

WAMBO COAL PTY LIMITED



WAMBO COAL MINE LONGWALL 24 TO 26 MODIFICATION

MODIFICATION REPORT

For the Modification of DA 305-7-2003 (MOD 19)
Optimisation and Continued Operation
of the Approved South Bates Extension Underground Mine

APPENDIX G

Agricultural Resource Assessment

WAMBO COAL MINE LONGWALL 24-26 MODIFICATION

Agricultural Resource Assessment

Prepared for:
Wambo Coal Pty Ltd

SLR Ref: 630.30259
Version No: -v0.1
July 2022 Final



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BASIS OF REPORT

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

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DOCUMENT CONTROL

| Reference | Date | Prepared | Checked | Authorised |
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| 630.30259 | July 2022 | Murray Fraser | Rod Masters | Murray Fraser |

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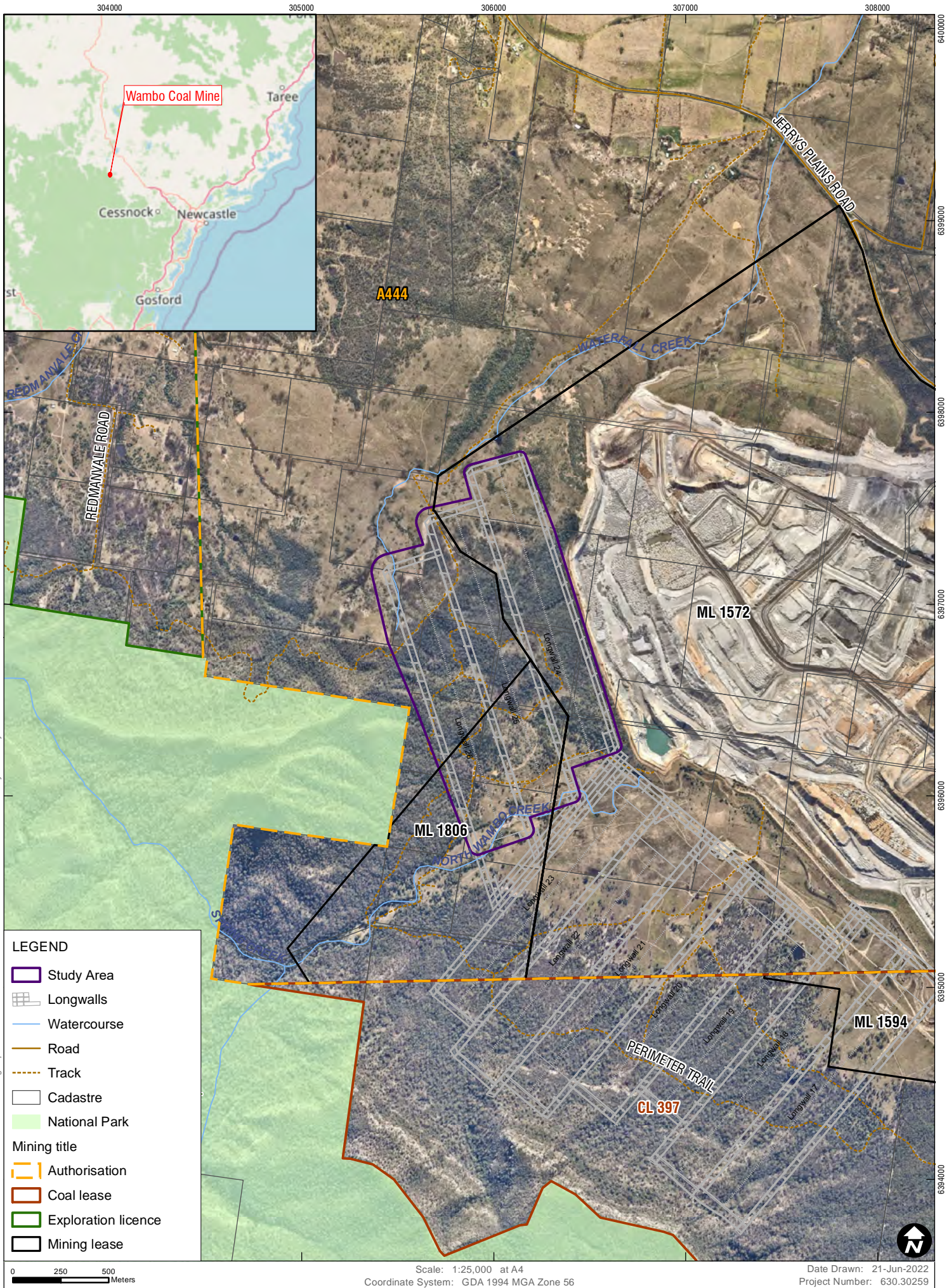
1 Introduction

The Wambo Coal Mine is an underground coal mining operation located approximately 15 kilometres (km) west of Singleton, near the village of Warkworth, New South Wales (NSW) (**Figure 1**). The Wambo Coal Mine is owned and operated by Wambo Coal Pty Ltd (WCPL), a subsidiary of Peabody Energy Australia Pty Limited.

Development Consent (DA 305-7-2003) for the Wambo Coal Mine was granted on 4 February 2004 by the then NSW Minister for Urban Affairs and Planning under Part 4 of the NSW *Environmental Planning and Assessment Act 1979*. A range of open cut and underground mine operations have been conducted at the Wambo Coal Mine since mining operations commenced in 1969. Mining under the Development Consent (DA 305-7-2003) commenced in 2004, with both open cut and underground operations conducted until 2020. From 1 December 2020, the Wambo Coal Mine transitioned into Phase 2 operations which includes underground mining and coal handling and processing.

The South Bates Extension Underground Mine is a component of the approved Wambo Coal Mine Phase 2 operations comprising Longwalls (LWs) 17 to 25 in the Whybrow Seam. WCPL proposes a Modification to Development Consent (DA 305-7-2003) to allow for the reorientation of LWs 24 and 25, and the addition of LW 26 (the Modification). The Modification would require an additional mining lease over a component of Authorisation (A) 444.

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by WCPL to complete an Agricultural Resource Assessment (ARA) to support the Modification application.



Locality
& Study Area

FIGURE 1

H:\Projects\SLR\630-Sr\NT\1630-NT\1630-30259-000000 Wambo Mod LW24 20 Ag Impact Assessment\106 SLR Data\01 CADGIS\GIS\SLR\63030256 F01 Locality and Study Area 202206.mxd

1.1 Study Requirements

The purpose of this ARA is to assess and report on the potential impacts of the Modification on agricultural resources and/or industries within and surrounding the Modified LW panels (Study Area). The term 'agricultural resource' is used to describe the land on which agriculture is dependent and the associated water resources (quality and quantity) that are linked to that land.

A Biophysical Strategic Agricultural Land (BSAL) Assessment (SLR, 2022) for the Modification was completed over areas outside existing WCPL tenements. A Site Verification Certificate was issued on by the NSW Department of Planning and Environment, confirming there is no BSAL in those areas.

1.2 Study Area

The Study Area for this assessment is the land above the proposed LW 24-26 and includes the 26.5° subsidence angle of draw surrounding LW 24-26. and comprises 162 hectares (**Figure 1**).

1.3 Methodology

This ARA was assessed using the methodology set out below:

- A desktop review of all publicly available information relating to the Modification.
- Field visits and site inspections in July 2020 by SLR's Principal Agronomist, Murray Fraser.
- Description of the biophysical environment for the Modification Area and surrounding locality.
- A review of other relevant technical studies which also form part of the Modification application.
- Assessment of potential impacts on agricultural resources and industry, including mitigation measures for any identified impacts.

1.4 Assessment Guidelines & Standards

The key standards for this assessment include:

- *The Land and Soil Capability Assessment Scheme; Second Approximation* (Office of Environment and Heritage [OEH], 2012).
- *Interim protocol for site verification and mapping of biophysical strategic agricultural land* (NSW Government, 2013).
- *Australian Soil Classification* (ASC) system (Isbell, 2002).
- *Guidelines for Surveying Soil and Land Resources* (National Committee on Soil and Terrain [NCST], 2008).
- *Australian Soil and Land Survey Field Handbook* (NCST, 2009).

2 Existing Biophysical Environment

2.1 Climate

Representative climate data for the Modification Area has been obtained from the nearest Bureau of Meteorology (BOM) weather station located at Jerrys Plains Post Office, approximately 5 kilometres to the northwest of the Study Area (BOM Station 061086, Monthly Climate Statistics) (BOM, 2022).

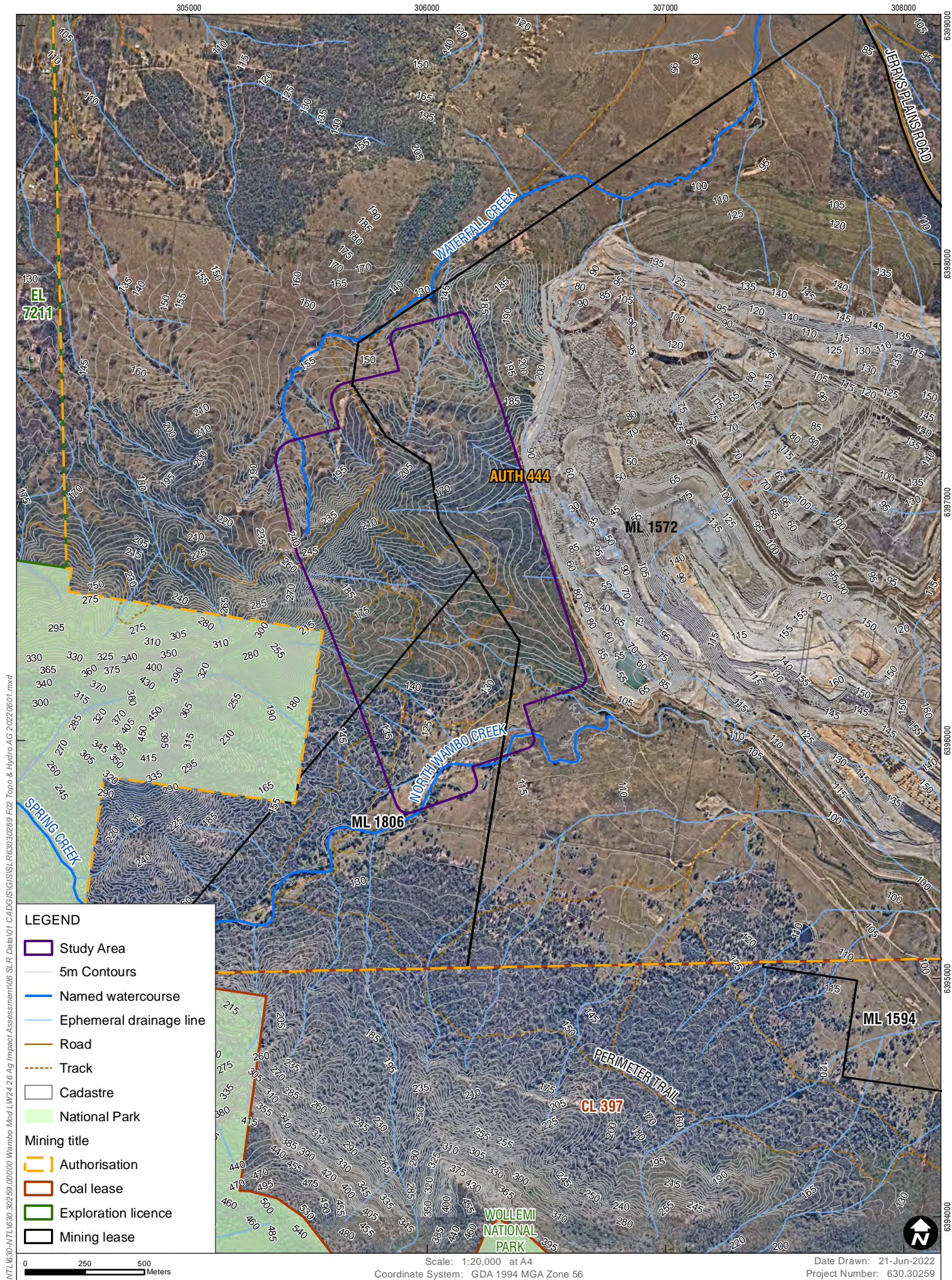
The Jerrys Plains Post Office BOM Station has recorded an average annual precipitation of 642 millimetres (mm), with the highest precipitation from November to March. Mean temperature range between 10.9 and 24.8 degrees Celsius (°C), with January being the warmest month. **Table 1** illustrates the variation in the average yearly precipitation measured at the station. The average annual precipitation ranged from 219 mm to 1,191 mm per annum.

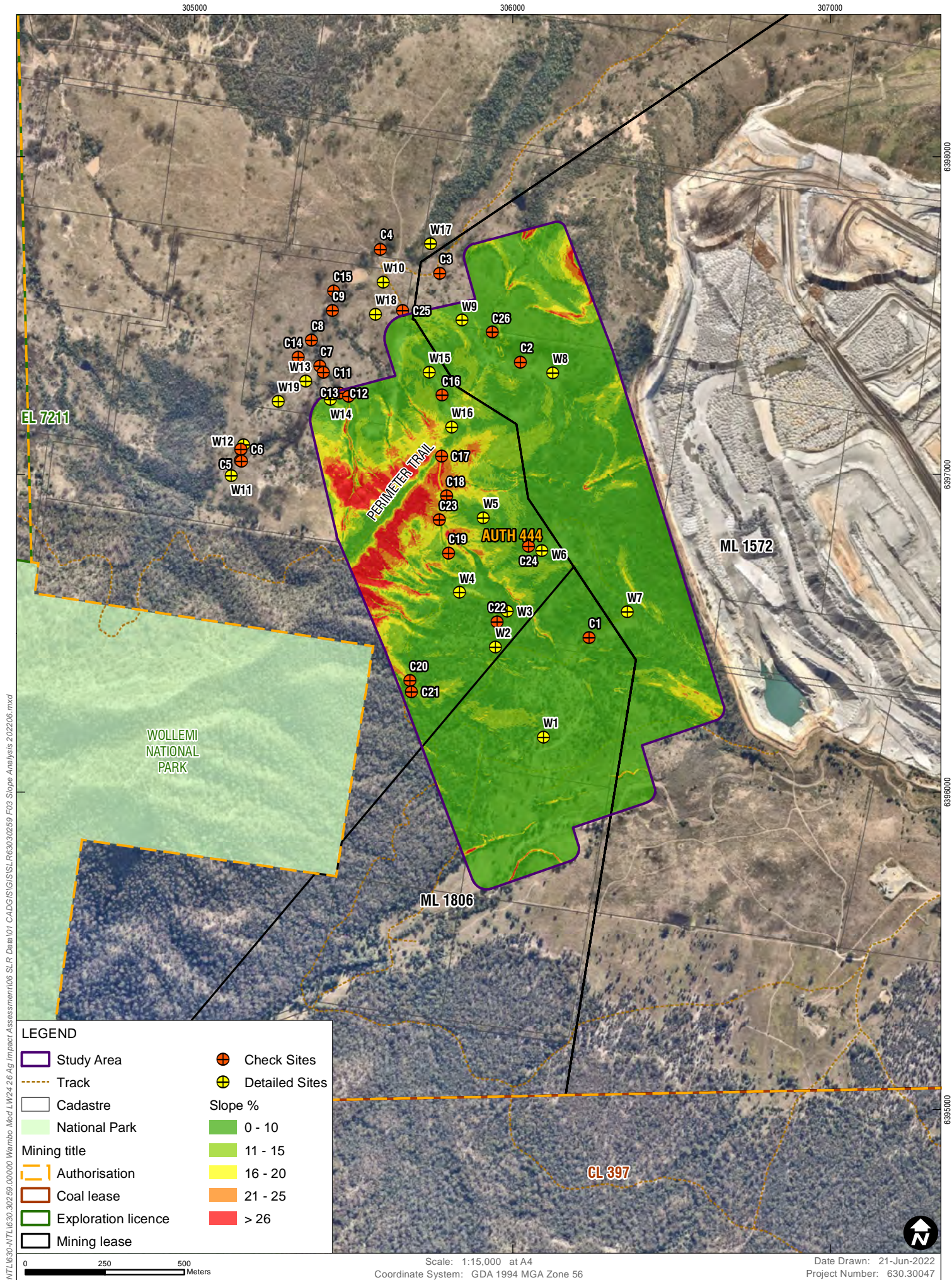
Table 1 Climate Data at the Jerrys Plains Post Office BOM Station

| Climate Factor | Average (mean) |
|------------------------------------|----------------|
| Temperature (1957 – 2014) | |
| Average annual minimum temperature | 10.9°C |
| Average annual maximum temperature | 24.8°C |
| Precipitation (1884 – 2014) | |
| Average annual precipitation | 642 mm |
| Average annual wettest month | January 78 mm |
| Average annual driest month | August 36 mm |

2.2 Topography

The Study Area is located at the foothills of the Wollemi National Park. The terrain generally dips to the north and south-east, and steepens towards the western and southern boundary lines, drainage gullies and creek banks. Sections of North Wambo Creek and Waterfall Creek intersect the Study Area (**Figure 2** and **Figure 3**).





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Slope Analysis

FIGURE 3

2.3 Hydrology

2.3.1 Surface Water

The Surface Water Assessment (Alluvium Consulting, 2022) for the Modification identified two named ephemeral watercourses which transect the Study Area, North Wambo Creek in the south and Waterfall Creek in the north, which both flow towards the east, north-east (**Figure 2**). All watercourses and drainage lines within the Study Area are classed as ephemeral.

North Wambo Creek Western Tributaries

Several western tributaries flow from the sandstone escarpment of the range to the west into North Wambo Creek. These tributaries transition from steep deeply incised bedrock-controlled gullies to broad alluvial flood-outs with no defined channel progressing downstream before entry to North Wambo Creek. These systems are all presently in dynamic equilibrium with relative stability. There are small farm dams on some of these tributaries in the grazing areas.

North Wambo Creek Northern Tributaries

To the north of North Wambo Creek several tributaries flow from the ridge towards the upstream reach of North Wambo Creek. These tributaries transition from steep deeply incised gullies to broader gullies but do not become alluvial flood-outs as observed with the western tributaries. Riparian vegetation is dense in the upper catchment with significant tree and ground cover. In the lower end of the tributaries the tree cover became less dense however dense ground cover remained. These systems appear to be in dynamic equilibrium with relative stability

Waterfall Creek

Waterfall Creek tributaries are steep and relatively incised gullies which run though the northern side of LW24 to 26, with similar characteristics to those seen in the Northern Tributaries. Downstream of the panel extents, the tributaries broaden but with an incised main channel.

Both the North Wambo and Waterfall systems have undergone some natural adjustment post clearing and some localised instabilities remain, though the extents of these are limited by bedrock.

2.3.2 Licenced Surface Water Users

The NSW Water Register indicates there are no Water Access Licences (WALs) associated with the Study Area.

2.4 Groundwater

2.4.1 User Extraction Points

There are no privately owned registered groundwater bores identified within the Study Area (Mine Subsidence Engineering Consultants [MSEC], 2022).

2.5 Geology

The Study Area lies in the Hunter Coalfield, within the Northern Sydney Basin and comprises the Narrabeen Group, Newcastle Coal Measures and the Wittingham Coal Measures. The Whybrow Seam lies within the Jerrys Plains Subgroup of the Wittingham Coal Measures. The rocks of the Wittingham Coal Measures mainly comprise frequently interbedded sandstones and siltstones, but also include isolated thinner beds of conglomerate and tuff. The formations are generally less than 10 metres (m) in thickness.

The Denman Formation marks the top of the Wittingham Coal Measures, which is overlain by the Newcastle Coal Measures. The Newcastle Coal Measures comprise the Watts Sandstone and the Appletree Flat, Horseshoe Creek, Doyles Creek and Glen Gallic Subgroups.

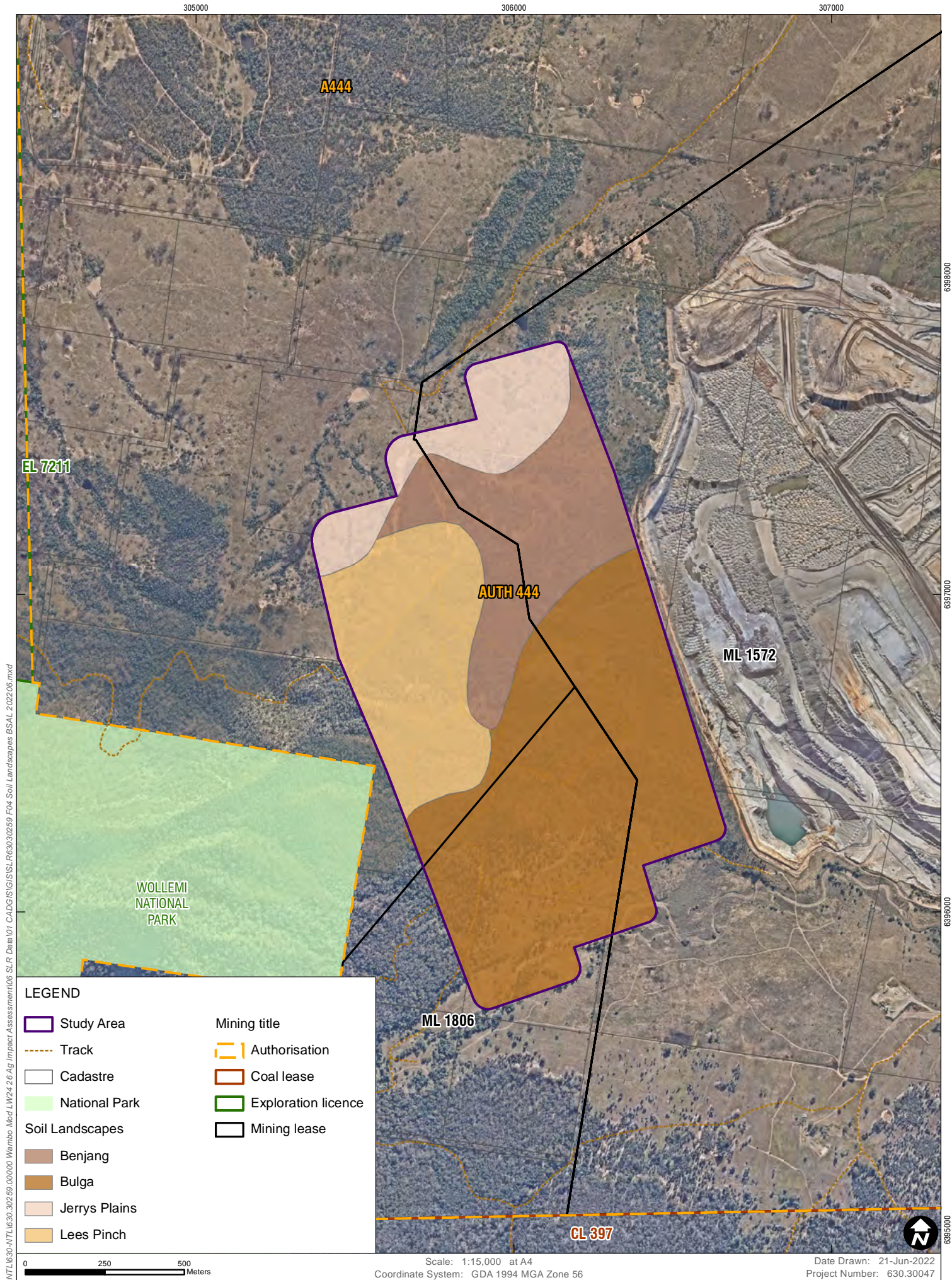
2.6 Soil Landscape Units

The soil landscapes units within the Study Area have been mapped by the former NSW Department of Land and Water Conservation, incorporating the NSW Soil Conservation Service (now part of NSW Department of Primary Industries (DPI)), on the *Soil Landscapes of the Singleton 1:250,000 Sheet* (Kovac & Lawrie, 1991) as shown on **Figure 4**. Descriptions of the four mapped soil landscape units follows:

Benjang

The Benjang soil landscape unit consists of rolling hills, ranging in elevation from 240 to 440 m which are generally rounded with frequent outcrops of sandstone or conglomerate on the summits, with slopes between 10-25%. It occurs on the Singleton Coal Measures geological unit consisting of shale, sandstone, conglomerate, mudstone, coal, tuff and some basalt.

