Exclusion Zone
Land & Soil Capability Class	6

Table 35 Profile: Shallow Brown Sodosol (Site 51)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.25	Dark brown (7.5YR 3/4) silty loam, strongly structured 10-20 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, 80% Sandstone >60 mm, abundant fine roots. Well drained with a gradual and even boundary. Not Sampled
	BC + 0.25	Weathered Sandstone Not Sampled

Table 36 Field Parameters: Shallow Brown Sodosol (Site 51)

Layer	Field pH		Field Dispersion
	Unit	Rating	Rating
A1	7.0	Neutral	Non-Dispersive

Site 52 – Eutrophic Red Chromosol

Table 37 Summary: Eutrophic Red Chromosol (Site 52)

Overview	
 Landscape Site 52	
ASC Name	Eutrophic Red Chromosol
Representative Site	Site 52
Survey Type	Detail
Dominant Topography	Mid Slope
Dominant Land Use	Grazing
Vegetation	Grey Box, Wire Grass, Red Grass
Inherent Soil Fertility	Moderately High
Slope	14%
Aspect	North
Verified	BSAL Exclusion Zone
Land & Soil Capability Class	4

Table 38 Profile: Eutrophic Red Chromosol (Site 52)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Dark reddish brown (5YR 3/2) silty loam, strongly structured 10-20 mm subangular blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.0 – 0.10
	B2 0.15 – 0.60	Reddish brown (5YR 4/3) light-medium clay, strongly structured 20-50 mm blocky peds with strong consistence and a rough fabric. Nil mottling; nil stone content, coarse roots common. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30 and 0.40 – 0.50
	C +0.60	Sandstone Not Sampled

Table 39 Chemical Parameters: Eutrophic Red Chromosol (Site 52)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.1	Slightly Acidic	0.4	Non Sodic	0.7	Non-Saline	3.4	Low
B2	6.6	Neutral	0.8	Non Sodic	0.3	Non-Saline	2.1	Low
B2	7.7	Mildly Alkaline	1.5	Non Sodic	0.3	Non-Saline	1.9	Low

Site 53 – Shallow Brown Vertosol

Table 40 Summary: Shallow Brown Vertosol (Site 53)

Overview	
 Landscape Site 53	
ASC Name	Shallow Brown Vertosol
Representative Site	Site 53
Survey Type	EIS Observation Site
Dominant Topography	Upper Slope
Dominant Land Use	Grazing
Vegetation	White Box, Wire Grass
Inherent Soil Fertility	Moderately High
Slope	10%
Aspect	North
Verified	BSAL Exclusion Zone
Land & Soil Capability Class	6

Table 41 Profile: Shallow Brown Vertosol (Site 53)

Profile	Horizon / Depth (m)	Description
	A 0.0 – 0.25	Reddish brown (7.5YR 4/3) clay loam, strongly structured 20-40 mm blocky peds with strong consistence and a smooth fabric. Nil mottling, nil stone content, abundant fine roots. Well drained with a gradual and even boundary. Not Sampled
	BC +0.25	Weathered Sandstone Not Sampled

Table 42 Field Parameters: Shallow Brown Vertosol (Site 53)

Layer	Field pH		Field Dispersion
	Unit	Rating	Rating
A1	7.0	Neutral	Slightly Dispersive

Appendix B

Laboratory Certificates of Analysis

Appendix B

Map Site & Laboratory Results Correlation

Samples were collected for the Land & Soil Capability Assessment during the Biophysical Strategic Agricultural Land Verification Assessment field program and were labelled as EIS samples. **Table 1** below shows the correlation between the map label and lab sample name for each of the sites tested. Sites 40, 46, 51 and 53 were Check Sites and as such were not lab tested.

Table 1 Site Correlation Table

Map Site	Lab Name
40	-
41	EIS2
42	EIS3
43	EIS4
44	EIS5
45	EIS6
46	-
47	EIS8
48	EIS9
49	EIS10
50	EIS11
51	-
52	EIS13
53	-

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

AGRICULTURAL SOIL ANALYSIS REPORT

34 samples supplied by SLR Consulting Australia Pty Ltd on 1st February, 2019. Lab Job No.H8053