The main soils are Sodosols on the steeper benched country with hard rocks where the near horizontal bedding has resulted in poor soil drainage. Kurosols occur on upper slopes, with Chromosols on the lower portions of longer flat slopes. Tenosols occur mid-slope on quartz sandstone. Limitations to the soil landscape unit are localised steep slopes, high to very high soil erosion hazard and low soil fertility.



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Soil Landscapes

FIGURE 4

Jerrys Plains

The Jerrys Plains landscape unit consists of undulating low hills ranging in elevation from 80 to 180 m, with a slope range from 2-10%. It occurs on the Jerry Plains subgroup of the Wittingham Coal Measures geological unit consisting of lithic sandstone, mudstone, some siltstone lenses and polymictic conglomerates. The main soils are Kurosols on the crests to mid-slopes with Sodosols on the lower slopes and in drainage depressions. Vertosols occur in mid-slope depressions and Sodosols occur on slopes where drainage is severely impeded by bedrock. Areas of severe salting occur in many of the drainage lines. Other soils found in this landscape unit include Chromosols on upper slopes with some Ferrosol- Sodosol intergrades. Limitations to the soil landscape unit are slight to very high soil erosion hazard and low soil fertility.

Lees Pinch

The Lees Pinch landscape unit consists of rolling hills to steep mountains with rounded summits, some edges by sandstone cliffs with elevations from 180 to 800 m and steep slopes to 90% with irregular benches and boulder littered slopes from minor rockfalls. Large sandstone outcrops occur on many hills. It occurs on the Narrabeen Group geological unit consisting of lithic and quartz sandstone, conglomerate, green and red claystone, shale and siltstone.

The main soils are shallow Tenosols with shallow loams on local occurrences of finer textured rocks. Some Chromosols occur on foot slopes, with Sodosols at slope breaks and in mid-slope positions.

Bulga

The Bulga landscape unit consists of smooth slopes forming undulating rises with elevations from 80 to 160 m and slopes up to 10%. The landscape covers the colluvial slopes of the area bounding the steep Lees Pinch and Watagan soil units. Much of the landscape has been cleared for grazing, with some horticulture. It occurs on the Narrabeen Group and Singleton Coal Measures geological group consisting of sandstone, conglomerate, red and green claystone, shale, mudstone and coal. The main soils consist of Sodosols and some Kurosols.

2.6.1 Soil Landscape Agricultural Limitations

As listed in **Table 2** four soil landscapes occur in the Study Area. Major points regarding the dominant soil landscape units are shown below:

- The majority of the Study Area (90%) is highly to severely constrained for cultivation (cropping) enterprises.
- Agricultural land best suited to grazing enterprises includes the Benjang, Jerrys Plains and Bulga soil landscape units, which cover 79% of the Study Area.
- Lees Pinch soil landscape unit has high limitations for grazing and severe limitations for cultivation and covers 21% of the Study Area.

Table 2 Soil Landscape Units

| Soil Landscape Unit | Study Area | | Agricultural Limitation Rating | |
|---------------------|------------|------------|--------------------------------|-------------|
| | Hectares | % | Grazing | Cultivation |
| Benjang | 33 | 20 | Moderate | High |
| Jerrys Plains | 17 | 10 | Low | Moderate |
| Lees Pinch | 33 | 21 | High | Severe |
| Bulga | 79 | 49 | Moderate | High |
| Total | 162 | 100 | | |

2.7 Acid Sulfate Soils

The likelihood of acid sulfate soils occurring within the Study Area is very low due to its position away from the coast and potential acid sulfate landform type. Furthermore, none of the Soil Landscape Units mapped within the Study Area have acid sulfate soil potential.

2.8 Dominant Soil Types and Inherent Fertility

The dominant ASC soil types were assessed and mapped according to the dominant ASC soil type as shown on **Figure 5**. The soil types present in the Study Area are dominated by Chromosols in the eastern portion of the Study Area with the remainder comprising Vertosols, Sodosols and Dermosols. These soil map units (SMUs) are summarised in **Table 3** with all soil types shown in **Table 4**, with the major soil type characteristics listed below:

- Chromosols are soils with a strong texture contrast between the A and B horizons, where the B horizon is not strongly acidic or sodic.
- Dermosols are soils with structured B2 horizons and lacking strong texture contrast between the A and B horizons.
- Sodosols are soils with a strong texture contrast between the A horizons and a sodic B horizon which are not strongly acidic (pH is greater than 5.5).
- Vertosols are clay soils with shrink-swell properties that exhibit strong cracking when dry and at depth have slickensides and/or lenticular structural aggregates.

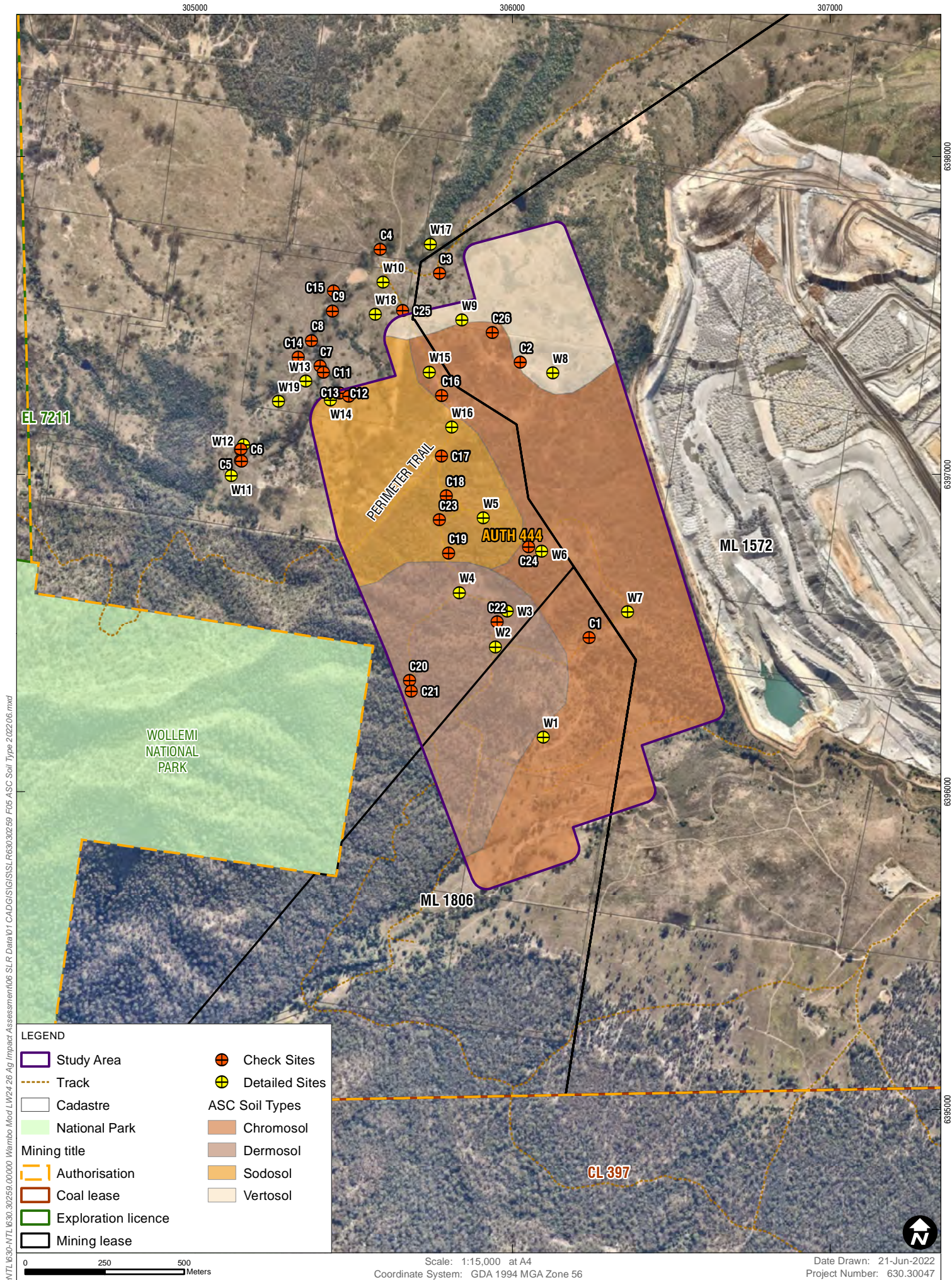


Table 3 Soil Map Unit Summary

| SMU | ASC Soil Type | Detailed Site | Check Site | Hectares |
|--------------|-------------------------------------|-----------------------------------|--|------------|
| 1 | Eutrophic Brown Dermosol | W2, W3, W4 | C20, C21, C22 | 35 |
| 2 | Eutrophic Brown Chromosol | W1, W6, W7, W15 | C1, C16, C24, C26 | 78 |
| 3 | Epipedal Black Vertosol | W8, W9 | C2 | 18 |
| 4 | Subnatric Brown Sodosol | W5, W14, W16 | C12, C13, C17, C18, C19, C23 | 31 |
| N/A | Sites Mapped Outside ARA Study Area | W10, W11, W12, W13, W17, W18, W19 | C3, C4, C5, C6, C7, C8, C9, C11, C14, C15, C25 | Nil |
| Total | | | | 162 |

Table 4 ASC Soil Types per Soil Map Unit

| SMU | ASC Soil Type | Soil Type Group | Detailed Site | Check Site | Hectares |
|--------------|-------------------------------------|-----------------|-----------------------------------|--|------------|
| 1 | Eutrophic Brown Dermosol | Dominant | W3 | C20, C21, C22 | 35 |
| | Eutrophic Black Dermosol | Sub-Dominant | W2 | Nil | |
| | Epipedal Brown Vertosol | | W4 | Nil | |
| 2 | Eutrophic Brown Chromosol | Dominant | W1, W6, W15 | C1, C16, C24 | 78 |
| | Subnatric Brown Sodosol | Sub-Dominant | W7 | C26 | |
| 3 | Epipedal Black Vertosol | Dominant | W8, W9 | C2 | 18 |
| 4 | Subnatric Brown Sodosol | Dominant | W5 | C13, C17, C18, C19, C23 | 31 |
| | Subnatric Grey-Black Sodosol | Sub-Dominant | W14 | C12 | |
| | Epipedal Grey Vertosol | | W16 | Nil | |
| N/A | Sites Mapped Outside ARA Study Area | | W10, W11, W12, W13, W17, W18, W19 | C3, C4, C5, C6, C7, C8, C9, C11, C14, C15, C25 | Nil |
| Total | | | | | 162 |

A description of one detailed representative site from each SMU follows **Figure 5**, with the remaining detailed soil profile descriptions are shown in **Appendix A** and check site descriptions in **Appendix B**. Laboratory certificates of analysis are shown in **Appendix C**.

Soil types in relation to their inherent fertility are shown below in **Table 5**.

Table 5 Dominant Soil Types & Inherent Fertility

| ASC Soil Type | Inherent Fertility | Modification Area Hectares | Modification Area % |
|---------------|--------------------|----------------------------|---------------------|
| Vertosol | High | 18 | 11 |
| Chromosol | Moderately High | 78 | 48 |
| Dermosol | | 35 | 21 |
| Sodosol | Moderately Low | 31 | 20 |
| Total | | 162 | 100 |

In summary, the majority of the Study Area is comprised of soils with moderately high to high inherent fertility (80%). The remainder of the Study Area comprises Sodosols of moderately low inherent fertility.

2.8.1 Soil Unit 1: Eutrophic Brown Dermosol

Dermosols are soils that do not have strong texture contrast between the A and B horizons. They have a well-structured B2 horizon containing low levels of free iron.

Table 6 Summary: Eutrophic Brown Dermosol (Site W3)

| Overview | |
|---|---|
|  | |
| ASC Name | Eutrophic Brown Dermosol |
| Representative Site | Site W3 |
| Other Mapped Sites | W2, W4 |
| Survey Type | Detailed lab |
| Dominant Topography | Midslope |
| Dominant Land Use | Cattle grazing |
| Vegetation | Native vegetation |
| Inherent Soil Fertility | Moderately high |
| Slope (%) | 7% |
| Surrounding Slope (%) | 0-10% |
| Aspect | East |
| Verified | Non-BSAL (Drainage, pH, ECe & Exchangeable Sodium Percentage [ESP]) |
| LSC Class | 4 |

Table 7 Profile: Eutrophic Brown Dermosol (Site W3)


| Profile | Horizon / Depth (m) | Description |
|--|---------------------|---|
|  | A1 0.0 – 0.10 | Dark brown (7.5YR 3/2) loam, weak structure of 2-10 mm crumb peds with a rough fabric and weak consistence. Nil mottling; 5% gravel 5-10 mm; nil segregations; many fine roots; well drained with a gradual and even boundary. Sampled 0.0 – 0.10. |
| | A2 0.10 – 0.20 | Brown (7.5YR 4/3) loam, weak structure of 10-20 mm crumb peds with a rough fabric and weak consistence. Nil mottling; 5% gravel 5-10 mm; nil segregations; many fine roots; well drained with a gradual and even boundary. Sampled 0.10 – 0.20. |
| | B21 0.20 – 0.40 | Brown (7.5YR 4/4) light clay, moderate structure of 20-40 mm blocky peds with a rough fabric and moderate consistence. 20% distinct grey mottling; nil stone content; nil segregations; no roots; poorly drained with a gradual and even boundary. Sampled 0.30 – 0.40. |
| | B22 +0.40 | Brown (7.5YR 4/3) light-medium clay, massive structure with a rough fabric and strong consistence. 20% distinct yellow mottling; 25% gravel 5-25mm; nil segregations; no roots; poorly drained with layer continuing beyond sampling depth. Sampled 0.65 – 0.75. |

Table 8 Chemical Parameters: Eutrophic Brown Dermosol (Site W3)

| Layer | pH (1:5 water) | | ESP | | EC _e | | Ca:Mg | |
|-------|----------------|-------------------------------|-------------|-----------------------|-----------------|--------------------------|-------|--------------|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 6.0 | Slightly Acidic | 0.4 | Non-Sodic | 0.4 | Non-Saline | 2.9 | Ca Low |
| A2 | 6.6 | Neutral | 0.6 | Non-Sodic | 0.2 | Non-Saline | 2.3 | Ca Low |
| B21 | 7.8 | Mildly Alkaline | 8.4 | Marginally Sodic | 0.8 | Non-Saline | 0.9 | Ca Deficient |
| B22 | 9.3 | Very Strongly Alkaline | 22.0 | Strongly Sodic | 5.7 | Moderately Saline | 0.7 | Ca Deficient |

2.8.2 Soil Unit 2: Eutrophic Brown Chromosol

Chromosols are soils with a strong texture contrast between the A horizon and a B horizon which is non-sodic and not strongly acidic.

Table 9 Summary: Eutrophic Brown Chromosol (Site W6)

| Overview | |
|---|-----------------------------|
|  | |
| ASC Name | Eutrophic Brown Chromosol |
| Representative Site | Site W6 |
| Other Mapped Sites | W1, W7, W15 |
| Survey Type | Detailed lab |
| Dominant Topography | Hillcrest |
| Dominant Land Use | Cattle grazing |
| Vegetation | Native vegetation |
| Inherent Soil Fertility | Moderately high |
| Slope (%) | 2% |
| Surrounding Slope (%) | 0-10% |
| Aspect | East |
| Verified | Non-BSAL (Physical Barrier) |
| LSC Class | 4 |

Table 10 Profile: Eutrophic Brown Chromosol (Site W6)


| Profile | Horizon / Depth (m) | Description |
|--|---------------------|--|
|  | A1 0.0 – 0.20 | Brown (7.5YR 4/2) silty clay loam, moderate structure of 10-20 mm blocky peds with a rough fabric and weak consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; moderately drained well drained with a clear and even boundary. Sampled 0.0-0.10. |
| | B21 0.20 – 0.40 | Strong brown (7.5YR 5/6) heavy clay, strong structure of 10-30 mm sub angular blocky peds with a rough fabric and moderate consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; well drained with a gradual and even boundary. Sampled 0.20-0.30. |
| | B22 0.40 – 0.60 | Brown (7.5YR 5/4) silty clay, strong massive structure with a rough fabric and strong consistence. Nil mottling; nil stone content; nil segregations; coarse roots common, moderately drained with a clear and even boundary. Sampled 0.50-0.60. |
| | BC 0.60 – 0.70 | Weathered sandstone with >50% gravel content 10-50 mm and nil roots beyond 0.70 m depth. Not sampled. |
| | C +0.70 | Sandstone bedrock. Not sampled. |

Table 11 Chemical Parameters: Eutrophic Brown Chromosol (Site W6)

| Layer | pH (1:5 water) | | ESP | | ECe | | Ca:Mg | |
|-------|----------------|-------------------|-----|-----------|------|------------|-------|--------|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 5.9 | Moderately Acidic | 1.2 | Non-Sodic | 0.6 | Non-Saline | 2.7 | Ca Low |
| B21 | 7.0 | Neutral | 1.6 | Non-Sodic | 0.3 | Non-Saline | 1.5 | Ca Low |
| B22 | 8.5 | Strongly Alkaline | 1.9 | Non-Sodic | 1.8 | Non-Saline | 2.7 | Ca Low |

2.8.3 Soil Unit 3: Epipedal Black Vertosol

Vertosols are clay soils with shrink-swell properties that exhibit strong cracking when dry and at depth have slickensides and/or lenticular structural aggregates.

Table 12 Summary: Epipedal Black Vertosol (Site W8)


| Overview | |
|---|-------------------------|
|  | |
| ASC Name | Epipedal Black Vertosol |
| Representative Site | Site W8 |
| Other Mapped Sites | W9 |
| Survey Type | Detailed lab |
| Dominant Topography | Upper slope |
| Dominant Land Use | Cattle grazing |
| Vegetation | Native vegetation |
| Inherent Soil Fertility | High |
| Slope (%) | 1% |
| Surrounding Slope (%) | 0-10% |
| Aspect | West |
| Verified | Non-BSAL (pH & ECe) |
| LSC Class | 3 |

Table 13 Profile: Epipedal Black Vertisol (Site W8)


| Profile | Horizon / Depth (m) | Description |
|--|---------------------|---|
|  | A1 0.0 – 0.20 | Very dark grey (7.5YR 3/1) medium clay, moderate structure of 10-15 mm blocky peds with a rough fabric and moderate consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; well drained with a gradual and wavy boundary. Sampled 0.0 – 0.10. |
| | B21 0.20 – 0.35 | Very dark grey (7.5YR 3/1) Heavy Clay, moderate structure of 10-20 mm blocky peds with a rough fabric and moderate consistence. Nil mottling; <5% gravel 5-10 mm; nil segregations; abundant fine roots; well drained with a gradual and wavy boundary. Sampled 0.20 – 0.30. |
| | B22 0.35 – 0.50 | Very dark greyish brown (10YR 3/2) heavy clay, massive structure with a rough fabric and strong consistence. Nil mottling; nil stone content; 20% soft calcium nodules; many fine roots; well drained with a gradual and wavy boundary. Sampled 0.40 – 0.50. |
| | B23 +0.50 | Brown (10YR 4/3) heavy clay, massive structure with a rough fabric and strong consistence. Nil mottling; nil stone content; 20% soft calcium nodules; few fine roots. Well drained with layer continuing beyond sampling depth. Sampled 0.65 – 0.75 |

Table 14 Chemical Parameters: Epipedal Black Vertisol (Site W8)

| Layer | pH (1:5 water) | | ESP | | ECe | | Ca:Mg | |
|-------|----------------|---------------------|------|------------------|------|-------------------|-------|--------------|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 7.2 | Neutral | 1.0 | Non-Sodic | 0.7 | Non-Saline | 1.8 | Ca Low |
| B21 | 8.2 | Moderately Alkaline | 6.0 | Marginally Sodic | 0.8 | Non-Saline | 0.9 | Ca Deficient |
| B22 | 8.9 | Strongly Alkaline | 11.6 | Sodic | 4.7 | Moderately Saline | 1.0 | Ca Deficient |
| B23 | 9.0 | Strongly Alkaline | 14.4 | Strongly Sodic | 6.8 | Moderately Saline | 0.9 | Ca Deficient |

2.8.4 Soil Unit 4: Subnatric Brown Sodosol

Sodosols are soils with a strong texture contrast between the A horizon and a Sodic B horizon which is not strongly acidic.

Table 15 Summary: Subnatric Brown Sodosol (Site W5)


| Overview | |
|---|---|
|  | |
| ASC Name | Subnatric Brown Sodosol |
| Representative Site | Site W5 |
| Other Mapped Sites | W14, W16 |
| Survey Type | Detailed lab |
| Dominant Topography | Midslope |
| Dominant Land Use | Cattle grazing |
| Vegetation | Native vegetation |
| Inherent Soil Fertility | Moderately low |
| Slope (%) | 3% |
| Surrounding Slope (%) | 0-15% |
| Aspect | Southeast |
| Verified | Non-BSAL (Fertility, Physical Barrier & Drainage) |
| LSC Class | 4 |

Table 16 Profile: Subnatric Brown Sodosol (Site W5)


| Profile | Horizon / Depth (m) | Description |
|--|---------------------|---|
|  | A1 0.0 – 0.10 | Brown (7.5YR 4/2) clay loam, moderate structure of 10-20 mm blocky peds with a rough fabric and moderate consistence. Nil mottling; 5% gravel 5-10 mm; nil segregations; few fine roots; well drained with a clear and even boundary. Sampled 0.0-0.10. |
| | B21 0.10 – 0.50 | Strong brown (7.5YR 5/6) heavy clay, moderate structure of 10-20 mm blocky peds with a rough fabric and moderate consistence. 10% distinct yellow mottling; nil stone content; nil segregations; few fine roots; poorly drained with a gradual and even boundary. Sampled 0.30-0.40. |
| | B22 0.50 – 0.70 | Brown (7.5YR 5/4) heavy clay, strong structure of 15-25 mm sub angular blocky peds with a rough fabric and weak consistence. 20% distinct yellow mottling; nil stone content; nil segregations; few coarse roots; poorly drained with an abrupt and even boundary. Sampled 0.60-0.70. |
| | BC +0.70 | Weathered sandstone with >50% gravel content 10-50 mm and nil roots beyond 0.70 m depth. Not sampled. |

Table 17 Chemical Parameters: Subnatric Brown Sodosol (Site W5)

| Layer | pH (1:5 water) | | ESP | | EC _e | | Ca:Mg | |
|-------|----------------|-------------------|-----|------------------|-----------------|------------|-------|--------------|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 6.9 | Neutral | 1.4 | Non-Sodic | 0.6 | Non-Saline | 2.8 | Ca Low |
| B21 | 5.8 | Moderately Acidic | 6.5 | Marginally Sodic | 1.2 | Non-Saline | 0.9 | Ca Deficient |
| B22 | 6.3 | Slightly Acidic | 9.1 | Marginally Sodic | 1.5 | Non-Saline | 0.9 | Ca Deficient |

2.9 Vegetation

Vegetation within the Study Area was mapped as Central Hunter Valley Eucalypt Forest & Woodland (Ecological, 2022), which contains the following vegetation communities:

- Hunter Valley Weeping Myall Woodland.
- Central Hunter Ironbark—Spotted Gum—Grey Box Forest.
- Hunter Valley Footslopes Slaty Gum Woodland.
- Hunter Lowland Redgum Forest.

Approximately one third of the Study Area has been cleared of native vegetation for grazing of cattle on grass pasture.

2.10 Agricultural Land Use

Based on the findings of site inspections by SLR's Principal Agronomist, there is approximately 60 hectares (37%) of the Study Area suitable for agricultural production (grazing) in its current state, as shown on **Figure 6**. The only agricultural land use observed within and surrounding the Study Area was cattle grazing.

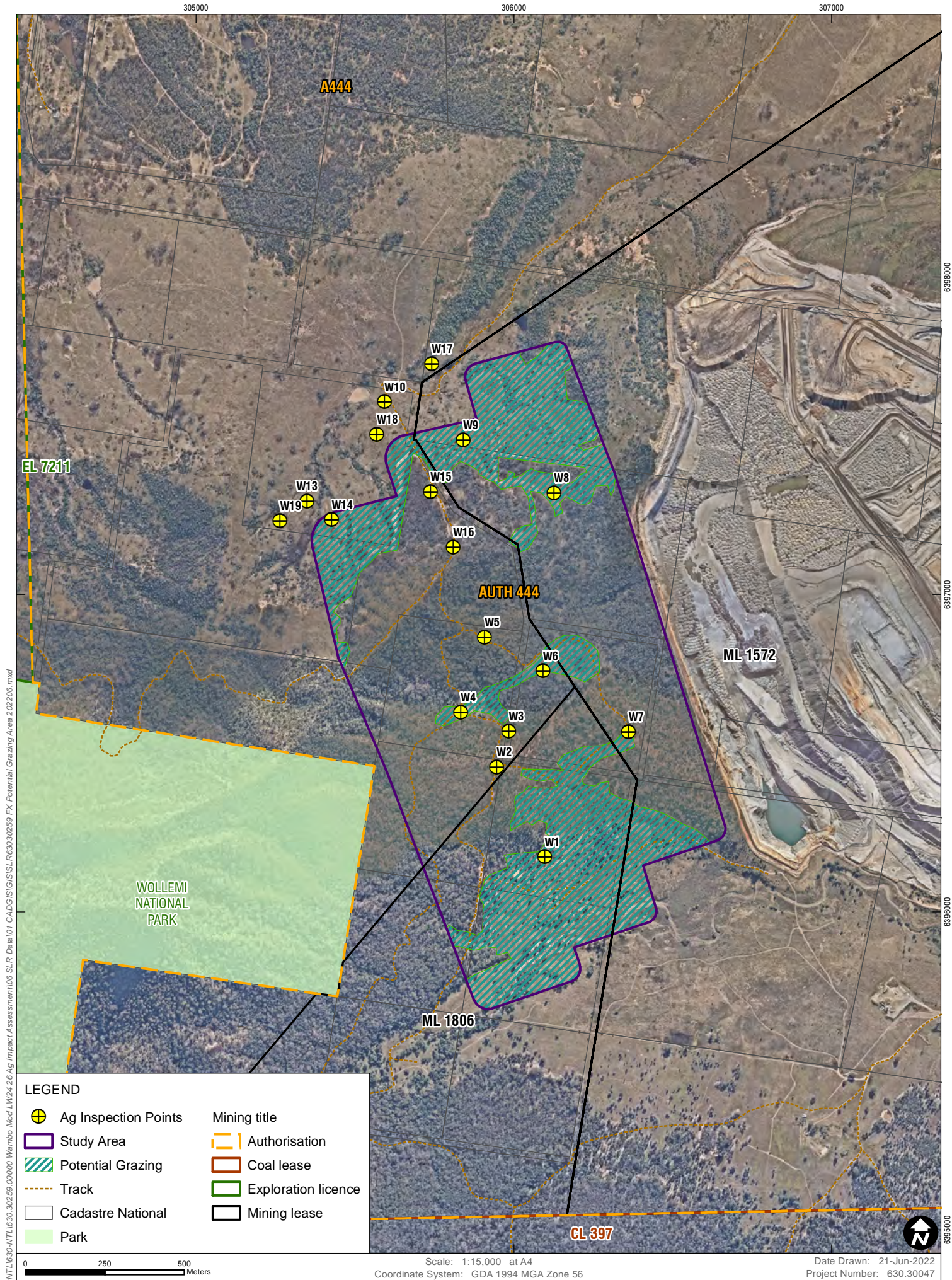
Whilst the remaining 63% of the Study Area is fenced within these cattle paddocks, there is very little grazing value for cattle due to the dense native vegetation and/or steep slopes.

There was no evidence of recent or historical cultivation having been undertaken within or adjacent to the Study Area.

2.11 Strategic Agricultural Land

There is no Strategic Agricultural Land within or in the vicinity of the Study Area.

The closest mapped BSAL mapped in the mining SEPP associated with the Hunter River and is located approximately 1 km to north of the Modification area.



2.12 Land & Soil Capability

The LSC classification applied to the Study Area is in accordance with the OEH guideline: *The Land and Soil Capability Assessment Scheme; Second Approximation* (OEH, 2012). This scheme uses the biophysical features of the land and soil to derive detailed rating tables for a range of land and soil hazards. The scheme consists of eight classes, which classify the land based on the severity of long-term limitations. The LSC classes are described in **Table 18** and their definition has been based on two considerations:

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

Table 18 Land and Soil Capability Classification

| Class | Land and Soil Capability |
|---|--|
| Land capable of a wide variety of land uses (cropping, grazing, horticulture, forestry, 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. |

LSC Soil Survey Density

To satisfy LSC and BSAL mapping requirements, the field soil survey program included areas both outside and inside the Study Area with a total of 44 sites assessed, comprising 19 detailed sites and 25 check sites within the Study Area, of these 7 detailed and 11 check sites surround the Study Area, as shown on **Figure 5**. A breakdown of the soil survey density within the Study Area is provided in **Table 19**.

Table 19 Assessment of Soil Survey Density

| Category | Study Area |
|---------------------------------|--------------------------------|
| Total Study Area Hectares | 162 |
| 1:100,000 Survey Density Target | Minimum 2 Required Sites |
| Actual Sites Surveyed | 12 Detailed and 14 Check Sites |
| Laboratory Analysed Sites | 12 |

Soil Survey Observation Types

Soil profiles were assessed at 44 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 m, to equipment refusal, or to bedrock.

Detailed soil profile morphological descriptions were recorded for the major parameters specified in **Table 20**. Global Positioning System 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 20 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 |

Soil collected from each major soil horizon (soil layer) was sent to a National Association of Testing Authorities Australia accredited laboratory (EAL Laboratories) for analysis. The selected physical and chemical laboratory analysis properties and their relevant application are listed in **Table 21**.

Table 21 Laboratory Analysis Parameters

| Property | Application |
|---|--|
| Coarse Fragments (>2 mm) | Soil workability; root development |
| Particle-Size Distribution (<2 mm) | 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.

2.12.2 LSC Classes

LSC Classes were determined according to the *The Land and Soil Capability Assessment Scheme; Second Approximation* (OEHL, 2012), with the hazard criteria assessment and final LSC Class for each detailed site shown below in **Table 22**.

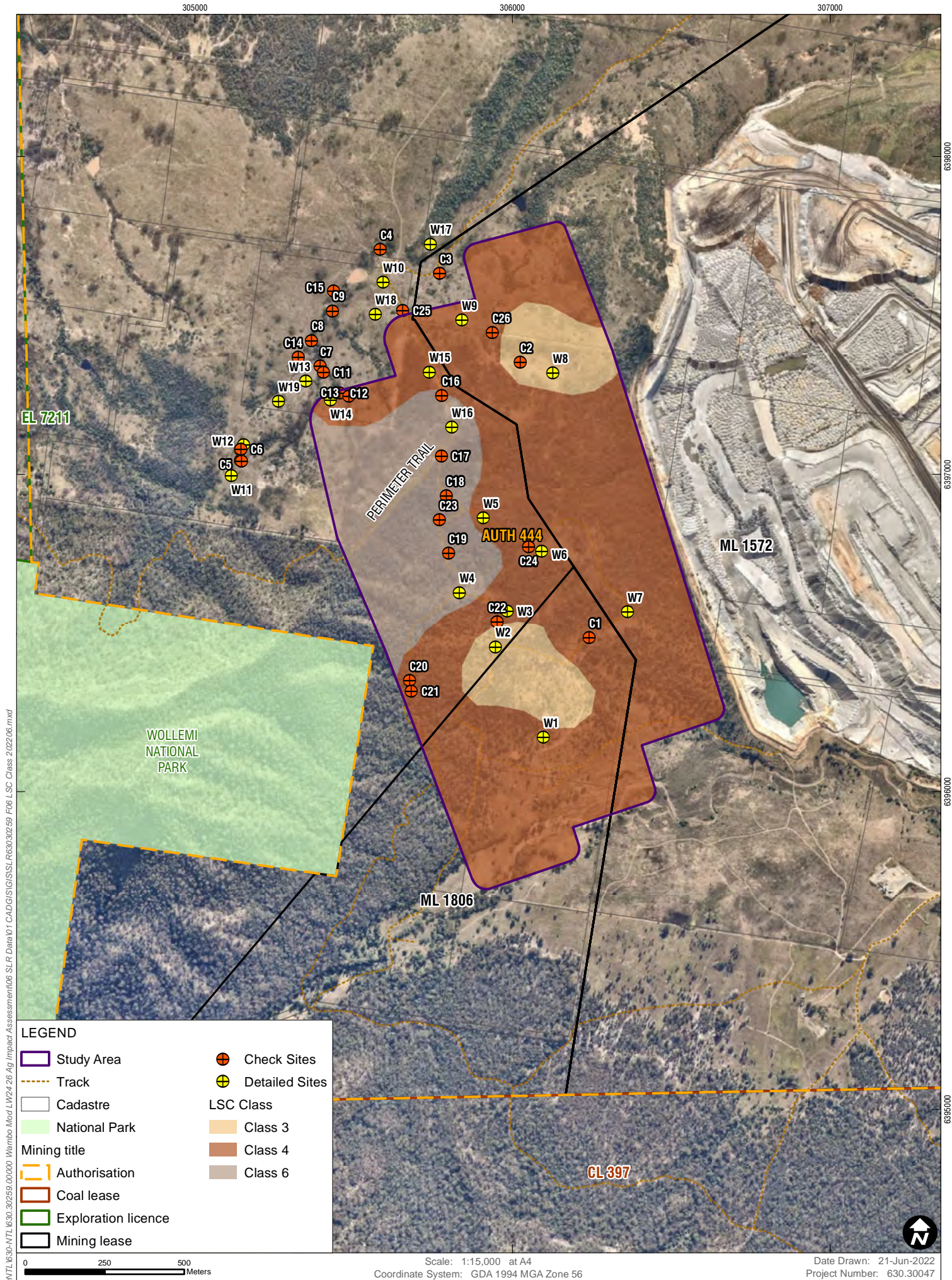
Table 22 LSC Hazard Criteria Assessment

| Site | Soil Type | Hazard Criteria | | | | | | | | LSC |
|------|------------------------------|-----------------|---|---|---|---|---|---|---|-----|
| | ASC Great Group | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| W1 | Eutrophic Brown Chromosol | 3 | 2 | 4 | 3 | 3 | 2 | 4 | 1 | 4 |
| W2 | Eutrophic Black Dermosol | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 1 | 3 |
| W3 | Eutrophic Brown Dermosol | 3 | 2 | 3 | 2 | 3 | 4 | 2 | 1 | 4 |
| W4 | Epipedal Brown Vertosol | 3 | 2 | 3 | 2 | 3 | 2 | 6 | 1 | 6 |
| W5 | Subnatric Brown Sodosol | 3 | 2 | 3 | 3 | 3 | 4 | 4 | 1 | 4 |
| W6 | Eutrophic Brown Chromosol | 3 | 2 | 3 | 3 | 3 | 2 | 4 | 1 | 4 |
| W7 | Subnatric Brown Sodosol | 3 | 2 | 3 | 3 | 3 | 2 | 4 | 1 | 4 |
| W8 | Epipedal Black Vertosol | 3 | 2 | 3 | 1 | 3 | 2 | 2 | 1 | 3 |
| W9 | Epipedal Black Vertosol | 3 | 2 | 3 | 2 | 3 | 2 | 4 | 1 | 4 |
| W14 | Subnatric Grey-Black Sodosol | 4 | 2 | 3 | 3 | 3 | 4 | 2 | 1 | 4 |
| W15 | Eutrophic Brown Chromosol | 3 | 2 | 3 | 3 | 3 | 2 | 4 | 1 | 4 |
| W16 | Epipedal Grey Vertosol | 3 | 2 | 3 | 3 | 3 | 2 | 6 | 1 | 6 |

Three LSC Classes were identified within the Study Area, as shown below in **Table 23** and on **Figure 7**. The majority of the Study Area is rated as LSC Class 4 (70%).

Table 23 LSC Classes

| Land & Soil Capability | Agricultural Capability | Modification Area | |
|------------------------|--------------------------|-------------------|-----|
| Class | Rating | Hectares | % |
| 3 | High capability land | 17 | 10 |
| 4 | Moderate capability land | 113 | 70 |
| 6 | Low capability land | 32 | 20 |
| Total | | 162 | 100 |



H:\Projects\SLR\630-SWTL\630-NTL\630-30259-00000-Wambo Mod LW24-26 Ag Impact Assessment\106 SLR Data\01 CADGIS\GIS\SLR\63030259_F06_LSC Class 2022.06.mxd



LSC Class

FIGURE 7

2.12.3 Potential Agricultural Production Value of the Study Area

Potential agricultural productivity was determined using NSW DPI agricultural gross margin productivity data for agricultural enterprises suitable for each of the LSC classes (see **Section 2.12**) that are present within the Study Area. This analysis has been undertaken on the potential capability of the land rather than current land use. If potential agricultural production values were to be pursued, significant investment in land management and agricultural infrastructure would be required. However, this information can be used to approximate potential farm incomes.

The *Beef Cattle Gross Margin Budget Inland Store Weaners* (DPI, 2019) (**Table 24**) has been applied to this assessment to determine potential agricultural income for the Study Area. The *NSW Department of Primary Industries Beef Stocking Rates & Farm Size* (DPI, 2006) was used to determine stocking rates in Dry Sheep Equivalents (DSE) for the three LSC's mapped within the Study Area. Full agricultural gross margin information is contained in **Appendix D**. The Singleton LGA is in the 600 to 700 millimetre per annum rainfall zone and DSE for each LSC Class were calculated accordingly

Table 24 Gross Margin per LSC Class

| LSC | Stocking Rate | Cow Calf Unit | Revenue | Variable Costs | Gross Margin |
|-------|---------------|---------------|-------------|----------------|--------------|
| Class | DSE | Per Hectare | Per Hectare | Per Hectare | Per Hectare |
| 3 | 10 | 0.60 | \$470 | \$100 | \$370 |
| 4 | 8 | 0.48 | \$376 | \$80 | \$296 |
| 6 | 4 | 0.24 | \$188 | \$40 | \$148 |

Based on the nominated gross margins and stocking rates, the Study Area has the capacity to generate an estimated gross margin of \$44,474 per annum (**Table 25**). It is important to note that these figures are derived from the optimum potential uses and are likely to be much higher than the actual incomes being achieved at the time of publication, and to achieve these outcomes would require significant investment in livestock, pasture, fertiliser and agricultural infrastructure.

Table 25 Annual Gross Margins per LSC Class

| LSC | Gross Margin | Study Area | |
|--------------|--------------|------------|-----------------|
| Class | Per Hectare | Hectares | Gross Margin |
| 3 | \$370 | 17 | \$6,290 |
| 4 | \$296 | 113 | \$33,448 |
| 6 | \$148 | 32 | \$4,736 |
| Total | | 162 | \$44,474 |

As discussed in **Section 2.10**, there is 60 hectares of land available for agricultural production within the Study Area in its current guise. Using a conservative assessment and assuming this total area is LSC Class 3 land this area has the potential to generate a gross margin of \$22,200 per annum from beef cattle production.

3 Assessment of Potential Impacts

As the Modification would not include any additional surface development areas, the primary potential impact to agricultural resources is from subsidence. MSEC (2022) predicts maximum vertical subsidence to be 1,950 mm over LW 26. Maximum predicted tilt is 75 mm per metres over LW 25 and LW 26, which is small when compared to the natural surface grade of slopes within the Study Area.

A comparison of the maximum predicted total subsidence effects for the approved and modified South Bates Extension Underground Mine layout is provided in **Table 26**. The values represent the maximum predicted accumulated movements due to the extraction of all LWs for the respective layouts.

Table 26 Comparison of maximum predicted total subsidence effects

| Layout | Maximum predicted total vertical subsidence (mm) | Maximum predicted total tilt (mm/m) | Maximum predicted total hogging curvature (km ⁻¹) | Maximum predicted total sagging curvature (km ⁻¹) |
|--------------------------------|--|-------------------------------------|---|---|
| Existing/Approved LWs 17 to 23 | 1,950 | 80 | > 3.0 | > 3.0 |
| Modified LWs 24 to 26 | 1,950 | 75 | > 3.0 | > 3.0 |

The predicted vertical subsidence, maximum predicted tilt and curvatures above the modified LWs 24 to 26 are similar to those predicted for the existing/approved LWs 17 to 23 and therefore the potential impacts to natural vegetation in the modified LWs 24 to 26 would be similar to the existing/approved LWs 17 to 23 (MSEC, 2022).

3.1.1 Land Permanently Removed from Agriculture

There is no land which will be permanently removed from agriculture as a result of the Modification.

3.1.2 Impact on Biophysical Strategic Agricultural Land

There is no Biophysical Strategic Agricultural Land within or adjacent to the Study Area. The Modification will not impact any Biophysical Strategic Agricultural Land.

3.1.3 Acid Sulfate Soils

As outlined in **Section 2.7** there are no Soil Landscape Units associated with the Study Area with acid sulfate potential. The Modification therefore would not impact upon acid sulfate soils.

3.2 Water Resources

3.2.1 Surface Water

Given that drainage channels within the Study Area are considered ephemeral and there are no WALs associated with the Study Area, any impact on agricultural users dependent on flows from these watercourses is negligible.

3.2.2 Groundwater

There are no registered privately-owned groundwater bores identified within, and surrounding the Study Area (MSEC, 2022), as such there are no agricultural enterprises which rely on groundwater extraction that will be impacted by the Modification.

3.2.3 Water Reallocation

The Modification would not require WCPL to obtain alluvial WALs or allocations.

3.2.4 Water Resource Impacts on Agricultural Productivity

Given the impacts described previously, longwall subsidence will result in negligible impact on water resources relied upon by agricultural enterprises and will not result in impacts on agricultural productivity.