Analysis requested by Murray Fraser. Your Job: SLR630.12463.001 EIS

10 Kings Road NEW LAMBTON NSW 2305

Parameter	Unit	Method reference	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7
		Sample ID:	EIS 2 0-10	EIS 2 20-30	EIS 2 40-50	EIS 2 65-75	EIS 3 0-10	EIS 3 20-30	EIS 3 40-50
		Crop:	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Client:	Maxwell EIS	Maxwell EIS	Maxwell EIS	Maxwell EIS	Maxwell EIS	Maxwell EIS	Maxwell EIS
Parameter		**Method reference**	**H8053/1**	**H8053/2**	**H8053/3**	**H8053/4**	**H8053/5**	**H8053/6**	**H8053/7**
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	6.25	6.03	8.00	8.12	5.88	6.60	8.00
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.56	6.78	8.61	8.79	6.28	7.19	8.58
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.084	0.040	0.126	0.149	0.047	0.050	0.098
Exchangeable Calcium	($cmol_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	10.78	14.12	23.78	26.13	6.63	14.67	18.97
	(kg/ha)		4841	6340	10674	11732	2974	6586	8514
	(mg/kg)		2161	2831	4765	5237	1328	2940	3801
Exchangeable Magnesium	($cmol_+$/kg)		4.51	10.11	12.20	13.48	1.68	4.09	4.16
	(kg/ha)		1229	2753	3320	3671	456	1114	1133
	(mg/kg)		548	1229	1482	1639	204	497	506
Exchangeable Potassium	($cmol_+$/kg)		1.13	0.84	0.59	0.42	1.12	1.02	0.79
	(kg/ha)		989	739	518	368	979	897	690
	(mg/kg)		442	330	231	164	437	401	308
Exchangeable Sodium	($cmol_+$/kg)		0.11	0.23	0.36	0.80	<0.065	0.17	0.25
	(kg/ha)		58	117	186	411	<33	88	130
	(mg/kg)		26	52	83	183	<15	39	58
Exchangeable Aluminium	($cmol_+$/kg)	**Inhouse S37 (KCl)	0.02	0.02	0.01	0.01	0.02	0.01	0.01
	(kg/ha)		4	4	2	2	3	2	2
	(mg/kg)		2	2	<1	<1	1	<1	<1
Exchangeable Hydrogen	($cmol_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.07	<0.01	<0.01	<0.01	0.03	<0.01	<0.01
	(kg/ha)		2	<1	<1	<1	<1	<1	<1
	(mg/kg)		<1	<1	<1	<1	<1	<1	<1
Effective Cation Exchange Capacity (ECEC) ($cmol_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H ($cmol_+$/kg)	16.63	25.33	36.94	40.85	9.51	19.97	24.18
Calcium (%)		**Base Saturation Calculations - Cation $cmol_+$/kg / ECEC x 100	64.8	55.8	64.4	64.0	69.6	73.5	78.4
Magnesium (%)			27.1	39.9	33.0	33.0	17.6	20.5	17.2
Potassium (%)			6.8	3.3	1.6	1.0	11.8	5.1	3.3
Sodium - ESP (%)			0.7	0.9	1.0	2.0	0.5	0.9	1.0
Aluminium (%)			0.1	0.1	0.0	0.0	0.2	0.1	0.0
Hydrogen			0.4	0.0	0.0	0.0	0.3	0.0	0.0
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium ($cmol_+$/kg)	2.4	1.4	1.9	1.9	4.0	3.6	4.6
Chloride Estimate (equiv. mg/kg)		**Calculation: Electrical Conductivity x 640	54	26	81	95	30	32	63
Colour (Munsell Soil Colour Classification) - Hue/Colour, Value/Chroma		**Inhouse	7.5YR 3/3	5YR 4/3	7.5YR 4/3	10YR 5/6	7.5YR 3/2	7.5YR 3/2	10YR 5/4
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	--	--	--	10YR 5/2 15%	--	--	7.5YR 5/6 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: Collingwood.
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11. Conversions to kg/ha = mg/kg x 2.24
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Quality Checked: Kris Saville
Agricultural Co-Ordinator

KS

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

Southern Cross University

CRICOS Provider: 01241G

ASPAC

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

Environmental Analysis Laboratory

AGRICULTURAL SOIL ANALYSIS REPORT

34 samples supplied by SLR Consulting Australia Pty Ltd on 1st February, 2019. Lab Job No.H8053