3.3 Impact on Agricultural Resources from Biodiversity Offsets

No biodiversity offsets associated with the Modification are proposed, as such there would be no impacts on agriculture due to biodiversity offsets.

3.3.1 Cumulative Impacts

Given the previously described impacts are of a minor nature and readily managed through application of appropriate mitigation measures and management strategies, any cumulative impacts on agricultural resources and enterprises are also expected to be minor and readily mitigated.

4 Mitigation Measures

This section describes the proposed mitigation measures and management strategies recommended to minimise potential agricultural impacts. Whilst the majority of impacts on agricultural enterprises and resources have been assessed as negligible, as a matter of best practice, WCPL has adopted a number of mitigation measures to further minimise these impacts. A summary of key measures specifically in relation to potential agricultural impact is provided below.

4.1 Review of Project Design

The proposed longwall mine plan has been reviewed and revised by WCPL in order to mitigate potential subsidence impacts. The final mine plan has been developed to minimise impacts from underground workings on land and surface infrastructure within the Modification Area.

The nature of underground longwall mining avoids significant disturbance to productive agricultural land, especially when compared to open cut mining methods.

4.2 Soil Resources

Whilst there is no surface development proposed as part of the Modification, in the unlikely event they would be required, it is recommended that gypsum be applied for any remediation earthworks where sodic subsoils (ESP is greater than 5%) are exposed. The application of gypsum would minimise the potential for tunnel erosion to occur on disturbed subsoil. The recommended application rates are shown in Table 27.

Table 27 Gypsum Application Rates

| Exchangeable Sodium (ESP) | Gypsum Rate per Hectare | Gypsum Rate per Square Metre |
|---------------------------|-------------------------|------------------------------|
| 5 to 10% | 2 to 5 tonnes | 0.2 to 0.5 kilograms |
| Greater than 10% | 5 tonnes | 0.5 kilograms |

It is noted that there are no soil stripping or stockpiling activities anticipated within the Study Area associated with the Modification.

5 Key Findings

The purpose of this ARA is to assess and report on the potential impacts of the Modification on agricultural resources and/or industries within and surrounding the Study Area.

The key findings of the ARA are listed below.

- There is no land which has been, or is currently used for agriculture, which would be permanently removed from agricultural production.
- There is no land which has been, or is currently used for agriculture, which will be temporarily removed from agricultural production.
- The Study Area contains no areas of verified BSAL.
- Post-mining agricultural economic activity in the Modification Area is expected to be similar to pre-mining activity as there are negligible changes predicted between the pre- and post-mining LSC classifications.
- The Modification would have negligible impact on surface water resources relied upon by agriculture.
- The Modification would have negligible impact on groundwater resources relied upon by agriculture.
- Any other impacts to agricultural resources or enterprises from mine induced subsidence are expected to be minor and readily mitigated.
- The Modification would provide considerable positive economic benefits to the local and broader communities.
- Stakeholder and community consultation has not revealed any issues regarding agricultural resources or enterprises and will be ongoing throughout the life of the Modification.

In summary, the Modification would have negligible impacts on surrounding agricultural resources, enterprises and dependent industries.

6 References

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APPENDIX A

Detailed Site Descriptions



Soil Unit 1: Eutrophic Brown Dermosol

Sub-Dominant Soil Type: Eutrophic Black Dermosol

Table 1 Summary: Eutrophic Black Dermosol (Site W2)


| Overview | |
|--|--------------------------|
| <p>Landscape Site W2</p>  | |
| ASC Name | Eutrophic Black Dermosol |
| Representative Site | Site W2 |
| Other Mapped Sites | W3, W4 |
| Survey Type | Detailed lab |
| Dominant Topography | Lower slope |
| Dominant Land Use | Cattle grazing |
| Vegetation | Native vegetation |
| Inherent Soil Fertility | Moderately high |
| Slope (%) | 6% |
| Surrounding Slope (%) | 0-10% |
| Aspect | South |
| Verified | BSAL |
| LSC Class | 3 |

Table 2 Profile: Eutrophic Black Dermosol (Site W2)


| Profile | Horizon / Depth (m) | Description |
|--|---------------------|---|
|  | A1 0.0 – 0.10 | Very dark grey (7.5YR 3/1) clay loam, weak structure of <10 mm crumb peds with a rough fabric and moderate consistence. Nil mottling; 5% gravel 5-10 mm; nil segregations; abundant fine roots; moderately drained with a gradual and even boundary. Sampled 0.0 – 0.10. |
| | A2 0.10 – 0.30 | Very dark grey (7.5YR 3/1) clay loam, moderate structure of 5-15 mm blocky peds with a rough fabric and moderate consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; well drained with a clear and even boundary. Sampled 0.10 – 0.20. |
| | B21 0.30 – 0.60 | Very dark grey (7.5YR 3/1) light clay, moderate structure of 10-20 mm blocky peds with a rough fabric and moderate consistence. Nil mottling; nil stone content; nil segregations; many fine roots; well drained with a gradual and even boundary. Sampled 0.40 – 0.50. |
| | B22 +0.60 | Dark brown (7.5YR 3/2) clay loam, weak structure of 20-40 mm blocky peds with a rough fabric and moderate consistence. Nil mottling; 20% gravel 10-30mm; nil segregations; many fine roots. Well drained. Layer continues beyond sampling depth. Sampled 0.65 – 0.75. |

Table 3 Chemical Parameters: Eutrophic Black Dermosol (Site W2)

| Layer | pH (1:5 water) | | ESP | | EC _e | | Ca:Mg | |
|-------|----------------|-----------------|-----|-----------|-----------------|------------|-------|----------|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 6.7 | Neutral | 0.2 | Non-Sodic | 0.4 | Non-Saline | 4.7 | Balanced |
| A2 | 6.9 | Neutral | 0.2 | Non-Sodic | 0.3 | Non-Saline | 4.3 | Balanced |
| B21 | 7.4 | Mildly Alkaline | 0.4 | Non-Sodic | 0.2 | Non-Saline | 3.1 | Ca Low |
| B22 | 7.6 | Mildly Alkaline | 0.7 | Non-Sodic | 0.2 | Non-Saline | 3.1 | Ca Low |

Soil Unit 1: Eutrophic Brown Dermosol

Sub-Dominant Soil Type: Epipedal Brown Vertosol

Table 4 Summary: Epipedal Brown Vertosol (Site W4)

| Overview | |
|---|-----------------------------|
| <p>Landscape Site W4</p>  | |
| ASC Name | Epipedal Brown Vertosol |
| Representative Site | Site W4 |
| Other Mapped Sites | W2, W3 |
| Survey Type | Detailed lab |
| Dominant Topography | Midslope |
| Dominant Land Use | Native vegetation |
| Vegetation | Native vegetation |
| Inherent Soil Fertility | Moderately high |
| Slope (%) | 9% |
| Surrounding Slope (%) | 0-10% |
| Aspect | East |
| Verified | Non-BSAL (Physical Barrier) |
| LSC Class | 6 |

Table 5 Profile: Epipedal Brown Vertisol (Site W4)


| Profile | Horizon / Depth (m) | Description |
|--|---------------------|---|
|  | A1 0.0 – 0.20 | Dark brown (7.5YR 3/2) heavy clay, moderate structure of <10 mm crumb peds with a rough fabric and moderate consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; moderately drained; gradual and even boundary. Sampled 0.0 – 0.10 |
| | B2 0.20 – 0.40 | Brown (10YR 5/3) silty clay, weak structure of 10-20 mm blocky peds with a rough fabric and weak consistence. Nil mottling; nil stone content; nil segregations; many coarse roots, well drained with a clear and even boundary. Sampled 0.20 – 0.30 |
| | BC 0.40 – 0.65 | Weathered sandstone with >50% gravel content 10-50 mm and nil roots beyond 0.50 m depth. Not sampled. |
| | C +0.65 | Sandstone bedrock. Not sampled. |

Table 6 Chemical Parameters: Epipedal Brown Vertisol (Site W4)

| Layer | pH (1:5 water) | | ESP | | ECe | | Ca:Mg | |
|-------|----------------|-------------------|-----|-----------|------|------------|-------|--------|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 7.5 | Mildly Alkaline | 0.6 | Non-Sodic | 0.5 | Non-Saline | 3.5 | Ca Low |
| B21 | 8.7 | Strongly Alkaline | 0.4 | Non-Sodic | 1.2 | Non-Saline | 3.5 | Ca Low |

Soil Unit 2: Eutrophic Brown Chromosol

Eutrophic Brown Chromosol

Table 7 Summary: Eutrophic Brown Chromosol (Site W1)


| Overview | |
|---|-----------------------------|
| <p>Landscape Site W1</p>  | |
| ASC Name | Eutrophic Brown Chromosol |
| Representative Site | Site W1 |
| Other Mapped Sites | W6, W7, W15 |
| Survey Type | Detailed lab |
| Dominant Topography | Lower slope |
| Dominant Land Use | Cattle grazing |
| Vegetation | Native vegetation |
| Inherent Soil Fertility | Moderately high |
| Slope (%) | 7% |
| Surrounding Slope (%) | 0-10% |
| Aspect | South |
| Verified | Non-BSAL (Physical Barrier) |
| LSC Class | 4 |

Table 8 Profile: Eutrophic Brown Chromosol (Site W1)


| Profile | Horizon / Depth (m) | Description |
|--|---------------------|--|
|  | A1 0.0 – 0.20 | Brown (7.5YR 4/3) silty clay loam, moderate structure of 5-10 mm crumb peds with a rough fabric and moderate consistence. Nil mottling; <5% gravel 5-10 mm; nil segregations; abundant fine roots; well drained with a clear and even boundary. Sampled 0.0 – 0.10. |
| | B21 0.20 – 0.30 | Brown (7.5YR 4/4) heavy clay, strong structure of 20-40 mm blocky peds with a rough fabric and strong consistence. Nil mottling; nil stone content; nil segregations; many fine roots; well drained with a gradual and even boundary. Sampled 0.20 – 0.30. |
| | B22 0.30 – 0.50 | Brown (7.5YR 4/4) heavy clay, strong massive structure with a rough fabric and strong consistence. 20% distinct yellow mottling; 10% gravel 5-10 mm; nil segregations; common fine roots. Poorly drained with a clear and even boundary. Sampled 0.40 – 0.50. |
| | C +0.50 | Sandstone bedrock with nil roots beyond 0.50 m depth. Not sampled |

Table 9 Chemical Parameters: Eutrophic Brown Chromosol (Site W1)

| Layer | pH (1:5 water) | | ESP | | EC _e | | Ca:Mg | |
|-------|----------------|-----------------|-----|-----------|-----------------|------------|-------|--------------|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 6.3 | Slightly Acidic | 2.0 | Non-Sodic | 0.4 | Non-Saline | 1.3 | Ca Low |
| B21 | 6.5 | Slightly Acidic | 4.8 | Non-Sodic | 0.4 | Non-Saline | 0.7 | Ca Deficient |
| B22 | 7.1 | Neutral | 5.2 | Non-Sodic | 0.8 | Non-Saline | 0.7 | Ca Deficient |

Soil Unit 2: Eutrophic Brown Chromosol

Sub-Dominant Soil Type: Subnatric Brown Sodosol

Table 10 Summary: Subnatric Brown Sodosol (Site W7)


| Overview | |
|---|---|
| <p>Landscape Site W7</p>  | |
| ASC Name | Subnatric Brown Sodosol |
| Representative Site | Site W7 |
| Other Mapped Sites | W1, W6, W15 |
| Survey Type | Detailed lab |
| Dominant Topography | Hillcrest |
| Dominant Land Use | Native vegetation |
| Vegetation | Native vegetation |
| Inherent Soil Fertility | Moderately low |
| Slope (%) | 5% |
| Surrounding Slope (%) | 0-10% |
| Aspect | South |
| Verified | Non-BSAL (Fertility, Physical Barrier & pH) |
| LSC Class | 4 |

Table 11 Profile: Subnatric Brown Sodosol (Site W7)


| Profile | Horizon / Depth (m) | Description |
|--|---------------------|--|
|  | A1 0.0 – 0.10 | Very dark greyish brown (10YR 3/2) clay loam, weak structure of <10 mm crumb peds with a rough fabric and weak consistence. Nil mottling; <5% gravel 5-10 mm; nil segregations; abundant fine roots; well drained with a clear and even boundary. Sampled 0.0 - 0.10. |
| | B21 0.10 – 0.30 | Brown (10YR 4/3) heavy clay, weak structure of 5-15 mm crumb peds with a rough fabric and moderate consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; moderately drained with a gradual and even boundary. Sampled 0.20 – 0.30. |
| | B22 0.30 – 0.50 | Olive brown (2.5Y 4/3) Heavy Clay, massive peds with a rough fabric. 30% distinct grey mottling; Nil stone content; nil segregations; many fine roots; poorly drained with an abrupt and even boundary Sampled 0.40 – 0.50. |
| | C +0.50 | Sandstone bedrock, with nil roots beyond 0.50 m depth. Not sampled |

Table 12 Chemical Parameters: Subnatric Brown Sodosol (Site W7)

| Layer | pH (1:5 water) | | ESP | | ECe | | Ca:Mg | |
|-------|----------------|-------------------|-----|------------------|------|------------|-------|--------------|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 6.1 | Slightly Acidic | 1.4 | Non-Sodic | 0.6 | Non-Saline | 1.4 | Ca Low |
| B21 | 7.4 | Mildly Alkaline | 5.1 | Non-Sodic | 0.3 | Non-Saline | 0.3 | Ca Deficient |
| B22 | 9.0 | Strongly Alkaline | 7.0 | Marginally Sodic | 1.5 | Non-Saline | 0.4 | Ca Deficient |

Soil Unit 2: Eutrophic Brown Chromosol

Eutrophic Brown Chromosol

Table 13 Summary: Eutrophic Brown Chromosol (Site W15)


| Overview | |
|---|-----------------------------|
| <p>Landscape Site 15</p>  | |
| ASC Name | Eutrophic Brown Chromosol |
| Representative Site | Site W15 |
| Other Mapped Sites | W1, W6, W7 |
| Survey Type | Detailed lab |
| Dominant Topography | Upper slope |
| Dominant Land Use | Cattle grazing |
| Vegetation | Native vegetation |
| Inherent Soil Fertility | Moderately high |
| Slope (%) | 8% |
| Surrounding Slope (%) | 0-15% |
| Aspect | Southwest |
| Verified | Non-BSAL (Physical Barrier) |
| LSC Class | 4 |

Table 14 Profile: Eutrophic Brown Chromosol (Site W15)


| Profile | Horizon / Depth (m) | Description |
|--|---------------------|---|
|  | A1 0.0 – 0.10 | Brown (7.5YR 4/2) clay loam, weak structure of 10-15 mm blocky peds with a rough fabric and weak consistence. Nil mottling; <5% gravel 5-10 mm; nil segregations; abundant fine roots; well drained with a gradual and even boundary. Sampled 0.0 – 0.10. |
| | A2 0.10 – 0.20 | Brown (7.5YR 4/3) loam, moderate structure of 10-20 mm blocky peds with a rough fabric and weak consistence. Nil mottling; 5% gravel 5-10 mm; nil segregations; few fine roots; well drained with an abrupt and even boundary. Sampled 0.10 – 0.20. |
| | B21 0.20 – 0.40 | Strong brown (7.5YR 5/6) heavy clay, strong structure of 10-30 mm blocky peds and strong consistence. nil mottling; nil stone content; nil segregations; few fine roots; well drained with a gradual and even boundary. Sampled 0.30 – 0.40. |
| | B22 0.40 – 0.60 | Yellowish-brown (10YR 5/4) silty clay, massive structure and strong consistence. nil mottling; nil stone content; 40% soft calcium nodules few coarse roots; well drained with an abrupt and even boundary Sampled 0.50 – 0.60. |
| | BC +0.60 | Weathered sandstone with >50% gravel content 10-50 mm and nil roots beyond 0.60 m depth. Not sampled. |

Table 15 Chemical Parameters: Eutrophic Brown Chromosol (Site W15)

| Layer | pH (1:5 water) | | ESP | | ECe | | Ca:Mg | |
|-------|----------------|-------------------|-----|-----------|------|------------|-------|--------|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 6.8 | Neutral | 2.1 | Non-Sodic | 0.6 | Non-Saline | 1.9 | Ca Low |
| A2 | 6.4 | Slightly Acidic | 3.5 | Non-Sodic | 0.6 | Non-Saline | 2.1 | Ca Low |
| B21 | 7.4 | Mildly Alkaline | 3.3 | Non-Sodic | 1.0 | Non-Saline | 1.8 | Ca Low |
| B22 | 8.8 | Strongly Alkaline | 1.7 | Non-Sodic | 1.5 | Non-Saline | 3.4 | Ca Low |

Soil Unit 3: Epipedal Black Vertosol

Epipedal Black Vertosol

Table 16 Summary: Epipedal Black Vertosol (Site W9)

| Overview | |
|--|-----------------------------|
| <p>Landscape Site W9</p>  | |
| ASC Name | Epipedal Black Vertosol |
| Representative Site | Site W9 |
| Survey Type | Detailed lab |
| Dominant Topography | Upper slope |
| Dominant Land Use | Cattle grazing |
| Vegetation | Native vegetation |
| Inherent Soil Fertility | High |
| Slope (%) | 7% |
| Surrounding Slope (%) | 0-10% |
| Aspect | Northeast |
| Verified | Non-BSAL (Physical Barrier) |
| LSC Class | 4 |

Table 17 Profile: Epipedal Black Vertisol (Site W9)


| Profile | Horizon / Depth (m) | Description |
|--|---------------------|---|
|  | A1 0.0 – 0.20 | Very dark greyish brown (10YR 3/2) silty clay, moderate structure of 5-10 mm crumb peds with a rough fabric and weak consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; well drained with a gradual and wavy boundary. Sampled 0.0 – 0.10. |
| | B21 0.20 – 0.40 | Very dark greyish brown (10YR 3/2) heavy clay, moderate structure of 10-30 mm blocky peds with a rough fabric and strong consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; well drained with a gradual and wavy boundary. Sampled 0.20 – 0.30 |
| | B22 0.40 – 0.60 | Dark brown (7.5YR 3/2) silty clay, massive structure with a rough fabric. Nil mottling; nil stone content; 20% soft calcium nodules; coarse roots common; well drained with an abrupt and wavy boundary. Sampled 0.40 – 0.50 |
| | BC +0.60 | Weathered sandstone with >50% gravel content 10-50 mm and nil roots beyond 0.70 m depth. Not sampled. |

Table 18 Chemical Parameters: Epipedal Black Vertisol (SiteW9)

| Layer | pH (1:5 water) | | ESP | | ECe | | Ca:Mg | |
|-------|----------------|-------------------|-----|-----------|------|------------|-------|--------|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 6.2 | Slightly Acidic | 1.3 | Non-Sodic | 0.5 | Non-Saline | 1.7 | Ca Low |
| B21 | 7.1 | Neutral | 2.6 | Non-Sodic | 0.3 | Non-Saline | 1.1 | Ca Low |
| B22 | 8.7 | Strongly Alkaline | 3.5 | Non-Sodic | 1.9 | Non-Saline | 1.6 | Ca Low |

Soil Unit 4: Subnatric Brown Sodosol

Sub-Dominant Soil Type: Subnatric Grey-Black Sodosol

Table 19 Summary: Subnatric Grey-Black Sodosol (Site W14)

| Overview | |
|--|--|
| <p>Landscape Site W14</p>  | |
| ASC Name | Subnatric Grey-Black Sodosol |
| Representative Site | Site W14 |
| Other Mapped Sites | W5, W16 |
| Survey Type | Detailed lab |
| Dominant Topography | Lower slope spur |
| Dominant Land Use | Cattle grazing |
| Vegetation | Native vegetation |
| Inherent Soil Fertility | Moderately low |
| Slope (%) | 10% |
| Surrounding Slope (%) | 5-25% |
| Aspect | Northwest |
| Verified | Non-BSAL (Slope, Fertility, Drainage, ECe & ESP) |
| LSC Class | 4 |

Table 20 Profile: Subnatric Grey-Black Sodosol (Site W14)


| Profile | Horizon / Depth (m) | Description |
|--|---------------------|--|
|  | A1 0.0 – 0.10 | Very dark brown (10YR 2/2) clay loam, weak structure of <10 mm crumb peds with a rough fabric and weak consistence. Nil mottling; 10% gravel 10-20mm; nil segregations; abundant fine roots; well drained with a gradual and even boundary. Sampled 0.0 – 0.10. |
| | A2 0.10 – 0.20 | Dark brown (7.5YR 3/2) clay loam, moderate structure of 5-10 mm crumb peds with a rough fabric and weak consistence. Nil mottling; 40% gravel 5-10mm; nil segregations; many fine roots; well drained with a clear and even boundary. Sampled 0.10 – 0.20. |
| | B21 0.20 – 0.50 | Brown (7.5YR 4/2) heavy clay, massive structure and strong consistence. 20% distinct grey mottling; <5% gravel 5-10mm; Nil segregations; many fine roots; poorly drained with a gradual and even boundary. Sampled 0.40 – 0.50. |
| | B22 +0.50 | Dark brown (7.5YR 3/3) Light-medium Clay, massive structure and strong consistence. 20% distinct grey mottling; 40% gravel 10-40mm; Nil segregations; few fine roots; poorly drained with layer continuing beyond sampling depth. Sampled 0.65 – 0.75. |

Table 21 Chemical Parameters: Subnatric Grey-Black Sodosol (Site W14)

| Layer | pH (1:5 water) | | ESP | | ECe | | Ca:Mg | |
|-------|----------------|---------------------|------|----------------|------|-------------------|-------|--------------|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 6.2 | Slightly Acidic | 1.9 | Non-Sodic | 0.9 | Non-Saline | 2.6 | Ca Low |
| A2 | 6.2 | Slightly Acidic | 1.5 | Non-Sodic | 0.4 | Non-Saline | 1.8 | Ca Low |
| B21 | 8.1 | Moderately Alkaline | 12.8 | Sodic | 2.5 | Slightly Saline | 0.5 | Ca Deficient |
| B22 | 8.3 | Moderately Alkaline | 24.3 | Strongly Sodic | 7.4 | Moderately Saline | 0.4 | Ca Deficient |

Soil Unit 4: Subnatric Brown Sodosol

Sub-Dominant Soil Type: Epipedal Grey Vertosol

Table 22 Summary: Epipedal Grey Vertosol (Site W16)


| Overview | |
|--|-----------------------------|
| <p>Landscape Site W16</p>  | |
| ASC Name | Epipedal Grey Vertosol |
| Representative Site | Site W16 |
| Other Mapped Sites | W5, W14 |
| Survey Type | Detailed |
| Dominant Topography | Upper slope ridge |
| Dominant Land Use | Cattle grazing |
| Vegetation | Native vegetation |
| Inherent Soil Fertility | Moderately high |
| Slope (%) | 7% |
| Surrounding Slope (%) | 0-20% |
| Aspect | West |
| Verified | Non-BSAL (Physical Barrier) |
| LSC Class | 6 |

Table 23 Profile: Epipedal Grey Vertisol (Site W16)


| Profile | Horizon / Depth (m) | Description |
|--|---------------------|--|
|  | A1 0.0 – 0.10 | Brown (7.5 YRY 5/2) light-medium clay; weak structure of 5-15 mm crumb peds with a rough fabric and weak consistence. Nil mottling; <5% gravel 5-10 mm; nil segregations; many fine roots; well drained with a gradual and wavy boundary. Sampled 0.0 – 0.10. |
| | B2 0.10 – 0.25 | Grey (10YYR 6/1) silty clay; moderate structure of 10-20 mm sub angular blocky peds with a rough fabric and moderate consistence. Nil mottling; nil stone content; nil segregations; well drained with a clear and wavy boundary. Sampled 0.20 – 0.30. |
| | BC 0.30 – 0.60 | Weathered sandstone with >60% gravel content 10-50 mm and nil roots beyond 0.50 m depth. Not sampled. |
| | C 0.60 | Sandstone bedrock. Not sampled. |

Table 24 Chemical Parameters: Epipedal Grey Vertisol (Site W16)

| Layer | pH (1:5 water) | | ESP | | EC _e | | Ca:Mg | |
|-------|----------------|---------------------|-----|-----------|-----------------|-----------------|-------|--------|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 8.3 | Moderately Alkaline | 0.7 | Non Sodic | 2.2 | Slightly Saline | 7.2 | Mg Low |
| B2 | 8.7 | Strongly Alkaline | 1.0 | Non Sodic | 1.3 | Non-Saline | 6.7 | Mg Low |

Detailed Sites Outside AIS Study Area

Epipedal Black Vertosol

Table 25 Summary: Epipedal Black Vertosol (Site W10)


| Overview | |
|--|-------------------------|
| <p style="text-align: center;">Landscape Site W10</p>  | |
| ASC Name | Epipedal Black Vertosol |
| Representative Site | Site W10 |
| Survey Type | Detailed lab |
| Dominant Topography | Lower slope bench |
| Dominant Land Use | Cattle grazing |
| Vegetation | Native vegetation |
| Inherent Soil Fertility | High |
| Slope (%) | 6% |
| Surrounding Slope (%) | 0-10% |
| Aspect | North |
| Verified | Non-BSAL (pH & ECe) |

Table 26 Profile: Epipedal Black Vertisol (Site W10)


| Profile | Horizon / Depth (m) | Description |
|--|---------------------|---|
|  | A1 0.0 – 0.20 | Dark brown (7.5YR 3/2) light clay, moderate structure of 5-10 mm crumb peds with a rough fabric and moderate consistence. Nil mottling; nil stone content; nil segregations; 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 3/2) heavy clay, strong structure of 20-30 mm lenticular peds with a smooth fabric and strong consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; well drained with a gradual and wavy boundary. Sampled 0.20-0.30. |
| | B22 0.40 – 0.60 | Brown (10YR 4/3) heavy clay, massive structure. Nil mottling; nil stone content; 20% soft calcium nodules; many fine roots; well drained with a gradual and wavy boundary. Sampled 0.40-0.50. |
| | B23 +0.60 | Yellowish-brown (10YR 5/4) heavy clay, massive structure. Nil mottling; nil stone content; 40% soft calcium nodules; nil roots; well drained with layer continuing beyond sampling depth. Sampled 0.65-0.75. |

Table 27 Chemical Parameters: Epipedal Black Vertisol (Site W10)

| Layer | pH (1:5 water) | | ESP | | ECe | | Ca:Mg | |
|-------|----------------|------------------------|------|------------------|------|-------------------|-------|--------------|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 6.4 | Slightly Acidic | 2.3 | Non-Sodic | 0.4 | Non-Saline | 1.1 | Ca Low |
| B21 | 7.0 | Neutral | 6.1 | Marginally Sodic | 0.5 | Non-Saline | 0.7 | Ca Deficient |
| B22 | 8.9 | Strongly Alkaline | 10.4 | Sodic | 3.9 | Slightly Saline | 0.9 | Ca Deficient |
| B23 | 9.1 | Very Strongly Alkaline | 13.4 | Sodic | 5.2 | Moderately Saline | 0.7 | Ca Deficient |

Detailed Sites Outside AIS Study Area

Eutrophic Black Chromosol

Table 28 Summary: Eutrophic Black Chromosol (Site W11)


| Overview | |
|---|---------------------------|
| Landscape Site W11 | |
|  | |
| ASC Name | Eutrophic Black Chromosol |
| Representative Site | Site W11 |
| Survey Type | Detailed lab |
| Dominant Topography | Upper slope |
| Dominant Land Use | Cattle grazing |
| Vegetation | Native vegetation |
| Inherent Soil Fertility | Moderately high |
| Slope (%) | 7% |
| Surrounding Slope (%) | 0-15% |
| Aspect | Southwest |
| Verified | Non-BSAL (pH & ECe) |

Table 29 Profile: Eutrophic Black Chromosol (Site W11)


| Profile | Horizon / Depth (m) | Description |
|--|---------------------|--|
|  | A1 0.0 – 0.20 | Very dark brown (7.5YR 2.5/2) clay loam, weak structure of 10-20 mm crumb peds with a rough fabric and weak consistence. Nil mottling; 5% gravel 5-10 mm; nil segregations; abundant fine roots; well drained with a clear and even boundary. Sampled 0.0 – 0.10. |
| | B21 0.20 – 0.40 | Dark brown (7.5YR 3/2) heavy clay, moderate structure of 30-40 mm lenticular peds with a smooth fabric and strong consistence. Nil mottling; nil stone content; nil segregations; many fine roots; well drained with a gradual and even boundary. Sampled 0.20 – 0.30 |
| | B22 0.40 – 0.60 | Brown (10YR 4/3) silty clay, strong structure of 30-50 mm lenticular peds with a smooth fabric and strong consistence. Nil mottling; nil stone content; nil segregations; few fine roots; well drained with a gradual and even boundary. Sampled 0.40 – 0.50 |
| | B23 0.60-0.75 | Brown (10YR 5/3) silty clay, massive structure. Nil mottling; <5% gravel 5-10 mm; 20% soft calcium nodules; no roots; well drained with a clear and even boundary. Sampled 0.65 – 0.75 |
| | BC +0.75 | Weathered sandstone. Not sampled |

Table 30 Chemical Parameters: Eutrophic Black Chromosol (Site W11)

| Layer | pH (1:5 water) | | ESP | | ECe | | Ca:Mg | |
|-------|----------------|------------------------|------|------------------|------|-------------------|-------|--------------|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 6.2 | Slightly Acidic | 2.4 | Non-Sodic | 1.2 | Non-Saline | 1.5 | Ca Low |
| B21 | 8.6 | Strongly Alkaline | 5.3 | Non-Sodic | 0.9 | Non-Saline | 0.6 | Ca Deficient |
| B22 | 9.3 | Very Strongly Alkaline | 8.7 | Marginally Sodic | 3.9 | Slightly Saline | 1.0 | Ca Deficient |
| B23 | 9.3 | Very Strongly Alkaline | 13.9 | Sodic | 7.5 | Moderately Saline | 1.1 | Ca Low |

Detailed Sites Outside AIS Study Area

Eutrophic Brown Chromosol

Table 31 Summary: Eutrophic Brown Chromosol (Site W12)


| Overview | |
|--|--|
| <p>Landscape Site W12</p>  | |
| ASC Name | Eutrophic Brown Chromosol |
| Representative Site | Site W12 |
| Survey Type | Detailed laboratory |
| Dominant Topography | Upper slope bench |
| Dominant Land Use | Cattle grazing |
| Vegetation | Native vegetation |
| Inherent Soil Fertility | Moderately high |
| Slope (%) | 4% |
| Surrounding Slope (%) | 0-20% |
| Aspect | North-West |
| Verified | Non-BSAL (Physical Barrier & Drainage) |

Table 32 Profile: Eutrophic Brown Chromosol (Site W12)


| Profile | Horizon / Depth (m) | Description |
|--|---------------------|---|
|  | A1 0.0 – 0.20 | Dark brown (7.5YR 3/2) clay loam, weak structure of 10-20 mm crumb peds with a rough fabric and weak consistence. Nil mottling; 20% cobbles 50-100mm; nil segregations; abundant fine roots; well drained; with clear and even boundary. Sampled 0.0-0.10. |
| | B2 0.20 – 0.40 | Strong brown (7.5YR 5/6) heavy clay, strong structure of 20-40 mm blocky peds with a rough fabric and strong consistence. 20% distinct grey mottling; 20% cobbles 50-100mm; nil segregations; many fine roots; poorly drained with an abrupt and even boundary Sampled 0.20-0.30. |
| | C +0.40 | Sandstone bedrock, with nil roots beyond 0.40 m depth. Not sampled. |

Table 33 Chemical Parameters: Eutrophic Brown Chromosol (Site W12)

| 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 | 0.6 | Non-Saline | 2.7 | Ca Low |
| B2 | 7.3 | Neutral | 1.2 | Non-Sodic | 0.3 | Non-Saline | 0.9 | Ca Deficient |

Detailed Sites Outside AIS Study Area

Epipedal Black Vertosol

Table 34 Summary: Epipedal Black Vertosol (Site W13)


| Overview | |
|---|--------------------------|
| <p>Landscape Site W13</p>  | |
| ASC Name | Epipedal Black Vertosol |
| Representative Site | Site W13 |
| Survey Type | Detailed lab |
| Dominant Topography | Lower slope bench |
| Dominant Land Use | Cattle grazing |
| Vegetation | Native vegetation |
| Inherent Soil Fertility | High |
| Slope (%) | 4% |
| Surrounding Slope (%) | 0-15% |
| Aspect | North |
| Verified | Non-BSAL (pH, ECe & ESP) |

Table 35 Profile: Epipedal Black Vertisol (Site W13)


| Profile | Horizon / Depth (m) | Description |
|--|---------------------|---|
|  | A1 0.0 – 0.20 | Dark brown (7.5YR 3/2) light-medium clay, moderate structure of 5-10 mm crumb peds with a rough fabric and moderate consistence. Nil mottling; 10% gravel 5-10 mm; nil segregations; abundant fine roots; well drained with a gradual and even boundary. Sampled 0.0 – 0.10. |
| | B21 0.20 – 0.50 | Very dark grey (7.5YR 3/1) heavy clay, strong structure of 40-50 mm lenticular peds with a rough fabric and strong consistence. Nil mottling; nil stone content; nil segregations; many fine roots; well drained with a gradual and even boundary. Sampled 0.20 – 0.30. |
| | B22 +0.50 | Dark brown (7.5YR 3/2) heavy clay, massive structure. Nil mottling; nil stone content; 5% soft calcium nodules; few fine roots; well drained with layer continuing beyond sample depth. Sampled 0.40 – 0.50 & 0.65 – 0.75. |

Table 36 Chemical Parameters: Epipedal Black Vertisol (Site W13)

| Layer | pH (1:5 water) | | ESP | | ECe | | Ca:Mg | |
|-------|----------------|---------------------|------|------------------|------|-------------------|-------|--------------|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 6.5 | Slightly Acidic | 2.7 | Non-Sodic | 0.6 | Non-Saline | 1.1 | Ca Low |
| B21 | 8.0 | Moderately Alkaline | 7.4 | Marginally Sodic | 0.8 | Non-Saline | 0.8 | Ca Deficient |
| B22 | 8.9 | Strongly Alkaline | 12.1 | Sodic | 3.3 | Slightly Saline | 1.2 | Ca Low |
| B22 | 9.0 | Strongly Alkaline | 15.6 | Strongly Sodic | 5.9 | Moderately Saline | 1.2 | Ca Low |

Detailed Sites Outside AIS Study Area

Eutrophic Black Chromosol

Table 37 Summary: Eutrophic Black Chromosol (Site W17)


| Overview | |
|---|---------------------------|
| Landscape Site W17 | |
|  | |
| ASC Name | Eutrophic Black Chromosol |
| Representative Site | Site W17 |
| Survey Type | Detailed lab |
| Dominant Topography | Lower slope |
| Dominant Land Use | Cattle grazing |
| Vegetation | Grass pasture |
| Inherent Soil Fertility | Moderately high |
| Slope (%) | 4% |
| Surrounding Slope (%) | 0-10% |
| Aspect | Southeast |
| Verified | BSAL |

Table 38 Profile: Eutrophic Black Chromsol (Site W17)


| Profile | Horizon / Depth (m) | Description |
|--|---------------------|--|
|  | A1 0.0 – 0.20 | Very dark brown (10YR 2/2) loam, weak structure of <10 mm crumb peds with a rough fabric and moderate consistence. Nil mottling; <5% gravel 5-10 mm; nil segregations; abundant fine roots; moderately drained with a clear and wavy boundary. Sampled 0.0 – 0.10. |
| | B21 0.20 – 0.30 | Very dark brown (7.5YR 2.5/2) clay loam, moderate structure of 5-15 mm blocky peds with a rough fabric and moderate consistence. Nil mottling; <5% gravel 5-10 mm; nil segregations; abundant fine roots; well drained with a gradual and wavy boundary. Sampled 0.20 – 0.30. |
| | B22 0.30 – 0.50 | Very dark greyish brown (10YR 3/2) clay loam, moderate structure of 10-20 mm blocky peds with a rough fabric and moderate consistence. Nil mottling; 25% gravel 5-10 mm; nil segregations; many fine roots; well drained with a gradual and even boundary. Sampled 0.40 – 0.50. |
| | B23 +0.50 | Black (10YR 2/1) clay loam, moderate structure of 20-40 mm blocky peds with a rough fabric and moderate consistence. Nil mottling; <5% gravel 10-30mm; nil segregations; many coarse roots. Well drained. Layer continues beyond sampling depth. Sampled 0.65 – 0.75. |

Table 39 Chemical Parameters: Eutrophic Black Chromsol (Site W17)

| Layer | pH (1:5 water) | | ESP | | EC _e | | Ca:Mg | |
|-------|----------------|-----------------|-----|-----------|-----------------|------------|-------|--------|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 6.3 | Slightly Acidic | 1.9 | Non Sodic | 0.5 | Non-Saline | 3.9 | Ca Low |
| B21 | 6.6 | Neutral | 1.2 | Non Sodic | 0.2 | Non-Saline | 3.0 | Ca Low |
| B22 | 6.9 | Neutral | 1.3 | Non Sodic | 0.2 | Non-Saline | 2.6 | Ca Low |
| B23 | 7.2 | Neutral | 1.5 | Non Sodic | 0.2 | Non-Saline | 2.4 | Ca Low |

Detailed Sites Outside AIS Study Area

Epipedal Black Vertosol

Table 40 Summary: Epipedal Black Vertosol (Site W18)


| Overview | |
|--|-------------------------|
| <p style="text-align: center;">Landscape Site W18</p>  | |
| ASC Name | Epipedal Black Vertosol |
| Representative Site | Site W18 |
| Survey Type | Detailed lab |
| Dominant Topography | Midslope |
| Dominant Land Use | Cattle grazing |
| Vegetation | Grass pasture |
| Inherent Soil Fertility | Moderately high |
| Slope (%) | 7% |
| Surrounding Slope (%) | 0-10% |
| Aspect | South |
| Verified | Non-BSAL (pH) |

Table 41 Profile: Epipedal Black Vertisol (Site W18)


| Profile | Horizon / Depth (m) | Description |
|--|---------------------|--|
|  | A1 0.0 – 0.20 | Very dark brown (7.5YR 2.5/2) medium clay, moderate structure of <10 mm crumb peds with a rough fabric and moderate consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; moderately drained; gradual and even boundary. Sampled 0 – 0.10. |
| | B21 0.20 – 0.40 | Very dark brown (7.5YR 2.5/2) heavy clay, strong structure of 10-20 mm blocky peds with a rough fabric and weak consistence. Nil mottling; nil stone content; nil segregations; many fine roots, well drained with a gradual and even boundary. Sampled 0.20 – 0.30. |
| | B22 0.40 – 0.60 | Very dark brown (7.5YR 2.5/2) medium clay, moderate structure of 10-20 mm blocky peds with a rough fabric and weak consistence. Nil mottling; nil stone content; nil segregations; coarse roots common, well drained with a gradual and even boundary. Sampled 0.40 – 0.50. |
| | B23 +0.60 | Dark brown (7.5YR 3/4) sandy loam, weak structure of 10-20 mm blocky peds with a rough fabric and weak consistence. Nil mottling; 20% gravel 5-10 mm; nil segregations; few coarse roots, well drained. Layer continues beyond sampling depth Sampled 0.65 – 0.75. |

Table 42 Chemical Parameters: Epipedal Black Vertisol (Site W18)

| Layer | pH (1:5 water) | | ESP | | ECe | | Ca:Mg | |
|-------|----------------|------------------------|-----|------------------|------|-----------------|-------|--------------|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 7.0 | Neutral | 1.4 | Non Sodic | 0.4 | Non-Saline | 0.9 | Ca Deficient |
| B21 | 7.7 | Mildly Alkaline | 2.2 | Non Sodic | 0.3 | Non-Saline | 0.8 | Ca Deficient |
| B22 | 8.7 | Strongly Alkaline | 3.6 | Non Sodic | 1.4 | Non-Saline | 1.0 | Ca Deficient |
| B23 | 9.2 | Very Strongly Alkaline | 6.7 | Marginally Sodic | 2.7 | Slightly Saline | 0.8 | Ca Deficient |

Detailed Sites Outside AIS Study Area

Eutrophic Black Chromosol

Table 43 Summary: Eutrophic Black Chromosol (Site W19)


| Overview | |
|--|---------------------------|
| <p>Landscape Site W19</p>  | |
| ASC Name | Eutrophic Black Chromosol |
| Representative Site | Site W19 |
| Survey Type | Detailed lab |
| Dominant Topography | Upper slope |
| Dominant Land Use | Cattle grazing |
| Vegetation | Grass pasture |
| Inherent Soil Fertility | Moderately high |
| Slope (%) | 11% |
| Surrounding Slope (%) | 10-15% |
| Aspect | Southwest |
| Verified | Non-BSAL (Slope) |

Table 44 Profile: Eutrophic Black Chromosol (Site W19)


| Profile | Horizon / Depth (m) | Description |
|--|---------------------|---|
|  | A1 0.0 – 0.20 | Black (10YR 2/1) clay loam, weak structure of 5-10 mm crumb peds with a rough fabric and weak consistence. Nil mottling; <5% gravel 5-10 mm; nil segregations; abundant fine roots; well drained with a clear and even boundary. Sampled 0.0 – 0.10. |
| | B21 0.20 – 0.40 | Very dark greyish brown (10YR 3/2) heavy clay, strong structure of 10-20 mm blocky peds with a rough fabric and moderate consistence. Nil mottling; nil stone content; nil segregations; few fine common; well drained with gradual and even boundary. Sampled 0.20 – 0.30. |
| | B22 0.40 – 0.60 | Brown (10YR 4/3) light-medium clay, strong structure of 20-40 mm blocky peds with a rough fabric and strong consistence. nil mottling; nil stone content; nil segregations; coarse roots common; well drained with a gradual and even boundary. Sampled 0.40 – 0.50. |
| | B23 +0.60 | Light yellowish brown 2.5Y 6/3) silty clay, moderate structure of 10-30 mm blocky peds with a rough fabric and moderate consistence. Nil mottling; nil stone content; nil segregations; few coarse roots, well drained. Layer continues beyond sampling depth Sampled 0.65 – 0.75 |

Table 45 Chemical Parameters: Eutrophic Black Chromosol (Site W19)

| Layer | pH (1:5 water) | | ESP | | ECe | | Ca:Mg | |
|-------|----------------|---------------------|------|------------------|------|------------|-------|--------------|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 6.8 | Neutral | 1.0 | Non Sodic | 0.6 | Non-Saline | 1.9 | Ca Low |
| B21 | 7.0 | Neutral | 2.9 | Non Sodic | 0.3 | Non-Saline | 1.1 | Ca Low |
| B22 | 8.0 | Moderately Alkaline | 6.6 | Marginally Sodic | 0.7 | Non-Saline | 0.8 | Ca Deficient |
| B23 | 8.8 | Strongly Alkaline | 11.0 | Sodic | 1.4 | Non-Saline | 0.7 | Ca Deficient |