Analysis requested by Murray Fraser. Your Job: SLR630.12463.001 EIS

10 Kings Road NEW LAMBTON NSW 2305

			Sample 8	Sample 9	Sample 10	Sample 11	Sample 12	Sample 13	Sample 14
		Sample ID:	EIS 4 0-10	EIS 4 20-30	EIS 4 40-50	EIS 4 65-75	EIS 5 0-10	EIS 5 20-30	EIS 5 40-50
		Crop:	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Client:	Maxwell EIS	Maxwell EIS	Maxwell EIS	Maxwell EIS	Maxwell EIS	Maxwell EIS	Maxwell EIS
Parameter		**Method reference**	**H8053/8**	**H8053/9**	**H8053/10**	**H8053/11**	**H8053/12**	**H8053/13**	**H8053/14**
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	5.72	7.59	8.14	8.27	5.46	5.76	6.50
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.37	8.11	8.81	9.13	6.06	6.34	7.10
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.075	0.198	0.153	0.234	0.054	0.041	0.058
Exchangeable Calcium	(cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	10.80	19.76	26.60	23.35	11.33	14.27	24.91
	(kg/ha)		4848	8870	11940	10484	5087	6407	11184
	(mg/kg)		2164	3960	5330	4680	2271	2860	4993
Exchangeable Magnesium	(cmol+/kg)		4.81	8.44	11.39	14.49	2.78	3.76	7.38
	(kg/ha)		1310	2298	3102	3945	755	1024	2010
	(mg/kg)		585	1026	1385	1761	337	457	897
Exchangeable Potassium	(cmol+/kg)		1.68	1.41	0.93	0.60	1.18	0.54	0.21
	(kg/ha)		1472	1234	815	529	1036	477	186
	(mg/kg)		657	551	364	236	463	213	83
Exchangeable Sodium	(cmol+/kg)		0.08	0.23	0.73	2.00	0.09	0.14	0.31
	(kg/ha)		39	120	376	1029	45	70	162
	(mg/kg)		17	54	168	459	20	31	72
Exchangeable Aluminium	(cmol+/kg)	**Inhouse S37 (KCl)	0.02	0.02	0.02	0.01	0.02	0.02	0.03
	(kg/ha)		4	4	4	3	5	5	5
	(mg/kg)		2	2	2	1	2	2	2
Exchangeable Hydrogen	(cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.04	<0.01	<0.01	<0.01	0.08	0.04	<0.01
	(kg/ha)		<1	<1	<1	<1	2	<1	<1
	(mg/kg)		<1	<1	<1	<1	<1	<1	<1
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	17.43	29.86	39.67	40.46	15.48	18.78	32.85
Calcium (%)		**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	61.9	66.2	67.0	57.7	73.2	76.0	75.8
Magnesium (%)			27.6	28.3	28.7	35.8	17.9	20.0	22.5
Potassium (%)			9.6	4.7	2.3	1.5	7.6	2.9	0.6
Sodium - ESP (%)			0.4	0.8	1.8	4.9	0.6	0.7	1.0
Aluminium (%)			0.1	0.1	0.1	0.0	0.1	0.1	0.1
Hydrogen			0.2	0.0	0.0	0.0	0.5	0.2	0.0
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol+/kg)	2.2	2.3	2.3	1.6	4.1	3.8	3.4
Chloride Estimate (equiv. mg/kg)		**Calculation: Electrical Conductivity x 640	48	127	98	150	35	27	37
Colour (Munsell Soil Colour Classification) - Hue/Colour, Value/Chroma		**Inhouse	5YR 3/3	2.5YR 3/4	2.5YR 3/4	2.5YR 3/4	5YR 3/2	2.5YR 3/2	5YR 3/3
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	--	--	--	--	--	--	--

Notes:

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Agricultural Co-Ordinator

KS

Southern Cross University

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ASPAC

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

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Analysis requested by Murray Fraser. Your Job: SLR630.12463.001 EIS

10 Kings Road NEW LAMBTON NSW 2305

			Sample 15	Sample 16	Sample 17	Sample 18	Sample 19	Sample 20	Sample 21
		Sample ID:	EIS 6 0-10	EIS 6 20-30	EIS 6 40-50	EIS 6 65-75	EIS 8 0-10	EIS 8 20-30	EIS 8 40-50
		Crop:	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Client:	Maxwell EIS	Maxwell EIS	Maxwell EIS	Maxwell EIS	Maxwell EIS	Maxwell EIS	Maxwell EIS
Parameter		**Method reference**	**H8053/15**	**H8053/16**	**H8053/17**	**H8053/18**	**H8053/19**	**H8053/20**	**H8053/21**
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	5.62	6.54	8.20	8.36	6.43	6.65	7.54
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.44	7.43	9.02	9.16	6.68	7.34	8.01
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.051	0.044	0.191	0.367	0.084	0.041	0.105
Exchangeable Calcium	(cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	6.51	9.49	23.86	20.70	21.80	32.42	28.30
	(kg/ha)		2921	4260	10711	9293	9788	14553	12706
	(mg/kg)		1304	1902	4782	4148	4369	6497	5672
Exchangeable Magnesium	(cmol+/kg)		6.33	10.35	12.23	14.22	9.51	15.73	12.32
	(kg/ha)		1722	2816	3328	3870	2589	4283	3355
	(mg/kg)		769	1257	1486	1728	1156	1912	1498
Exchangeable Potassium	(cmol+/kg)		1.21	1.22	0.67	0.47	0.50	0.33	0.26
	(kg/ha)		1060	1066	589	415	434	286	225
	(mg/kg)		473	476	263	185	194	128	100
Exchangeable Sodium	(cmol+/kg)		0.29	0.56	1.31	2.74	0.18	0.44	0.64
	(kg/ha)		148	286	672	1411	92	228	329
	(mg/kg)		66	128	300	630	41	102	147
Exchangeable Aluminium	(cmol+/kg)	**Inhouse S37 (KCl)	0.03	0.02	0.02	0.02	0.01	0.02	0.02
	(kg/ha)		5	4	3	3	3	3	3
	(mg/kg)		2	2	2	1	1	1	2
Exchangeable Hydrogen	(cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.06	<0.01	<0.01	<0.01	0.07	<0.01	<0.01
	(kg/ha)		1	<1	<1	<1	2	<1	<1
	(mg/kg)		<1	<1	<1	<1	<1	<1	<1
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	14.42	21.63	38.08	38.15	32.07	48.94	41.54
Calcium (%)		**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	45.1	43.9	62.7	54.3	68.0	66.2	68.1
Magnesium (%)			43.9	47.8	32.1	37.3	29.6	32.1	29.7
Potassium (%)			8.4	5.6	1.8	1.2	1.5	0.7	0.6
Sodium - ESP (%)			2.0	2.6	3.4	7.2	0.6	0.9	1.5
Aluminium (%)			0.2	0.1	0.0	0.0	0.0	0.0	0.0
Hydrogen			0.4	0.0	0.0	0.0	0.2	0.0	0.0
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol+/kg)	1.0	0.9	2.0	1.5	2.3	2.1	2.3
Chloride Estimate (equiv. mg/kg)		**Calculation: Electrical Conductivity x 640	33	28	122	235	54	26	67
Colour (Munsell Soil Colour Classification) - Hue/Colour, Value/Chroma		**Inhouse	5YR 4/4	5YR 4/4	7.5YR 5/4	7.5YR 5/6	5YR2.5/1	5YR 3/2	10YR 3/4
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	--	--	--	--	--	--	--