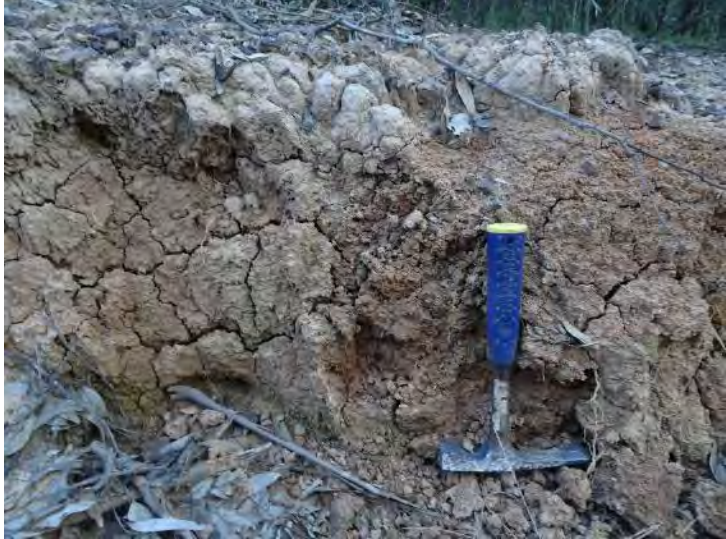
APPENDIX B

Check Site Descriptions




Soil Unit 1: Eutrophic Brown Dermosol

Table 1 Site C20 Brown Dermosol

| Profile | Horizon / Depth (m) | Description |
|--|---------------------|--|
|  | A1 0.0 – 0.20 | Clay loam with a gradual and even boundary |
| | B2 +0.20 | Heavy clay, strong structure, 7.5YR 5/6 (strong brown) |
| ASC Name | Brown Dermosol | |
| Representative Site | Site C20 | |
| Other Mapped Detailed Sites | W2, W3, W4 | |
| Survey Type | Check site | |
| Dominant Topography | Mid slope | |
| Dominant Land Use | Cattle grazing | |
| Vegetation | Native vegetation | |
| Inherent Soil Fertility | Moderately high | |
| Slope (%) | 16 | |
| Aspect | South | |


Soil Unit 1: Eutrophic Brown Dermosol

Table 2 Site C21 Brown Dermosol

| Profile | Horizon / Depth (m) | Description |
|---|---------------------|--|
|  | A1 0.0 – 0.20 | Clay loam with a gradual and even boundary |
| | B2 +0.20 | Light clay, strong structure, 7.5YR 5/6 (strong brown) |
| ASC Name | Brown Dermosol | |
| Representative Site | Site C21 | |
| Other Mapped Detailed Sites | W2, W3, W4 | |
| Survey Type | Check site | |
| Dominant Topography | Mid slope | |
| Dominant Land Use | Cattle grazing | |
| Vegetation | Native vegetation | |
| Inherent Soil Fertility | Moderately high | |
| Slope (%) | 11 | |
| Aspect | South | |


Soil Unit 1: Eutrophic Brown Dermosol

Table 3 Site C22 Brown Dermosol

| Profile | Horizon / Depth (m) | Description |
|---|----------------------|---|
|  | A1 0.0 – 0.10 | Clay loam with a gradual and even boundary |
| | B2 +0.10 | Light clay, moderate structure, 7.5YR 4/4 (brown) |
| ASC Name | Brown Dermosol | |
| Representative Site | Site C22 | |
| Other Mapped Detailed Sites | W2, W3, W4 | |
| Survey Type | Check site | |
| Dominant Topography | Lower slope | |
| Dominant Land Use | Cattle grazing | |
| Vegetation | Native grass pasture | |
| Inherent Soil Fertility | Moderately high | |
| Slope (%) | 8 | |
| Aspect | East | |


Soil Unit 2: Eutrophic Brown Chromosol

Table 4 Site C1 Brown Chromosol

| Profile | | Horizon / Depth (m) | Description |
|---|--|----------------------|--|
|  | | A1 0.0 – 0.10 | Clay loam with a clear and even boundary |
| | | B2 +0.10 | Light clay, strong structure, 10YR 4/4 (brown) |
| ASC Name | | Brown Chromosol | |
| Representative Site | | Site C1 | |
| Other Mapped Detailed Sites | | W1, W6, W7, W15 | |
| Survey Type | | Check site | |
| Dominant Topography | | Lower slope | |
| Dominant Land Use | | Cattle grazing | |
| Vegetation | | Native grass pasture | |
| Inherent Soil Fertility | | Moderately low | |
| Slope (%) | | 5 | |
| Aspect | | Southeast | |


Soil Unit 2: Eutrophic Brown Chromosol

Table 5 Site C16 Brown Chromosol

| Profile | | Horizon / Depth (m) | Description |
|---|--|----------------------|---|
|  | | A1 0.0 – 0.10 | Clay loam with a clear and even boundary |
| | | B2 +0.10 | Medium clay, strong structure, 7.5YR 5/8 (strong brown) |
| ASC Name | | Brown Chromosol | |
| Representative Site | | Site C16 | |
| Other Mapped Detailed Sites | | W1, W6, W7, W15 | |
| Survey Type | | Check site | |
| Dominant Topography | | Mid slope | |
| Dominant Land Use | | Cattle grazing | |
| Vegetation | | Native grass pasture | |
| Inherent Soil Fertility | | Moderately high | |
| Slope (%) | | 7 | |
| Aspect | | South | |


Soil Unit 2: Eutrophic Brown Chromosol

Table 6 Site C24 Brown Chromosol

| Profile | | Horizon / Depth (m) | Description |
|--|--|----------------------|---|
|  | | A1 0.0 – 0.10 | Clay loam with a clear and even boundary |
| | | B2 +0.10 | Medium clay, strong structure, 10YR 4/3 (brown) |
| ASC Name | | Brown Chromosol | |
| Representative Site | | Site C24 | |
| Other Mapped Detailed Sites | | W1, W6, W7, W15 | |
| Survey Type | | Check site | |
| Dominant Topography | | Upper slope | |
| Dominant Land Use | | Cattle grazing | |
| Vegetation | | Native grass pasture | |
| Inherent Soil Fertility | | Moderately high | |
| Slope (%) | | 5 | |
| Aspect | | East | |


Soil Unit 2: Eutrophic Brown Chromosol

Table 7 Site C26 Brown Sodosol

| Profile | | Horizon / Depth (m) | Description |
|---|--|----------------------|---|
|  | | A1 0.0 – 0.15 | Clay loam with a clear and even boundary |
| | | B2 +0.15 | Medium clay, strong structure, 7.5YR 4/6 (strong brown) |
| ASC Name | | Brown Sodosol | |
| Representative Site | | Site C26 | |
| Other Mapped Detailed Sites | | W1, W6, W7, W15 | |
| Survey Type | | Check site | |
| Dominant Topography | | Drainage line | |
| Dominant Land Use | | Cattle grazing | |
| Vegetation | | Native grass pasture | |
| Inherent Soil Fertility | | Moderately high | |
| Slope (%) | | 4 | |
| Aspect | | North | |


Soil Unit 3: Epipedal Black Vertosol

Table 8 Site C2 Black Vertosol

| Profile | Horizon / Depth (m) | Description |
|---|----------------------|--|
|  | A1 0.0 – 0.25 | Light clay with a gradual and even boundary |
| | B2 +0.25 | Heavy clay, strong structure, 7.5YR 3/1 (very dark grey) |
| ASC Name | Black Vertosol | |
| Representative Site | Site C2 | |
| Other Mapped Detailed Sites | W8, W9 | |
| Survey Type | Check site | |
| Dominant Topography | Drainage line | |
| Dominant Land Use | Cattle grazing | |
| Vegetation | Native grass pasture | |
| Inherent Soil Fertility | High | |
| Slope (%) | 3 | |
| Aspect | Northeast | |


Soil Unit 4: Subnatric Brown Sodosol

Table 9 Site C12 Black Sodosol

| Profile | Horizon / Depth (m) | Description |
|---|----------------------|---|
|  | A1 0.0 – 0.15 | Clay loam with a clear and even boundary |
| | B2 +0.15 | Medium clay, strong structure, 7.5YR 3/1 (very dark grey) |
| ASC Name | Black Sodosol | |
| Representative Site | Site C12 | |
| Other Mapped Detailed Sites | W5, W14, W16 | |
| Survey Type | Check site | |
| Dominant Topography | Upper slope | |
| Dominant Land Use | Cattle Grazing | |
| Vegetation | Native grass pasture | |
| Inherent Soil Fertility | Moderately low | |
| Slope (%) | 5 | |
| Aspect | West | |


Soil Unit 4: Subnatric Brown Sodosol

Table 10 Site C13 Brown Sodosol

| Profile | Horizon / Depth (m) | Description |
|---|----------------------|---|
|  | A1 0.0 – 0.10 | Clay loam with a clear and even boundary |
| | B2 +0.10 | Medium clay, strong structure, 7.5YR 5/8 (strong brown) |
| ASC Name | Brown Sodosol | |
| Representative Site | Site C13 | |
| Other Mapped Detailed Sites | W5, W14, W16 | |
| Survey Type | Check site | |
| Dominant Topography | Upper slope | |
| Dominant Land Use | Cattle Grazing | |
| Vegetation | Native grass pasture | |
| Inherent Soil Fertility | Moderately low | |
| Slope (%) | 16 | |
| Aspect | West | |


Soil Unit 4: Subnatic Brown Sodosol

Table 11 Site C17 Brown Sodosol

| Profile | Horizon / Depth (m) | Description |
|---|---------------------|--|
|  | A1 0.0 – 0.15 | Silty loam with a clear and even boundary |
| | B2 +0.15 | Medium clay, strong structure, 7.5YR 4/4 (brown) |
| ASC Name | Brown Sodosol | |
| Representative Site | Site C17 | |
| Other Mapped Detailed Sites | W5, W14, W16 | |
| Survey Type | Check site | |
| Dominant Topography | Lower slope | |
| Dominant Land Use | Cattle grazing | |
| Vegetation | Native vegetation | |
| Inherent Soil Fertility | Moderately low | |
| Slope (%) | 24 | |
| Aspect | Northwest | |


Soil Unit 4: Subnatric Brown Sodosol

Table 12 Site C18 Brown Sodosol

| Profile | Horizon / Depth (m) | Description |
|--|---------------------|--|
|  | A1 0.0 – 0.10 | Clay loam with a clear and even boundary |
| | B2 +0.10 | Medium clay, strong structure, 7.5YR 4/2 (brown) |
| ASC Name | Brown Sodosol | |
| Representative Site | Site C18 | |
| Other Mapped Detailed Sites | W5, W14, W16 | |
| Survey Type | Check site | |
| Dominant Topography | Mid slope | |
| Dominant Land Use | Cattle grazing | |
| Vegetation | Native vegetation | |
| Inherent Soil Fertility | Moderately low | |
| Slope (%) | 15 | |
| Aspect | Northwest | |


Soil Unit 4: Subnatric Brown Sodosol

Table 13 Site C19 Brown Sodosol

| Profile | Horizon / Depth (m) | Description |
|---|---------------------|---|
|  | A1 0.0 – 0.10 | Clay loam with a clear and even boundary |
| | B2 +0.10 | Medium clay, strong structure, 7.5YR 4/6 (strong brown) |
| ASC Name | Brown Sodosol | |
| Representative Site | Site C19 | |
| Other Mapped Detailed Sites | W5, W14, W16 | |
| Survey Type | Check site | |
| Dominant Topography | Mid slope | |
| Dominant Land Use | Cattle grazing | |
| Vegetation | Native vegetation | |
| Inherent Soil Fertility | Moderately low | |
| Slope (%) | 12 | |
| Aspect | Southeast | |


Soil Unit 4: Subnatic Brown Sodosol

Table 14 Site C23 Brown Sodosol

| Profile | Horizon / Depth (m) | Description |
|---|---------------------|---|
|  | A1 0.0 – 0.20 | Loam with a clear and even boundary |
| | B2 +0.20 | Medium clay, strong structure, 7.5YR 5/6 (strong brown) |
| ASC Name | Sodosol | |
| Representative Site | Site C23 | |
| Other Mapped Detailed Sites | W5, W14, W16 | |
| Survey Type | Check site | |
| Dominant Topography | Mid slope | |
| Dominant Land Use | Cattle grazing | |
| Vegetation | Native vegetation | |
| Inherent Soil Fertility | Moderately low | |
| Slope (%) | 11 | |
| Aspect | Northwest | |


Check Sites Outside BSAL Study Area

Table 15 Site C3 Brown Chromosol

| Profile | | Horizon / Depth (m) | Description |
|---|--|----------------------|---|
|  | | A1 0.0 – 0.15 | Clay loam with a clear and even boundary |
| | | B2 +0.15 | Medium clay, strong structure, 10YR 5/4 (yellowish brown) |
| ASC Name | | Brown Chromosol | |
| Representative Site | | Site C3 | |
| Other Mapped Detailed Sites | | N/A | |
| Survey Type | | Check site | |
| Dominant Topography | | Lower slope | |
| Dominant Land Use | | Cattle grazing | |
| Vegetation | | Native grass pasture | |
| Inherent Soil Fertility | | Moderately high | |
| Slope (%) | | 7 | |
| Aspect | | East | |


Check Sites Outside BSAL Study Area

Table 16 Site C4 Brown Chromosol

| Profile | | Horizon / Depth (m) | Description |
|---|--|----------------------|---|
|  | | A1 0.0 – 0.10 | Clay loam with a clear and even boundary |
| | | B2 +0.10 | Medium clay, strong structure, 10YR 4/3 (brown) |
| ASC Name | | Brown Chromosol | |
| Representative Site | | Site C4 | |
| Other Mapped Detailed Sites | | N/A | |
| Survey Type | | Check site | |
| Dominant Topography | | Mid slope | |
| Dominant Land Use | | Cattle grazing | |
| Vegetation | | Native grass pasture | |
| Inherent Soil Fertility | | Moderately high | |
| Slope (%) | | 2 | |
| Aspect | | Northeast | |


Check Sites Outside BSAL Study Area

Table 17 Site C5 Brown Chromosol

| Profile | Horizon / Depth (m) | Description |
|---|----------------------|---|
|  | A1 0.0 – 0.05 | Clay loam with a clear and even boundary |
| | B2 +0.05 | Heavy clay, strong structure, 7.5YR 4/3 (brown) |
| ASC Name | Brown Chromosol | |
| Representative Site | Site C5 | |
| Survey Type | N/A | |
| Dominant Topography | Upper slope bench | |
| Dominant Land Use | Cattle grazing | |
| Vegetation | Native grass pasture | |
| Inherent Soil Fertility | Moderately high | |
| Slope (%) | 5 | |
| Aspect | Northwest | |


Check Sites Outside BSAL Study Area

Table 18 Site C6 Brown Chromosol

| Profile | Horizon / Depth (m) | Description |
|---|----------------------|---|
|  | A1 0.0 – 0.10 | Clay loam with a clear and even boundary |
| | B2 +0.10 | Heavy clay, strong structure, 7.5YR 4/3 (brown) |
| ASC Name | Brown Chromosol | |
| Representative Site | Site C6 | |
| Survey Type | N/A | |
| Dominant Topography | Upper slope | |
| Dominant Land Use | Cattle grazing | |
| Vegetation | Native grass pasture | |
| Inherent Soil Fertility | Moderately high | |
| Slope (%) | 5 | |
| Aspect | South | |


Check Sites Outside BSAL Study Area

Table 19 Site C7 Black Sodosol

| Profile | Horizon / Depth (m) | Description |
|---|----------------------|--|
|  | A1 0.0 – 0.15 | Clay loam with a clear and even boundary |
| | B2 +0.15 | Heavy clay, strong structure, 7.5YR 3/2 (dark brown) |
| ASC Name | Black Sodosol | |
| Representative Site | Site C7 | |
| Other Mapped Detailed Sites | N/A | |
| Survey Type | Check site | |
| Dominant Topography | Mid slope | |
| Dominant Land Use | Cattle Grazing | |
| Vegetation | Native grass pasture | |
| Inherent Soil Fertility | Moderately low | |
| Slope (%) | 14 | |
| Aspect | Northeast | |


Check Sites Outside BSAL Study Area

Table 20 Site C8 Black Vertosol

| Profile | Horizon / Depth (m) | Description |
|---|----------------------|---|
|  | A1 0.0 – 0.10 | Light clay with a gradual and even boundary |
| | B2 +0.10 | Heavy clay, strong structure, 7.5YR 3/2 (black) |
| ASC Name | Black Vertosol | |
| Representative Site | Site C8 | |
| Other Mapped Detailed Sites | N/A | |
| Survey Type | Check site | |
| Dominant Topography | Lower slope | |
| Dominant Land Use | Cattle grazing | |
| Vegetation | Native grass pasture | |
| Inherent Soil Fertility | High | |
| Slope (%) | 3 | |
| Aspect | Northeast | |


Check Sites Outside BSAL Study Area

Table 21 Site C9 Brown Vertosol

| Profile | | Horizon / Depth (m) | Description |
|---|--|----------------------|--|
|  | | A1 0.0 – 0.15 | Light clay with a gradual and even boundary |
| | | B2 +0.15 | Heavy clay, strong structure, 10YR 4/3 (brown) |
| ASC Name | | Brown Vertosol | |
| Representative Site | | Site C9 | |
| Other Mapped Detailed Sites | | N/A | |
| Survey Type | | Check site | |
| Dominant Topography | | Lower slope | |
| Dominant Land Use | | Cattle grazing | |
| Vegetation | | Native grass pasture | |
| Inherent Soil Fertility | | Moderately high | |
| Slope (%) | | 5 | |
| Aspect | | Northeast | |


Check Sites Outside BSAL Study Area

Table 22 Sire C11 Brown Sodosol

| Profile | | Horizon / Depth (m) | Description |
|--|--|----------------------|--|
|  | | A1 0.0 – 0.10 | Clay loam with a clear and even boundary |
| | | B2 +0.10 | Medium clay, strong structure, 7.5YR 5/4 (brown) |
| ASC Name | | Brown Sodosol | |
| Representative Site | | Site C11 | |
| Other Mapped Detailed Sites | | N/A | |
| Survey Type | | Check site | |
| Dominant Topography | | Mid slope | |
| Dominant Land Use | | Cattle Grazing | |
| Vegetation | | Native grass pasture | |
| Inherent Soil Fertility | | Moderately low | |
| Slope (%) | | 9 | |
| Aspect | | North | |


Check Sites Outside BSAL Study Area

Table 23 Site C14 Brown Vertosol

| Profile | Horizon / Depth (m) | Description |
|--|----------------------|---|
|  | A1 0.0 – 0.20 | Silty clay with a gradual and even boundary |
| | B2 +0.20 | Heavy clay, strong structure, 7.5YR 5/4 (brown) |
| ASC Name | Brown Vertosol | |
| Representative Site | Site C14 | |
| Other Mapped Detailed Sites | N/A | |
| Survey Type | Check site | |
| Dominant Topography | Lower slope | |
| Dominant Land Use | Cattle grazing | |
| Vegetation | Native grass pasture | |
| Inherent Soil Fertility | Moderately high | |
| Slope (%) | 14 | |
| Aspect | North | |


Check Sites Outside BSAL Study Area

Table 24 Site C15 Brown Vertosol

| Profile | | Horizon / Depth (m) | Description |
|--|--|----------------------|--|
|  | | A1 0.0 – 0.20 | Light clay with a gradual and even boundary |
| | | B2 +0.20 | Heavy clay, strong structure, 10YR 4/4 (brown) |
| ASC Name | | Brown Vertosol | |
| Representative Site | | Site C15 | |
| Other Mapped Detailed Sites | | N/A | |
| Survey Type | | Check site | |
| Dominant Topography | | Drainage line | |
| Dominant Land Use | | Cattle grazing | |
| Vegetation | | Native grass pasture | |
| Inherent Soil Fertility | | Moderately high | |
| Slope (%) | | 6 | |
| Aspect | | Northeast | |

Check Sites Outside BSAL Study Area

Table 25 Site C25 Brown Vertosol

| Profile | Horizon / Depth (m) | Description |
|---|----------------------|---|
|  | A1 0.0 – 0.10 | Light clay with a gradual and even boundary |
| | B2 +0.10 | Heavy clay, strong structure, 10YR 4/6 (strong brown) |
| ASC Name | Brown Vertosol | |
| Representative Site | Site C25 | |
| Other Mapped Detailed Sites | N/A | |
| Survey Type | Check site | |
| Dominant Topography | Drainage line | |
| Dominant Land Use | Cattle grazing | |
| Vegetation | Native grass pasture | |
| Inherent Soil Fertility | Moderately high | |
| Slope (%) | 8 | |
| Aspect | Northwest | |

APPENDIX C

Laboratory Certificates of Analysis



AGRICULTURAL SOIL ANALYSIS REPORT

51 samples supplied by SLR Consulting Australia Pty Ltd on 29/07/2020. Lab Job No.J6517
 Analysis requested by Murray Fraser. Your Job: PO: SLR 630.30047; Wambo Mod 18
 10 Kings Road NEW LAMBTON NSW 2305

| Sample ID: | | Sample 1 W1 0-10 27/7/2020 | Sample 2 W1 20-30 27/7/2020 | Sample 3 W1 40-50 27/7/2020 | Sample 4 W2 0-10 27/7/2020 | Sample 5 W2 10-20 27/7/2020 |
|---|---|----------------------------------|-----------------------------------|-----------------------------------|----------------------------------|-----------------------------------|
| Crop: | | Soil | Soil | Soil | Soil | Soil |
| Client: | | Wambo | Wambo | Wambo | Wambo | Wambo |
| Parameter | Method reference | J6517/1 | J6517/2 | J6517/3 | J6517/4 | J6517/5 |
| pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 6.31 | 6.45 | 7.07 | 6.68 | 6.90 |
| Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.051 | 0.076 | 0.137 | 0.048 | 0.037 |
| Exchangeable Calcium | (cmol _e /kg) | 5.3 | 5.8 | 7.2 | 13 | 13 |
| | (kg/ha) | 2,379 | 2,607 | 3,212 | 5,945 | 5,868 |
| | (mg/kg) | 1,062 | 1,164 | 1,434 | 2,654 | 2,620 |
| Exchangeable Magnesium | (cmol _e /kg) | 4.2 | 8.6 | 11 | 2.8 | 3.0 |
| | (kg/ha) | 1,136 | 2,354 | 2,968 | 774 | 823 |
| | (mg/kg) | 507 | 1,051 | 1,325 | 346 | 368 |
| Exchangeable Potassium | (cmol _e /kg) | 0.66 | 0.42 | 0.51 | 0.88 | 0.74 |
| | (kg/ha) | 579 | 367 | 446 | 769 | 651 |
| | (mg/kg) | 258 | 164 | 199 | 343 | 291 |
| Exchangeable Sodium | (cmol _e /kg) | 0.21 | 0.76 | 1.0 | <0.065 | <0.065 |
| | (kg/ha) | 107 | 391 | 526 | <33 | <33 |
| | (mg/kg) | 48 | 175 | 235 | <15 | <15 |
| Exchangeable Aluminium | (cmol _e /kg) | 0.02 | 0.04 | 0.02 | 0.01 | 0.01 |
| | (kg/ha) | 4.2 | 7.6 | 4.1 | 2.7 | 2.3 |
| | (mg/kg) | 1.9 | 3.4 | 1.9 | 1.2 | 1.0 |
| Exchangeable Hydrogen | (cmol _e /kg) | 0.14 | 0.08 | <0.01 | <0.01 | <0.01 |
| | (kg/ha) | 3.0 | 1.9 | <1 | <1 | <1 |
| | (mg/kg) | 1.4 | <1 | <1 | <1 | <1 |
| Effective Cation Exchange Capacity (ECEC) (cmol _e /kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol _e /kg) | 10 | 16 | 20 | 17 | 17 |
| Calcium (%) | **Base Saturation Calculations - Cation cmol _e /kg / ECEC x 100 | 50 | 37 | 36 | 78 | 77 |
| Magnesium (%) | | 40 | 55 | 56 | 17 | 18 |
| Potassium (%) | | 6.3 | 2.7 | 2.6 | 5.2 | 4.4 |
| Sodium - ESP (%) | | 2.0 | 4.8 | 5.2 | 0.33 | 0.30 |
| Aluminium (%) | | 0.20 | 0.24 | 0.10 | 0.08 | 0.07 |
| Hydrogen (%) | | 1.3 | 0.53 | 0.00 | 0.00 | 0.00 |
| Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol _e /kg) | 1.3 | 0.67 | 0.66 | 4.7 | 4.3 |
| pH | **Rayment & Lyons 2011 - 4B4 (CaCl ₂) | 5.8 | 5.4 | 6.5 | 6.0 | 6.0 |
| Moist Munsell Colour | **Inhouse Munsell Soil Colour Classification | 7.5 YR 4/3 Brown | 7.5 YR 4/4 Brown | 7.5 YR 4/4 Brown | 7.5 YR 3/1 Very Dark Grey | 7.5 YR 3/1 Very Dark Grey |
| Mottles Munsell Colour | | .. | .. | .. | .. | .. |
| Degree of Mottling (%) | | .. | .. | .. | .. | .. |
| | | .. | .. | .. | .. | .. |