Notes:

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2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia*. CSIRO Publishing: Collingwood.
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KS

Southern Cross University

ASPAC

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal
ABN: 41 995 651 524

AGRICULTURAL SOIL ANALYSIS REPORT

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Analysis requested by Murray Fraser. Your Job: SLR630.12463.001 EIS
10 Kings Road NEW LAMBTON NSW 2305

Parameter	Unit	Method reference	Sample 22	Sample 23	Sample 24	Sample 25	Sample 26	Sample 27	Sample 28
		Sample ID:	EIS 9 0-10	EIS 9 20-30	EIS 9 40-50	EIS 10 0-10	EIS 10 20-30	EIS 10 40-50	EIS 11 0-10
		Crop:	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Client:	Maxwell EIS	Maxwell EIS	Maxwell EIS	Maxwell EIS	Maxwell EIS	Maxwell EIS	Maxwell EIS
			H8053/22	H8053/23	H8053/24	H8053/25	H8053/26	H8053/27	H8053/28
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	5.32	5.17	6.20	5.72	5.88	6.39	5.14
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.19	6.06	6.92	6.12	6.59	7.19	5.70
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.027	0.023	0.031	0.039	0.022	0.038	0.075
Exchangeable Calcium	($cmol_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	3.92	3.81	9.41	7.93	6.80	10.86	4.68
	(kg/ha)		1758	1710	4223	3562	3054	4874	2103
	(mg/kg)		785	763	1885	1590	1363	2176	939
Exchangeable Magnesium	($cmol_+$/kg)		0.96	0.86	2.15	1.48	1.35	2.77	1.57
	(kg/ha)		260	234	585	403	369	754	428
	(mg/kg)		116	104	261	180	165	336	191
Exchangeable Potassium	($cmol_+$/kg)		0.72	0.81	0.64	1.12	0.50	0.70	1.55
	(kg/ha)		629	712	563	977	442	613	1360
	(mg/kg)		281	318	251	436	197	274	607
Exchangeable Sodium	($cmol_+$/kg)		<0.065	<0.065	0.12	<0.065	0.11	0.18	0.15
	(kg/ha)		<33	<33	62	<33	58	94	75
	(mg/kg)		<15	<15	28	<15	26	42	33
Exchangeable Aluminium	($cmol_+$/kg)	**Inhouse S37 (KCl)	0.02	0.04	0.02	0.02	0.02	0.02	0.05
	(kg/ha)		4	8	4	4	4	4	9
	(mg/kg)		2	4	2	2	2	2	4
Exchangeable Hydrogen	($cmol_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.05	0.09	<0.01	0.07	0.04	<0.01	0.20
	(kg/ha)		1	2	<1	2	<1	<1	4
	(mg/kg)		<1	<1	<1	<1	<1	<1	2
Effective Cation Exchange Capacity (ECEC) ($cmol_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H ($cmol_+$/kg)	5.70	5.65	12.34	10.67	8.83	14.53	8.20
Calcium (%)		**Base Saturation Calculations - Cation $cmol_+$/kg / ECEC x 100	68.8	67.5	76.2	74.4	77.1	74.7	57.1
Magnesium (%)			16.8	15.2	17.4	13.9	15.3	19.1	19.2
Potassium (%)			12.6	14.4	5.2	10.5	5.7	4.8	18.9
Sodium - ESP (%)			0.6	0.7	1.0	0.4	1.3	1.3	1.8
Aluminium (%)			0.4	0.7	0.2	0.2	0.2	0.1	0.6
Hydrogen			0.9	1.5	0.0	0.7	0.4	0.0	2.4
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium ($cmol_+$/kg)	4.1	4.4	4.4	5.4	5.0	3.9	3.0
Chloride Estimate (equiv. mg/kg)		**Calculation: Electrical Conductivity x 640	17	15	20	25	14	24	48
Colour (Munsell Soil Colour Classification) - Hue/Colour, Value/Chroma		**Inhouse	7.5YR 3/3	7.5YR 4/3	5YR 4/4	7.5YR 3/2	7.5YR 3/2	5YR 4/3	5YR 3/4
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	7.5YR 5/6 2%	2.5YR 5/6 2%	--	--	--	--	--

Notes:

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Southern Cross University

ASPAC

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Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
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			Sample 29	Sample 30	Sample 31	Sample 32	Sample 33	Sample 34
		Sample ID:	EIS 11 20-30	EIS 11 40-50	EIS 11 65-75	EIS 13 0-10	EIS 13 20-30	EIS 13 40-50
		Crop:	N/A	N/A	N/A	N/A	N/A	N/A
		Client:	Maxwell EIS	Maxwell EIS	Maxwell EIS	Maxwell EIS	Maxwell EIS	Maxwell EIS
Parameter		**Method reference**	**H8053/29**	**H8053/30**	**H8053/31**	**H8053/32**	**H8053/33**	**H8053/34**
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	5.91	6.57	7.06	5.59	5.85	6.89
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.63	7.30	7.73	6.10	6.62	7.69
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.053	0.068	0.120	0.068	0.036	0.044
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	7.71	13.17	12.25	11.11	12.47	12.70
	(kg/ha)		3460	5914	5499	4986	5597	5699
	(mg/kg)		1545	2640	2455	2226	2499	2544
Exchangeable Magnesium	(cmol$_+$/kg)		3.22	7.97	9.87	3.28	5.92	6.85
	(kg/ha)		878	2168	2688	892	1611	1865
	(mg/kg)		392	968	1200	398	719	832
Exchangeable Potassium	(cmol$_+$/kg)		1.08	0.95	0.28	2.02	1.02	0.62
	(kg/ha)		942	832	243	1773	897	542
	(mg/kg)		421	371	109	791	400	242
Exchangeable Sodium	(cmol$_+$/kg)		0.34	0.65	0.68	<0.065	0.16	0.30
	(kg/ha)		175	334	349	<33	80	156
	(mg/kg)		78	149	156	<15	36	69
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.02	0.02	0.02	0.03	0.02	0.03
	(kg/ha)		5	5	5	5	5	5
	(mg/kg)		2	2	2	2	2	2
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.04	<0.01	<0.01	0.06	0.04	<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)	12.41	22.76	23.10	16.55	19.63	20.49
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	62.1	57.9	53.0	67.1	63.5	62.0
Magnesium (%)			26.0	35.0	42.7	19.8	30.1	33.4
Potassium (%)			8.7	4.2	1.2	12.2	5.2	3.0
Sodium - ESP (%)			2.7	2.8	2.9	0.4	0.8	1.5
Aluminium (%)			0.2	0.1	0.1	0.2	0.1	0.1
Hydrogen			0.3	0.0	0.0	0.0	0.3	0.2	0.0
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	2.4	1.7	1.2	3.4	2.1	1.9
Chloride Estimate (equiv. mg/kg)		**Calculation: Electrical Conductivity x 640	34	44	77	44	23	28
Colour (Munsell Soil Colour Classification) - Hue/Colour, Value/Chroma		**Inhouse	2.5YR 3/3	5YR 4/4	5YR 4/3	5YR 3/2	5YR 4/3	5YR 4/4
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	--	--	7.5YR 2.5/1 15%	--	5YR 5/8 3%	5YR 6/8 5%

Notes:

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

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

AGRICULTURAL SOIL ANALYSIS REPORT

34 samples supplied by SLR Consulting Australia Pty Ltd on 1st February, 2019. Lab Job No.H8053

Analysis requested by Murray Fraser. Your Job: SLR630.12463.001 EIS

10 Kings Road NEW LAMBTON NSW 2305

			Heavy Soil	Medium Soil	Light Soil	Sandy Soil
		Sample ID:				
		Crop:				
		Client:	Clay	Clay Loam	Loam	Loamy Sand
Parameter		**Method reference**	**Indicative guidelines - refer to Notes 6 and 8**			
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	..			
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 (%) / Hydrogen			6.0	7.1	10.5	12.1
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol+/kg)	6.5	6.4	4.2	3.2
Chloride Estimate (equiv. mg/kg)		**Calculation: Electrical Conductivity x 640	..	..	..	..
Colour (Munsell Soil Colour Classification) - Hue/Colour, Value/Chroma		**Inhouse	..			
Colour (Munsell Soil Colour Classification) - Mottle Hue, Value/Chroma, Proportion		**Inhouse	..			

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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Quality Checked: Kris Saville
Agricultural Co-Ordinator

KS

GRAIN SIZE ANALYSIS (hydrometer and sieving techniques)

34 soil samples supplied by SLR Consulting Australia Pty Ltd on 1 February, 2019 - Lab Job No. H8053
Analysis requested by Murray Fraser.
(10 Kings Road NEW LAMBTON NSW 2305)