AGRICULTURAL SOIL ANALYSIS REPORT

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10 Kings Road NEW LAMBTON NSW 2305

| Sample ID: | | Sample 6 W2 40-50 27/7/2020 | Sample 7 W2 65-75 27/7/2020 | Sample 8 W3 0-10 27/7/2020 | Sample 9 W3 10-20 27/7/2020 | Sample 10 W3 30-40 27/7/2020 |
|---|---|-----------------------------------|-----------------------------------|----------------------------------|-----------------------------------|------------------------------------|
| Crop: | | Soil | Soil | Soil | Soil | Soil |
| Client: | | Wambo | Wambo | Wambo | Wambo | Wambo |
| Parameter | Method reference | J6517/6 | J6517/7 | J6517/8 | J6517/9 | J6517/10 |
| pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 7.40 | 7.61 | 6.01 | 6.58 | 7.79 |
| Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.028 | 0.025 | 0.038 | 0.020 | 0.094 |
| Exchangeable Calcium | (cmol _e /kg) | 12 | 8.8 | 5.3 | 3.4 | 4.4 |
| | (kg/ha) | 5,515 | 3,931 | 2,365 | 1,537 | 1,981 |
| | (mg/kg) | 2,462 | 1,755 | 1,056 | 686 | 884 |
| Exchangeable Magnesium | (cmol _e /kg) | 4.0 | 2.8 | 1.8 | 1.5 | 4.7 |
| | (kg/ha) | 1,082 | 763 | 496 | 404 | 1,284 |
| | (mg/kg) | 483 | 341 | 221 | 181 | 573 |
| Exchangeable Potassium | (cmol _e /kg) | 0.78 | 0.41 | 0.75 | 0.50 | 0.61 |
| | (kg/ha) | 687 | 362 | 661 | 440 | 530 |
| | (mg/kg) | 307 | 162 | 295 | 197 | 237 |
| Exchangeable Sodium | (cmol _e /kg) | 0.07 | 0.08 | <0.065 | <0.065 | 0.89 |
| | (kg/ha) | 34 | 41 | <33 | <33 | 460 |
| | (mg/kg) | 15 | 18 | <15 | <15 | 205 |
| Exchangeable Aluminium | (cmol _e /kg) | 0.01 | 0.01 | 0.01 | <0.01 | <0.01 |
| | (kg/ha) | 2.5 | 2.4 | 2.9 | 1.1 | <1 |
| | (mg/kg) | 1.1 | 1.1 | 1.3 | <1 | <1 |
| Exchangeable Hydrogen | (cmol _e /kg) | <0.01 | <0.01 | 0.14 | <0.01 | <0.01 |
| | (kg/ha) | <1 | <1 | 3.0 | <1 | <1 |
| | (mg/kg) | <1 | <1 | 1.4 | <1 | <1 |
| Effective Cation Exchange Capacity (ECEC) (cmol _e /kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol _e /kg) | 17 | 12 | 8.0 | 5.5 | 11 |
| Calcium (%) | **Base Saturation Calculations - Cation cmol _e /kg / ECEC x 100 | 72 | 73 | 66 | 62 | 42 |
| Magnesium (%) | | 23 | 23 | 23 | 27 | 44 |
| Potassium (%) | | 4.6 | 3.4 | 9.4 | 9.2 | 5.7 |
| Sodium - ESP (%) | | 0.38 | 0.66 | 0.53 | 1.2 | 8.4 |
| Aluminium (%) | | 0.07 | 0.10 | 0.18 | 0.10 | 0.02 |
| Hydrogen (%) | | 0.00 | 0.00 | 1.7 | 0.00 | 0.00 |
| Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol _e /kg) | 3.1 | 3.1 | 2.9 | 2.3 | 0.94 |
| pH | **Rayment & Lyons 2011 - 4B4 (CaCl ₂) | 6.5 | 6.7 | 5.2 | 5.5 | 6.7 |
| Moist Munsell Colour | **Inhouse Munsell Soil Colour Classification | 7.5 YR 3/1 Very Dark Grey | 7.5 YR 3/2 Dark Brown | 7.5 YR 3/2 Dark Brown | 7.5 YR 4/3 Brown | 7.5 YR 4/4 Brown |
| Mottles Munsell Colour | | .. | .. | .. | .. | .. |
| Degree of Mottling (%) | | .. | .. | .. | .. | .. |
| | | .. | .. | .. | .. | .. |

AGRICULTURAL SOIL ANALYSIS REPORT

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10 Kings Road NEW LAMBTON NSW 2305

| Sample ID: | | Sample 11 W3 65-75 27/7/2020 | Sample 12 W4 0-10 27/7/2020 | Sample 13 W4 20-30 27/7/2020 | Sample 14 W5 0-10 27/7/2020 | Sample 15 W5 30-40 27/7/2020 |
|---|---|------------------------------------|-----------------------------------|------------------------------------|-----------------------------------|------------------------------------|
| Crop: | | Soil | Soil | Soil | Soil | Soil |
| Client: | | Wambo | Wambo | Wambo | Wambo | Wambo |
| Parameter | Method reference | J6517/11 | J6517/12 | J6517/13 | J6517/14 | J6517/15 |
| pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 9.26 | 7.50 | 8.73 | 6.88 | 5.75 |
| Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.666 | 0.082 | 0.138 | 0.074 | 0.206 |
| Exchangeable Calcium | (cmol _e /kg) | 6.0 | 20 | 29 | 8.0 | 5.4 |
| | (kg/ha) | 2,710 | 8,886 | 12,844 | 3,611 | 2,417 |
| | (mg/kg) | 1,210 | 3,967 | 5,734 | 1,612 | 1,079 |
| Exchangeable Magnesium | (cmol _e /kg) | 8.6 | 5.7 | 8.3 | 2.9 | 6.2 |
| | (kg/ha) | 2,336 | 1,556 | 2,254 | 792 | 1,684 |
| | (mg/kg) | 1,043 | 695 | 1,006 | 354 | 752 |
| Exchangeable Potassium | (cmol _e /kg) | 0.82 | 1.3 | 0.54 | 0.81 | 0.81 |
| | (kg/ha) | 715 | 1,145 | 469 | 705 | 708 |
| | (mg/kg) | 319 | 511 | 209 | 315 | 316 |
| Exchangeable Sodium | (cmol _e /kg) | 4.4 | 0.16 | 0.15 | 0.17 | 0.88 |
| | (kg/ha) | 2,243 | 80 | 80 | 88 | 452 |
| | (mg/kg) | 1,001 | 36 | 36 | 39 | 202 |
| Exchangeable Aluminium | (cmol _e /kg) | <0.01 | <0.01 | <0.01 | <0.01 | 0.11 |
| | (kg/ha) | <1 | <1 | <1 | <1 | 21 |
| | (mg/kg) | <1 | <1 | <1 | <1 | 9.6 |
| Exchangeable Hydrogen | (cmol _e /kg) | <0.01 | <0.01 | <0.01 | <0.01 | 0.20 |
| | (kg/ha) | <1 | <1 | <1 | <1 | 4.5 |
| | (mg/kg) | <1 | <1 | <1 | <1 | 2.0 |
| Effective Cation Exchange Capacity (ECEC) (cmol _e /kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol _e /kg) | 20 | 27 | 38 | 12 | 14 |
| Calcium (%) | **Base Saturation Calculations - Cation cmol _e /kg / ECEC x 100 | 31 | 73 | 76 | 67 | 40 |
| Magnesium (%) | | 43 | 21 | 22 | 24 | 46 |
| Potassium (%) | | 4.1 | 4.8 | 1.4 | 6.7 | 6.0 |
| Sodium - ESP (%) | | 22 | 0.58 | 0.41 | 1.4 | 6.5 |
| Aluminium (%) | | 0.01 | 0.01 | 0.01 | 0.03 | 0.79 |
| Hydrogen (%) | | 0.00 | 0.00 | 0.00 | 0.00 | 1.5 |
| Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol _e /kg) | 0.70 | 3.5 | 3.5 | 2.8 | 0.87 |
| pH | **Rayment & Lyons 2011 - 4B4 (CaCl ₂) | 8.6 | 7.0 | 8.0 | 6.4 | 5.0 |
| Moist Munsell Colour | **Inhouse Munsell Soil Colour Classification | 7.5 YR 4/3 Brown | 7.5 YR 3/2 Dark Brown | 10 YR 5/3 Brown | 7.5 YR 4/2 Brown | 7.5 YR 5/6 Strong Brown |
| Mottles Munsell Colour | | .. | .. | .. | .. | .. |
| Degree of Mottling (%) | | .. | .. | .. | .. | .. |
| | | .. | .. | .. | .. | .. |

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| Sample ID: | | Sample 16 W5 60-70 27/7/2020 | Sample 17 W6 0-10 27/7/2020 | Sample 18 W6 20-30 27/7/2020 | Sample 19 W6 50-60 27/7/2020 | Sample 20 W7 0-10 27/7/2020 |
|---|---|------------------------------------|-----------------------------------|------------------------------------|------------------------------------|--------------------------------------|
| Crop: | | Soil | Soil | Soil | Soil | Soil |
| Client: | | Wambo | Wambo | Wambo | Wambo | Wambo |
| Parameter | Method reference | J6517/16 | J6517/17 | J6517/18 | J6517/19 | J6517/20 |
| pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 6.31 | 5.91 | 7.01 | 8.52 | 6.14 |
| Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.255 | 0.067 | 0.044 | 0.206 | 0.065 |
| Exchangeable Calcium | (cmol _e /kg) | 5.7 | 7.4 | 8.0 | 13 | 5.2 |
| | (kg/ha) | 2,576 | 3,304 | 3,577 | 5,723 | 2,314 |
| | (mg/kg) | 1,150 | 1,475 | 1,597 | 2,555 | 1,033 |
| Exchangeable Magnesium | (cmol _e /kg) | 6.5 | 2.7 | 5.3 | 4.8 | 3.7 |
| | (kg/ha) | 1,780 | 748 | 1,440 | 1,296 | 1,012 |
| | (mg/kg) | 795 | 334 | 643 | 578 | 452 |
| Exchangeable Potassium | (cmol _e /kg) | 0.65 | 0.88 | 0.81 | 0.50 | 0.87 |
| | (kg/ha) | 568 | 773 | 711 | 437 | 765 |
| | (mg/kg) | 253 | 345 | 318 | 195 | 342 |
| Exchangeable Sodium | (cmol _e /kg) | 1.3 | 0.13 | 0.23 | 0.34 | 0.14 |
| | (kg/ha) | 669 | 68 | 119 | 176 | 74 |
| | (mg/kg) | 299 | 30 | 53 | 78 | 33 |
| Exchangeable Aluminium | (cmol _e /kg) | 0.01 | 0.01 | <0.01 | <0.01 | <0.01 |
| | (kg/ha) | 2.4 | 2.0 | 1.1 | <1 | <1 |
| | (mg/kg) | 1.1 | <1 | <1 | <1 | <1 |
| Exchangeable Hydrogen | (cmol _e /kg) | 0.07 | 0.18 | <0.01 | <0.01 | 0.16 |
| | (kg/ha) | 1.5 | 4.1 | <1 | <1 | 3.6 |
| | (mg/kg) | <1 | 1.8 | <1 | <1 | 1.6 |
| Effective Cation Exchange Capacity (ECEC) (cmol _e /kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol _e /kg) | 14 | 11 | 14 | 18 | 10 |
| Calcium (%) | **Base Saturation Calculations - Cation cmol _e /kg / ECEC x 100 | 40 | 65 | 56 | 69 | 51 |
| Magnesium (%) | | 46 | 24 | 37 | 26 | 37 |
| Potassium (%) | | 4.5 | 7.8 | 5.7 | 2.7 | 8.7 |
| Sodium - ESP (%) | | 9.1 | 1.2 | 1.6 | 1.9 | 1.4 |
| Aluminium (%) | | 0.08 | 0.09 | 0.04 | 0.02 | 0.04 |
| Hydrogen (%) | | 0.47 | 1.6 | 0.00 | 0.00 | 1.6 |
| Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol _e /kg) | 0.88 | 2.7 | 1.5 | 2.7 | 1.4 |
| pH | **Rayment & Lyons 2011 - 4B4 (CaCl ₂) | 5.6 | 5.2 | 6.1 | 8.0 | 5.3 |
| Moist Munsell Colour | **Inhouse Munsell Soil Colour Classification | 7.5 YR 5/4 Brown | 7.5 YR 4/2 Brown | 7.5 YR 5/6 Strong Brown | 7.5 YR 5/4 Brown | 10 YR 3/2 Very Dark Greyish Brown |
| Mottles Munsell Colour | | .. | .. | .. | .. | .. |
| Degree of Mottling (%) | | .. | .. | .. | .. | .. |
| | | .. | .. | .. | .. | .. |

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| Sample ID: | | Sample 21 W7 20-30 27/7/2020 | Sample 22 W7 40-50 27/7/2020 | Sample 23 W8 0-10 27/7/2020 | Sample 24 W8 20-30 27/7/2020 | Sample 25 W8 40-50 27/7/2020 |
|--|--|------------------------------------|------------------------------------|-----------------------------------|------------------------------------|--------------------------------------|
| Crop: | | Soil | Soil | Soil | Soil | Soil |
| Client: | | Wambo | Wambo | Wambo | Wambo | Wambo |
| Parameter | Method reference | J6517/21 | J6517/22 | J6517/23 | J6517/24 | J6517/25 |
| pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 7.42 | 8.97 | 7.21 | 8.21 | 8.86 |
| Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.052 | 0.265 | 0.098 | 0.135 | 0.814 |
| Exchangeable Calcium | (cmol _e /kg) | 3.0 | 6.9 | 16 | 13 | 20 |
| | (kg/ha) | 1,358 | 3,116 | 7,275 | 6,023 | 9,036 |
| | (mg/kg) | 606 | 1,391 | 3,248 | 2,689 | 4,034 |
| Exchangeable Magnesium | (cmol _e /kg) | 9.0 | 17 | 8.8 | 15 | 21 |
| | (kg/ha) | 2,459 | 4,518 | 2,385 | 3,967 | 5,654 |
| | (mg/kg) | 1,098 | 2,017 | 1,065 | 1,771 | 2,524 |
| Exchangeable Potassium | (cmol _e /kg) | 0.75 | 0.55 | 1.8 | 1.2 | 1.1 |
| | (kg/ha) | 660 | 486 | 1,597 | 1,039 | 994 |
| | (mg/kg) | 295 | 217 | 713 | 464 | 444 |
| Exchangeable Sodium | (cmol _e /kg) | 0.69 | 1.8 | 0.28 | 1.9 | 5.5 |
| | (kg/ha) | 353 | 933 | 146 | 963 | 2,835 |
| | (mg/kg) | 158 | 416 | 65 | 430 | 1,266 |
| Exchangeable Aluminium | (cmol _e /kg) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | (kg/ha) | <1 | <1 | <1 | <1 | <1 |
| | (mg/kg) | <1 | <1 | <1 | <1 | <1 |
| Exchangeable Hydrogen | (cmol _e /kg) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | (kg/ha) | <1 | <1 | <1 | <1 | <1 |
| | (mg/kg) | <1 | <1 | <1 | <1 | <1 |
| Effective Cation Exchange Capacity (CEC) (cmol _e /kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol _e /kg) | 14 | 26 | 27 | 31 | 48 |
| Calcium (%) | **Base Saturation Calculations - Cation cmol _e /kg / CEC x 100 | 22 | 27 | 60 | 43 | 42 |
| Magnesium (%) | | 67 | 64 | 32 | 47 | 44 |
| Potassium (%) | | 5.6 | 2.1 | 6.7 | 3.8 | 2.4 |
| Sodium - ESP (%) | | 5.1 | 7.0 | 1.0 | 6.0 | 12 |
| Aluminium (%) | | 0.01 | 0.01 | 0.02 | 0.02 | 0.01 |
| Hydrogen (%) | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol _e /kg) | 0.33 | 0.42 | 1.8 | 0.92 | 0.97 |
| pH | **Rayment & Lyons 2011 - 4B4 (CaCl ₂) | 6.1 | 8.2 | 6.6 | 7.2 | 8.3 |
| Moist Munsell Colour | **Inhouse Munsell Soil Colour Classification | 10 YR 4/3 Brown | 2.5 Y 4/3 Olive Brown | 7.5 YR 3/1 Very Dark Grey | 7.5 YR 3/1 Very Dark Grey | 10 YR 3/2 Very Dark Greyish Brown |
| Mottles Munsell Colour | | .. | .. | .. | .. | .. |
| Degree of Mottling (%) | | .. | .. | .. | .. | .. |
| | | .. | .. | .. | .. | .. |

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10 Kings Road NEW LAMBTON NSW 2305

| Sample ID: | | Sample 26 W8 65-75 27/7/2020 | Sample 27 W9 0-10 27/7/2020 | Sample 28 W9 20-30 27/7/2020 | Sample 29 W9 40-50 27/7/2020 | Sample 30 W10 0-10 27/7/2020 |
|---|---|------------------------------------|---|---|------------------------------------|------------------------------------|
| Crop: | | Soil | Soil | Soil | Soil | Soil |
| Client: | | Wambo | Wambo | Wambo | Wambo | Wambo |
| Parameter | Method reference | J6517/26 | J6517/27 | J6517/28 | J6517/29 | J6517/30 |
| pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 8.96 | 6.22 | 7.12 | 8.67 | 6.39 |
| Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 1.180 | 0.053 | 0.052 | 0.223 | 0.051 |
| Exchangeable Calcium | (cmol _e /kg) | 21 | 10 | 16 | 27 | 8.2 |
| | (kg/ha) | 9,208 | 4,625 | 7,053 | 12,214 | 3,660 |
| | (mg/kg) | 4,111 | 2,065 | 3,149 | 5,453 | 1,634 |
| Exchangeable Magnesium | (cmol _e /kg) | 22 | 5.9 | 14 | 17 | 7.4 |
| | (kg/ha) | 5,880 | 1,615 | 3,752 | 4,496 | 2,018 |
| | (mg/kg) | 2,625 | 721 | 1,675 | 2,007 | 901 |
| Exchangeable Potassium | (cmol _e /kg) | 0.99 | 1.3 | 1.0 | 0.69 | 0.60 |
| | (kg/ha) | 870 | 1,167 | 878 | 608 | 525 |
| | (mg/kg) | 389 | 521 | 392 | 271 | 234 |
| Exchangeable Sodium | (cmol _e /kg) | 7.2 | 0.24 | 0.83 | 1.6 | 0.39 |
| | (kg/ha) | 3,730 | 124 | 426 | 825 | 201 |
| | (mg/kg) | 1,665 | 55 | 190 | 368 | 90 |
| Exchangeable Aluminium | (cmol _e /kg) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | (kg/ha) | <1 | <1 | <1 | <1 | <1 |
| | (mg/kg) | <1 | <1 | <1 | <1 | <1 |
| Exchangeable Hydrogen | (cmol _e /kg) | <0.01 | 0.09 | <0.01 | <0.01 | 0.12 |
| | (kg/ha) | <1 | 2.0 | <1 | <1 | 2.6 |
| | (mg/kg) | <1 | <1 | <1 | <1 | 1.2 |
| Effective Cation Exchange Capacity (ECEC) (cmol _e /kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol _e /kg) | 50 | 18 | 31 | 46 | 17 |
| Calcium (%) | **Base Saturation Calculations - Cation cmol _e /kg / ECEC x 100 | 41 | 58 | 50 | 59 | 49 |
| Magnesium (%) | | 43 | 33 | 44 | 36 | 44 |
| Potassium (%) | | 2.0 | 7.4 | 3.2 | 1.5 | 3.6 |
| Sodium - ESP (%) | | 14 | 1.3 | 2.6 | 3.5 | 2.3 |
| Aluminium (%) | | 0.01 | 0.02 | 0.01 | 0.01 | 0.02 |
| Hydrogen (%) | | 0.00 | 0.50 | 0.00 | 0.00 | 0.70 |
| Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol _e /kg) | 0.95 | 1.7 | 1.1 | 1.6 | 1.1 |
| pH | **Rayment & Lyons 2011 - 4B4 (CaCl ₂) | 8.4 | 5.3 | 6.0 | 7.9 | 5.4 |
| Moist Munsell Colour | **Inhouse Munsell Soil Colour Classification | 10 YR 4/3 Brown | 10 YR 3/2 Very Dark Greyish Brown | 10 YR 3/2 Very Dark Greyish Brown | 7.5 YR 3/2 Dark Brown | 7.5 YR 3/2 Dark Brown |
| Mottles Munsell Colour | | .. | .. | .. | .. | .. |
| Degree of Mottling (%) | | .. | .. | .. | .. | .. |
| | | .. | .. | .. | .. | .. |