SAMPLE ID	Lab Code	MOISTURE CONTENT (% of water in air-dry 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)
EIS 2 0-10	H8053/1	6.5%	1.9%	14.0%	40.0%	16.3%	27.8%	100.0%
EIS 2 20-30	H8053/2	12.4%	0.2%	6.1%	24.1%	21.8%	47.9%	100.0%
EIS 2 40-50	H8053/3	12.5%	1.0%	4.6%	18.2%	28.8%	47.4%	100.0%
EIS 2 65-75	H8053/4	10.3%	1.3%	4.9%	21.1%	35.4%	37.2%	100.0%
EIS 3 0-10	H8053/5	4.2%	1.2%	34.8%	36.9%	15.3%	11.8%	100.0%
EIS 3 20-30	H8053/6	10.7%	2.2%	18.8%	37.9%	4.1%	37.0%	100.0%
EIS 3 40-50	H8053/7	9.6%	1.9%	15.4%	33.4%	11.7%	37.6%	100.0%
EIS 4 0-10	H8053/8	8.6%	16.8%	16.0%	37.1%	10.7%	19.4%	100.0%
EIS 4 20-30	H8053/9	13.3%	17.8%	11.9%	28.3%	10.7%	31.2%	100.0%
EIS 4 40-50	H8053/10	10.1%	10.3%	18.4%	24.7%	16.4%	30.2%	100.0%
EIS 4 65-75	H8053/11	8.9%	3.5%	23.2%	27.4%	14.3%	31.5%	100.0%
EIS 5 0-10	H8053/12	7.0%	2.3%	6.3%	51.8%	20.6%	19.0%	100.0%
EIS 5 20-30	H8053/13	9.7%	0.7%	4.6%	42.0%	23.0%	29.6%	100.0%
EIS 5 40-50	H8053/14	13.1%	0.0%	3.2%	35.1%	28.5%	33.3%	100.0%
EIS 6 0-10	H8053/15	9.8%	0.3%	12.3%	36.6%	13.0%	37.8%	100.0%
EIS 6 20-30	H8053/16	13.2%	0.1%	9.0%	27.4%	14.7%	48.7%	100.0%
EIS 6 40-50	H8053/17	10.9%	0.4%	6.8%	18.5%	27.6%	46.8%	100.0%
EIS 6 65-75	H8053/18	10.4%	0.7%	5.3%	18.6%	25.6%	49.8%	100.0%
EIS 8 0-10	H8053/19	11.8%	0.4%	12.4%	41.1%	19.6%	26.5%	100.0%
EIS 8 20-30	H8053/20	16.7%	0.0%	8.2%	28.6%	16.9%	46.3%	100.0%
EIS 8 40-50	H8053/21	13.0%	2.2%	22.8%	42.0%	9.9%	23.2%	100.0%
EIS 9 0-10	H8053/22	3.1%	1.6%	54.3%	20.4%	13.1%	10.6%	100.0%
EIS 9 20-30	H8053/23	3.9%	3.5%	52.7%	18.4%	13.4%	11.9%	100.0%
EIS 9 40-50	H8053/24	8.2%	4.3%	41.6%	9.3%	11.1%	33.8%	100.0%
EIS 10 0-10	H8053/25	3.9%	0.2%	38.0%	35.7%	10.6%	15.5%	100.0%
EIS 10 20-30	H8053/26	5.2%	2.0%	42.4%	21.3%	19.8%	14.5%	100.0%
EIS 10 40-50	H8053/27	7.1%	0.7%	37.2%	19.7%	11.1%	31.3%	100.0%
EIS 11 0-10	H8053/28	3.8%	0.2%	30.1%	47.0%	15.3%	7.3%	100.0%
EIS 11 20-30	H8053/29	9.8%	1.3%	30.7%	33.9%	10.0%	24.2%	100.0%
EIS 11 40-50	H8053/30	14.4%	0.4%	15.8%	22.4%	13.6%	47.8%	100.0%
EIS 11 65-75	H8053/31	12.2%	0.6%	18.6%	25.7%	16.7%	38.4%	100.0%
EIS 13 0-10	H8053/32	6.2%	0.4%	18.0%	39.3%	25.5%	16.8%	100.0%
EIS 13 20-30	H8053/33	10.2%	0.2%	21.9%	19.0%	18.0%	40.9%	100.0%
EIS 13 40-50	H8053/34	10.1%	0.2%	30.7%	12.3%	15.3%	41.5%	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: All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions.
These Terms and Conditions are available on the EAL website: scu.edu.au/eal, or on request.

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

Appendix C

Land & Soil Capability Assessment Tables

Table 1 Land & Soil Capability Assessment (SLR 2018-2019 Sites)

Soil Type		Hazard Criteria								
Site	ASC Name	1 Water Erosion	2 Wind Erosion	3 Structure	4 Acidity	5 Salinity	6 Waterlogging	7 Soil Depth	8 Movement	LSC Class
1	Eutrophic Red Dermosol	3	2	4	3	3	1	1	1	**4**
2	Subnatric Red Sodosol	4	3	4	4	3	6	4	1	**6**
3	Eutrophic Red Chromosol	3	5	4	3	3	3	4	1	**5**
4	Epipedal Black Vertosol	3	2	4	2	3	1	4	1	**4**
5	Epipedal Brown Vertosol	3	2	1	1	3	1	1	1	**3**
6	Eutrophic Red Chromosol	2	5	3	3	3	3	4	1	**5**
7	Eutrophic Brown Chromosol	4	2	4	3	3	3	4	1	**4**
8	Epipedal Black Vertosol	5	2	4	1	3	1	1	1	**5**
9	Epipedal Brown Vertosol	3	2	3	2	3	1	1	1	**3**
10	Eutrophic Brown Chromosol	3	2	4	4	3	1	4	1	**4**
11	Eutrophic Grey Dermosol	3	2	4	4	3	2	1	1	**4**
12	Epipedal Black Vertosol	3	2	1	1	3	1	2	1	**3**
14	Mottled-Subnatric Red Sodosol	5	3	4	4	3	6	4	1	**6**

TOC

Soil Type		Hazard Criteria								
Site	ASC Name	1 Water Erosion	2 Wind Erosion	3 Structure	4 Acidity	5 Salinity	6 Waterlogging	7 Soil Depth	8 Movement	LSC Class
15	Eutrophic Brown Chromosol	3	2	4	3	3	2	3	1	**4**
16	Subnatric Brown Sodosol	3	2	3	4	3	2	1	1	**4**
17	Subnatric Brown Sodosol	3	3	4	5	3	2	1	1	**5**
18	Mottled-Mesonatric Brown Sodosol	2	5	4	4	3	6	1	1	**6**
19	Eutrophic Brown Dermosol	3	2	4	3	3	2	1	1	**4**
22	Mottled-Subnatric Brown Sodosol	5	3	4	3	3	6	2	1	**6**
24	Eutrophic Brown Chromosol	5	2	4	4	3	3	1	1	**5**
25	Subnatric Brown Sodosol	5	2	4	4	3	2	1	1	**5**
26	Subnatric Grey Sodosol	3	2	4	4	3	2	1	1	**4**
27	Subnatric Brown Sodosol	6	2	4	4	3	2	4	1	**6**
30	Epipedal Brown Vertosol	3	2	1	2	3	1	1	1	**3**
31	Subnatric Black Sodosol	4	2	3	4	3	2	1	1	**4**
32	Hypernatric Brown Sodosol	3	3	3	4	3	6	1	1	**6**
33	Epipedal Brown Vertosol	3	2	4	1	3	1	1	1	**4**

Soil Type		Hazard Criteria								
Site	ASC Name	1 Water Erosion	2 Wind Erosion	3 Structure	4 Acidity	5 Salinity	6 Waterlogging	7 Soil Depth	8 Movement	LSC Class
34	Epipedal Brown Vertosol	4	2	4	1	3	1	3	1	**4**
35	Mesonatric Brown Sodosol	3	2	4	4	3	2	1	1	**4**
36	Eutrophic Red Chromosol	3	2	4	3	3	2	4	1	**4**
37	Epipedal Red Vertosol	3	2	1	1	3	1	3	1	**3**
38	Eutrophic Red Chromosol	3	2	4	3	3	2	4	1	**4**
39	Eutrophic Red Chromosol	3	2	4	3	3	2	4	1	**4**
41	Epipedal Red Vertosol	4	2	3	2	3	1	3	1	**4**
42	Eutrophic Black Chromosol	4	2	3	3	3	2	4	1	**4**
43	Eutrophic Red Dermosol	4	2	3	3	3	2	1	1	**4**
44	Eutrophic Black Dermosol	4	2	3	3	3	2	4	1	**4**
45	Epipedal Red Vertosol	4	2	1	2	3	1	3	1	**4**
47	Eutrophic Black Dermosol	4	2	3	3	3	2	4	1	**4**
48	Eutrophic Red Chromosol	4	2	3	3	3	3	4	1	**4**
49	Eutrophic Red Chromosol	4	2	3	3	3	2	4	1	**4**

Soil Type		Hazard Criteria								
Site	ASC Name	1 Water Erosion	2 Wind Erosion	3 Structure	4 Acidity	5 Salinity	6 Waterlogging	7 Soil Depth	8 Movement	LSC Class
50	Eutrophic Red Chromosol	3	3	3	4	3	2	1	1	**4**
52	Eutrophic Red Chromosol	4	2	4	3	3	2	4	1	**4**

Table 2 Land & Soil Capability Assessment (SLR 2015 Sites)

Soil Type		Hazard Criteria								
SLR 2015 Site	ASC Name	1 Water Erosion	2 Wind Erosion	3 Structure	4 Acidity	5 Salinity	6 Waterlogging	7 Soil Depth	8 Movement	LSC Class
1	Subnatric Brown Sodosol	3	2	4	4	3	3	1	1	**4**
2	Eutrophic Black Dermosol	3	2	3	3	3	2	1	1	**3**
3	Eutrophic Brown Chromosol	3	2	3	3	3	2	3	1	**3**
4	Subnatric Grey Sodosol	3	2	3	4	3	3	1	1	**4**
5	Eutrophic Brown Chromosol	3	2	3	3	3	2	4	1	**4**
7	Eutrophic Brown Dermosol	3	5	3	3	3	2	1	1	**5**
8	Self-Mulching Brown Vertosol	3	2	1	2	3	1	3	1	**3**
9	Mesonatric Brown Sodosol	3	2	4	4	3	3	1	1	**4**
10	Eutrophic Brown Chromosol	3	2	3	3	3	2	1	1	**3**
11	Self-Mulching Brown Vertosol	3	2	1	1	3	1	1	1	**3**
12	Subnatric Brown Sodosol	3	2	4	4	3	3	1	1	**4**
13	Subnatric Brown Sodosol	3	2	3	4	3	3	1	1	**4**
14	Subnatric Brown Sodosol	3	2	3	4	3	3	1	1	**4**

Soil Type		Hazard Criteria								
SLR 2015 Site	ASC Name	1	2	3	4	5	6	7	8	LSC Class
		Water Erosion	Wind Erosion	Structure	Acidity	Salinity	Waterlogging	Soil Depth	Movement	
15	Eutrophic Brown Dermosol	3	2	3	3	3	2	1	1	**3**
16	Eutrophic Brown Dermosol	3	2	3	3	3	2	1	1	**3**
17	Self-Mulching Red Vertosol	3	2	3	2	3	1	3	1	**3**
18	Self-Mulching Brown Vertosol	3	2	3	2	3	1	1	1	**3**
20	Eutrophic Brown Chromosol	3	2	3	3	3	2	1	1	**3**
21	Eutrophic Brown Chromosol	3	2	3	3	3	2	1	1	**3**
22	Paralithic Hypercalcic Calcarosol	3	2	3	1	3	2	3	1	**3**
23	Subnatric Brown Sodosol	3	2	3	4	3	3	3	1	**4**
24	Eutrophic Red Chromosol	3	3	3	3	3	2	3	1	**3**
25	Eutrophic Brown Chromosol	3	2	3	3	3	2	3	1	**3**
26	Eutrophic Brown Chromosol	3	3	3	3	3	2	3	1	**3**
27	Eutrophic Brown Chromosol	3	2	3	3	3	2	1	1	**3**
28	Eutrophic Yellow Chromosol	4	5	3	3	3	2	1	1	**5**
29	Mottled-Hypernatric Grey Sodosol	3	3	3	4	3	3	1	1	**4**

Soil Type		Hazard Criteria								
SLR 2015 Site	ASC Name	1 Water Erosion	2 Wind Erosion	3 Structure	4 Acidity	5 Salinity	6 Waterlogging	7 Soil Depth	8 Movement	LSC Class
30	Mottled-Subnatric Brown Sodosol	3	2	3	4	3	3	1	1	**4**
31	Subnatric Brown Sodosol	3	2	3	4	3	3	1	1	**4**
32	Self-Mulching Brown Vertosol	3	2	3	3	3	2	3	1	**3**
33	Self-Mulching Brown Vertosol	3	2	1	1	3	1	3	1	**3**
34	Mesonatric Brown Sodosol	3	2	4	4	3	3	1	1	**4**
35	Eutrophic Grey Chromosol	4	2	3	3	3	2	1	1	**4**
36	Eutrophic Brown Chromosol	3	3	3	3	3	2	1	1	**3**
38	Eutrophic Red Chromosol	3	2	4	3	3	2	3	1	**4**
39	Eutrophic Red Chromosol	3	2	4	3	3	2	3	1	**4**
40	Subnatric Brown Sodosol	3	2	3	4	3	3	3	1	**4**
42	Subnatric Grey Sodosol	3	2	3	4	3	3	3	1	**4**
43	Mesonatric Brown Sodosol	3	3	3	4	3	3	1	1	**4**
45	Eutrophic Brown Chromosol	3	2	3	3	3	2	1	1	**3**
46	Subnatric Brown Sodosol	3	2	4	4	3	3	1	1	**4**

Soil Type		Hazard Criteria								
SLR 2015 Site	ASC Name	1	2	3	4	5	6	7	8	LSC Class
		Water Erosion	Wind Erosion	Structure	Acidity	Salinity	Waterlogging	Soil Depth	Movement	
48	Natric Yellow Kurosol	3	3	3	4	3	2	1	1	**4**
49	Hypercalcic Calcarosol	3	2	1	2	3	2	1	1	**3**
52	Eutrophic Brown Chromosol	3	2	3	3	3	2	1	1	**3**
53	Subnatric Red Sodosol	3	2	3	4	3	3	1	1	**4**
54	Eutrophic Brown Chromosol	3	2	3	3	3	2	1	1	**3**
55	Eutrophic Brown Chromosol	3	2	3	3	3	2	1	1	**3**
56	Eutrophic Brown Chromosol	3	2	3	3	3	2	6	1	**6**
57	Eutrophic Brown Chromosol	3	2	3	3	3	2	6	1	**6**
58	Eutrophic Brown Chromosol	3	2	3	3	3	2	6	1	**6**
59	Eutrophic Brown Chromosol	3	2	3	3	3	2	1	1	**3**
61	Self-Mulching Brown Vertosol	3	2	3	3	3	2	3	1	**3**
62	Mesonatric Brown Sodosol	3	2	3	4	3	3	1	1	**4**
63	Mesonatric Red Sodosol	3	3	3	4	3	3	1	1	**4**
65	Subnatric Black Sodosol	3	2	3	4	3	3	1	1	**4**

Soil Type		Hazard Criteria								
SLR 2015 Site	ASC Name	1 Water Erosion	2 Wind Erosion	3 Structure	4 Acidity	5 Salinity	6 Waterlogging	7 Soil Depth	8 Movement	LSC Class
68	Subnatric Brown Sodosol	3	3	4	4	3	3	1	1	**4**
70	Subnatric Brown Sodosol	3	2	3	3	3	3	1	1	**3**
71	Eutrophic Brown Chromosol	3	2	3	3	3	2	1	1	**3**
74	Subnatric Brown Sodosol	3	2	4	4	3	3	1	1	**4**
75	Eutrophic Brown Chromosol	3	2	3	3	3	2	1	1	**3**
76	Mesonatric Brown Sodosol	3	2	3	4	3	3	1	1	**4**