AGRICULTURAL SOIL ANALYSIS REPORT

51 samples supplied by SLR Consulting Australia Pty Ltd on 29/07/2020. Lab Job No.J6517
Analysis requested by Murray Fraser. Your Job: PO: SLR 630.30047; Wambo Mod 18
10 Kings Road NEW LAMBTON NSW 2305

| Sample ID: | | Sample 31 W10 20-30 27/7/2020 | Sample 32 W10 40-50 27/7/2020 | Sample 33 W10 65-75 27/7/2020 | Sample 34 W11 0-10 27/7/2020 | Sample 35 W11 20-30 27/7/2020 |
|---|---|-------------------------------------|-------------------------------------|-------------------------------------|------------------------------------|-------------------------------------|
| Crop: | | Soil | Soil | Soil | Soil | Soil |
| Client: | | Wambo | Wambo | Wambo | Wambo | Wambo |
| Parameter | Method reference | J6517/31 | J6517/32 | J6517/33 | J6517/34 | J6517/35 |
| pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 6.97 | 8.85 | 9.09 | 6.17 | 8.55 |
| Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.081 | 0.681 | 0.889 | 0.142 | 0.147 |
| Exchangeable Calcium | (cmol _e /kg) | 8.9 | 22 | 20 | 9.4 | 14 |
| | (kg/ha) | 3,982 | 9,934 | 9,114 | 4,218 | 6,171 |
| | (mg/kg) | 1,778 | 4,435 | 4,069 | 1,883 | 2,755 |
| Exchangeable Magnesium | (cmol _e /kg) | 14 | 26 | 31 | 6.2 | 23 |
| | (kg/ha) | 3,687 | 6,973 | 8,362 | 1,681 | 6,261 |
| | (mg/kg) | 1,646 | 3,113 | 3,733 | 750 | 2,795 |
| Exchangeable Potassium | (cmol _e /kg) | 0.59 | 0.77 | 0.70 | 3.2 | 2.1 |
| | (kg/ha) | 516 | 673 | 615 | 2,820 | 1,878 |
| | (mg/kg) | 230 | 300 | 275 | 1,259 | 838 |
| Exchangeable Sodium | (cmol _e /kg) | 1.5 | 5.6 | 8.0 | 0.47 | 2.2 |
| | (kg/ha) | 765 | 2,904 | 4,111 | 244 | 1,129 |
| | (mg/kg) | 342 | 1,296 | 1,835 | 109 | 504 |
| Exchangeable Aluminium | (cmol _e /kg) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | (kg/ha) | <1 | <1 | <1 | <1 | <1 |
| | (mg/kg) | <1 | <1 | <1 | <1 | <1 |
| Exchangeable Hydrogen | (cmol _e /kg) | <0.01 | <0.01 | <0.01 | 0.15 | <0.01 |
| | (kg/ha) | <1 | <1 | <1 | 3.3 | <1 |
| | (mg/kg) | <1 | <1 | <1 | 1.5 | <1 |
| Effective Cation Exchange Capacity (ECEC) (cmol _e /kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol _e /kg) | 24 | 54 | 60 | 19 | 41 |
| Calcium (%) | **Base Saturation Calculations - Cation cmol _e /kg / ECEC x 100 | 36 | 41 | 34 | 48 | 33 |
| Magnesium (%) | | 55 | 47 | 51 | 32 | 56 |
| Potassium (%) | | 2.4 | 1.4 | 1.2 | 17 | 5.2 |
| Sodium - ESP (%) | | 6.1 | 10 | 13 | 2.4 | 5.3 |
| Aluminium (%) | | 0.01 | 0.01 | 0.00 | 0.01 | 0.01 |
| Hydrogen (%) | | 0.00 | 0.00 | 0.00 | 0.76 | 0.00 |
| Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol _e /kg) | 0.66 | 0.86 | 0.66 | 1.5 | 0.60 |
| pH | **Rayment & Lyons 2011 - 4B4 (CaCl ₂) | 5.8 | 8.2 | 8.5 | 5.7 | 7.6 |
| Moist Munsell Colour | **Inhouse Munsell Soil Colour Classification | 7.5 YR 3/2 Dark Brown | 10 YR 4/3 Brown | 10 YR 5/4 Yellowish Brown | 7.5 YR 2.5/2 Yellowish Brown | 7.5 YR 3/2 Dark Brown |
| Mottles Munsell Colour | | .. | .. | .. | .. | .. |
| Degree of Mottling (%) | | .. | .. | .. | .. | .. |
| | | .. | .. | .. | .. | .. |

AGRICULTURAL SOIL ANALYSIS REPORT

51 samples supplied by SLR Consulting Australia Pty Ltd on 29/07/2020. Lab Job No.J6517
Analysis requested by Murray Fraser. Your Job: PO: SLR 630.30047; Wambo Mod 18
10 Kings Road NEW LAMBTON NSW 2305

| Sample ID: | | Sample 36 W11 40-50 27/7/2020 | Sample 37 W11 65-75 27/7/2020 | Sample 38 W12 0-10 27/7/2020 | Sample 39 W12 20-30 27/7/2020 | Sample 40 W13 0-10 27/7/2020 |
|---|---|-------------------------------------|-------------------------------------|------------------------------------|-------------------------------------|------------------------------------|
| Crop: | | Soil | Soil | Soil | Soil | Soil |
| Client: | | Wambo | Wambo | Wambo | Wambo | Wambo |
| Parameter | Method reference | J6517/36 | J6517/37 | J6517/38 | J6517/39 | J6517/40 |
| pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 9.28 | 9.29 | 6.11 | 7.25 | 6.47 |
| Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.458 | 0.878 | 0.066 | 0.060 | 0.075 |
| Exchangeable Calcium | (cmol _e /kg) | 21 | 18 | 7.4 | 7.8 | 8.6 |
| | (kg/ha) | 9,311 | 8,032 | 3,319 | 3,490 | 3,846 |
| | (mg/kg) | 4,157 | 3,586 | 1,482 | 1,558 | 1,717 |
| Exchangeable Magnesium | (cmol _e /kg) | 21 | 16 | 2.7 | 8.5 | 7.5 |
| | (kg/ha) | 5,658 | 4,395 | 739 | 2,316 | 2,054 |
| | (mg/kg) | 2,526 | 1,962 | 330 | 1,034 | 917 |
| Exchangeable Potassium | (cmol _e /kg) | 0.64 | 0.45 | 1.1 | 0.78 | 0.88 |
| | (kg/ha) | 557 | 397 | 962 | 685 | 775 |
| | (mg/kg) | 249 | 177 | 429 | 306 | 346 |
| Exchangeable Sodium | (cmol _e /kg) | 4.0 | 5.6 | 0.12 | 0.20 | 0.48 |
| | (kg/ha) | 2,081 | 2,861 | 61 | 104 | 249 |
| | (mg/kg) | 929 | 1,277 | 27 | 46 | 111 |
| Exchangeable Aluminium | (cmol _e /kg) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | (kg/ha) | <1 | <1 | <1 | <1 | <1 |
| | (mg/kg) | <1 | <1 | <1 | <1 | <1 |
| Exchangeable Hydrogen | (cmol _e /kg) | <0.01 | <0.01 | 0.19 | <0.01 | 0.16 |
| | (kg/ha) | <1 | <1 | 4.2 | <1 | 3.6 |
| | (mg/kg) | <1 | <1 | 1.9 | <1 | 1.6 |
| Effective Cation Exchange Capacity (ECEC) (cmol _e /kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol _e /kg) | 46 | 40 | 12 | 17 | 18 |
| Calcium (%) | **Base Saturation Calculations - Cation cmol _e /kg / ECEC x 100 | 45 | 45 | 64 | 45 | 49 |
| Magnesium (%) | | 45 | 40 | 24 | 49 | 43 |
| Potassium (%) | | 1.4 | 1.1 | 9.5 | 4.5 | 5.0 |
| Sodium - ESP (%) | | 8.7 | 14 | 1.0 | 1.2 | 2.7 |
| Aluminium (%) | | 0.01 | 0.01 | 0.04 | 0.01 | 0.03 |
| Hydrogen (%) | | 0.00 | 0.00 | 1.6 | 0.00 | 0.90 |
| Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol _e /kg) | 1.00 | 1.1 | 2.7 | 0.91 | 1.1 |
| pH | **Rayment & Lyons 2011 - 4B4 (CaCl ₂) | 8.4 | 8.6 | 5.4 | 6.4 | 5.6 |
| Moist Munsell Colour | **Inhouse Munsell Soil Colour Classification | 10 YR 4/3 Brown | 10 YR 5/3 Brown | 7.5 YR 3/2 Dark Brown | 7.5 YR 5/6 Strong Brown | 7.5 YR 3/2 Dark Brown |
| Mottles Munsell Colour | | .. | .. | .. | .. | .. |
| Degree of Mottling (%) | | .. | .. | .. | .. | .. |
| | | .. | .. | .. | .. | .. |

AGRICULTURAL SOIL ANALYSIS REPORT

51 samples supplied by SLR Consulting Australia Pty Ltd on 29/07/2020. Lab Job No.J6517
Analysis requested by Murray Fraser. Your Job: PO: SLR 630.30047; Wambo Mod 18
10 Kings Road NEW LAMBTON NSW 2305

| Sample ID: | | Sample 41 W13 20-30 27/7/2020 | Sample 42 W13 40-50 27/7/2020 | Sample 43 W13 65-75 27/7/2020 | Sample 44 W14 0-10 27/7/2020 | Sample 45 W14 10-20 27/7/2020 |
|---|---|-------------------------------------|-------------------------------------|-------------------------------------|------------------------------------|-------------------------------------|
| Crop: | | Soil | Soil | Soil | Soil | Soil |
| Client: | | Wambo | Wambo | Wambo | Wambo | Wambo |
| Parameter | Method reference | J6517/41 | J6517/42 | J6517/43 | J6517/44 | J6517/45 |
| pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 7.99 | 8.94 | 8.95 | 6.23 | 6.20 |
| Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.131 | 0.566 | 0.790 | 0.099 | 0.045 |
| Exchangeable Calcium | (cmol _e /kg) | 11 | 16 | 13 | 6.9 | 3.6 |
| | (kg/ha) | 4,968 | 7,051 | 5,918 | 3,091 | 1,638 |
| | (mg/kg) | 2,218 | 3,148 | 2,642 | 1,380 | 731 |
| Exchangeable Magnesium | (cmol _e /kg) | 14 | 13 | 11 | 2.7 | 2.0 |
| | (kg/ha) | 3,707 | 3,593 | 3,069 | 733 | 545 |
| | (mg/kg) | 1,655 | 1,604 | 1,370 | 327 | 243 |
| Exchangeable Potassium | (cmol _e /kg) | 0.72 | 0.61 | 0.56 | 2.0 | 0.80 |
| | (kg/ha) | 634 | 531 | 494 | 1,749 | 699 |
| | (mg/kg) | 283 | 237 | 221 | 781 | 312 |
| Exchangeable Sodium | (cmol _e /kg) | 2.0 | 4.1 | 4.6 | 0.23 | 0.10 |
| | (kg/ha) | 1,044 | 2,089 | 2,388 | 116 | 50 |
| | (mg/kg) | 466 | 933 | 1,066 | 52 | 22 |
| Exchangeable Aluminium | (cmol _e /kg) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | (kg/ha) | <1 | <1 | <1 | 1.2 | 1.0 |
| | (mg/kg) | <1 | <1 | <1 | <1 | <1 |
| Exchangeable Hydrogen | (cmol _e /kg) | <0.01 | <0.01 | <0.01 | 0.21 | 0.06 |
| | (kg/ha) | <1 | <1 | <1 | 4.8 | 1.3 |
| | (mg/kg) | <1 | <1 | <1 | 2.1 | <1 |
| Effective Cation Exchange Capacity (ECEC) (cmol _e /kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol _e /kg) | 27 | 34 | 30 | 12 | 6.6 |
| Calcium (%) | **Base Saturation Calculations - Cation cmol _e /kg / ECEC x 100 | 40 | 47 | 44 | 57 | 55 |
| Magnesium (%) | | 50 | 39 | 38 | 22 | 30 |
| Potassium (%) | | 2.6 | 1.8 | 1.9 | 17 | 12 |
| Sodium - ESP (%) | | 7.4 | 12 | 16 | 1.9 | 1.5 |
| Aluminium (%) | | 0.01 | 0.01 | 0.01 | 0.05 | 0.08 |
| Hydrogen (%) | | 0.00 | 0.00 | 0.00 | 1.8 | 0.89 |
| Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol _e /kg) | 0.81 | 1.2 | 1.2 | 2.6 | 1.8 |
| pH | **Rayment & Lyons 2011 - 4B4 (CaCl ₂) | 6.9 | 8.4 | 8.4 | 5.4 | 5.2 |
| Moist Munsell Colour | **Inhouse Munsell Soil Colour Classification | 7.5 YR 3/1 Very Dark Grey | 7.5 YR 3/2 Dark Brown | 7.5 YR 4/3 Brown | 10 YR 2/2 Very Dark Brown | 7.5 YR 3/2 Dark Brown |
| Mottles Munsell Colour | | .. | .. | .. | .. | .. |
| Degree of Mottling (%) | | .. | .. | .. | .. | .. |
| | | .. | .. | .. | .. | .. |

AGRICULTURAL SOIL ANALYSIS REPORT

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Analysis requested by Murray Fraser. Your Job: PO: SLR 630.30047; Wambo Mod 18
10 Kings Road NEW LAMBTON NSW 2305

| Sample ID: | | Sample 46 W14 40-50 27/7/2020 | Sample 47 W14 65-75 27/7/2020 | Sample 48 W15 0-10 27/7/2020 | Sample 49 W15 10-20 27/7/2020 | Sample 50 W15 30-40 27/7/2020 |
|---|---|-------------------------------------|-------------------------------------|------------------------------------|-------------------------------------|-------------------------------------|
| Crop: | | Soil | Soil | Soil | Soil | Soil |
| Client: | | Wambo | Wambo | Wambo | Wambo | Wambo |
| Parameter | Method reference | J6517/46 | J6517/47 | J6517/48 | J6517/49 | J6517/50 |
| pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 8.11 | 8.28 | 6.77 | 6.37 | 7.36 |
| Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.432 | 0.862 | 0.072 | 0.065 | 0.170 |
| Exchangeable Calcium | (cmol _e /kg) | 5.2 | 4.0 | 10 | 4.8 | 13 |
| | (kg/ha) | 2,338 | 1,795 | 4,605 | 2,164 | 5,772 |
| | (mg/kg) | 1,044 | 802 | 2,056 | 966 | 2,577 |
| Exchangeable Magnesium | (cmol _e /kg) | 10.0 | 9.2 | 5.4 | 2.3 | 7.0 |
| | (kg/ha) | 2,719 | 2,504 | 1,479 | 625 | 1,910 |
| | (mg/kg) | 1,214 | 1,118 | 660 | 279 | 853 |
| Exchangeable Potassium | (cmol _e /kg) | 1.1 | 0.72 | 0.70 | 0.26 | 0.58 |
| | (kg/ha) | 921 | 630 | 614 | 231 | 512 |
| | (mg/kg) | 411 | 281 | 274 | 103 | 228 |
| Exchangeable Sodium | (cmol _e /kg) | 2.4 | 4.5 | 0.35 | 0.27 | 0.70 |
| | (kg/ha) | 1,227 | 2,305 | 178 | 141 | 359 |
| | (mg/kg) | 548 | 1,029 | 79 | 63 | 160 |
| Exchangeable Aluminium | (cmol _e /kg) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | (kg/ha) | <1 | <1 | <1 | 1.7 | <1 |
| | (mg/kg) | <1 | <1 | <1 | <1 | <1 |
| Exchangeable Hydrogen | (cmol _e /kg) | <0.01 | <0.01 | <0.01 | 0.14 | <0.01 |
| | (kg/ha) | <1 | <1 | <1 | 3.2 | <1 |
| | (mg/kg) | <1 | <1 | <1 | 1.4 | <1 |
| Effective Cation Exchange Capacity (ECEC) (cmol _e /kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol _e /kg) | 19 | 18 | 17 | 7.8 | 21 |
| Calcium (%) | **Base Saturation Calculations - Cation cmol _e /kg / ECEC x 100 | 28 | 22 | 61 | 62 | 61 |
| Magnesium (%) | | 54 | 50 | 32 | 29 | 33 |
| Potassium (%) | | 5.6 | 3.9 | 4.2 | 3.4 | 2.8 |
| Sodium - ESP (%) | | 13 | 24 | 2.1 | 3.5 | 3.3 |
| Aluminium (%) | | 0.01 | 0.00 | 0.01 | 0.11 | 0.01 |
| Hydrogen (%) | | 0.00 | 0.00 | 0.00 | 1.8 | 0.00 |
| Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol _e /kg) | 0.52 | 0.43 | 1.9 | 2.1 | 1.8 |
| pH | **Rayment & Lyons 2011 - 4B4 (CaCl ₂) | 7.4 | 7.8 | 6.2 | 5.8 | 6.7 |
| Moist Munsell Colour | **Inhouse Munsell Soil Colour Classification | 7.5 YR 4/2 Brown | 7.5 YR 3/3 Dark Brown | 7.5 YR 4/2 Brown | 7.5 YR 4/3 Brown | 7.5 YR 5/6 Strong Brown |
| Mottles Munsell Colour | | .. | .. | .. | .. | .. |
| Degree of Mottling (%) | | .. | .. | .. | .. | .. |
| | | .. | .. | .. | .. | .. |

AGRICULTURAL SOIL ANALYSIS REPORT

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Analysis requested by Murray Fraser. Your Job: PO: SLR 630.30047; Wambo Mod 18
10 Kings Road NEW LAMBTON NSW 2305

| | | Sample ID: | Sample 51 W15 50-60 27/7/2020 Soil | Heavy Soil | Medium Soil | Light Soil | Sandy Soil |
|---|-------------------------|---|---|--|----------------|------------|---------------|
| | | Crop: | | | | | |
| | | Client: | Wambo | Clay | Clay Loam | Loam | Loamy Sand |
| Parameter | | Method reference | J6517/51 | Indicative guidelines - refer to Notes 6 and 8 | | | |
| pH | | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 8.76 | 6.5 | 6.5 | 6.3 | 6.3 |
| Electrical Conductivity (dS/m) | | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.176 | 0.200 | 0.150 | 0.120 | 0.100 |
| Exchangeable Calcium | (cmol _e /kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 25 | 15.6 | 10.8 | 5.0 | 1.9 |
| | (kg/ha) | | 11,094 | 7000 | 4816 | 2240 | 840 |
| | (mg/kg) | | 4,953 | 3125 | 2150 | 1000 | 375 |
| Exchangeable Magnesium | (cmol _e /kg) | | 7.3 | 2.4 | 1.7 | 1.2 | 0.60 |
| | (kg/ha) | | 1,986 | 650 | 448 | 325 | 168 |
| | (mg/kg) | | 887 | 290 | 200 | 145 | 75 |
| Exchangeable Potassium | (cmol _e /kg) | | 0.41 | 0.60 | 0.50 | 0.40 | 0.30 |
| | (kg/ha) | | 363 | 526 | 426 | 336 | 224 |
| | (mg/kg) | | 162 | 235 | 190 | 150 | 100 |
| Exchangeable Sodium | (cmol _e /kg) | | 0.56 | 0.3 | 0.26 | 0.22 | 0.11 |
| | (kg/ha) | | 288 | 155 | 134 | 113 | 57 |
| | (mg/kg) | | 128 | 69 | 60 | 51 | 25 |
| Exchangeable Aluminium | (cmol _e /kg) | **Inhouse S37 (KCl) | <0.01 | 0.6 | 0.5 | 0.4 | 0.2 |
| | (kg/ha) | | <1 | 121 | 101 | 73 | 30 |
| | (mg/kg) | | <1 | 54 | 45 | 32 | 14 |
| Exchangeable Hydrogen | (cmol _e /kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | 0.6 | 0.5 | 0.4 | 0.2 |
| | (kg/ha) | | <1 | 13 | 11 | 8 | 3 |
| | (mg/kg) | | <1 | 6 | 5 | 4 | 2 |
| Effective Cation Exchange Capacity (ECEC) (cmol _e /kg) | | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol _e /kg) | 33 | 20.1 | 14.3 | 7.8 | 3.3 |
| Calcium (%) | | **Base Saturation Calculations - Cation cmol _e /kg / ECEC x 100 | 75 | 77.6 | 75.7 | 65.6 | 57.4 |
| Magnesium (%) | | | 22 | 11.9 | 11.9 | 15.7 | 18.1 |
| Potassium (%) | | | 1.3 | 3.0 | 3.5 | 5.2 | 9.1 |
| Sodium - ESP (%) | | | 1.7 | 1.5 | 1.8 | 2.9 | 3.3 |
| Aluminium (%) | | | 0.01 | 6.0 | 7.1 | 10.5 | 12.1 |
| Hydrogen (%) | | | 0.00 | | | | |
| Calcium/Magnesium Ratio | | **Calculation: Calcium / Magnesium (cmol _e /kg) | 3.4 | 6.5 | 6.4 | 4.2 | 3.2 |
| pH | | **Rayment & Lyons 2011 - 4B4 (CaCl ₂) | 8.1 | .. | | | |
| Moist Munsell Colour | | **Inhouse Munsell Soil Colour Classification | 10 YR 5/4 | .. | | | |
| | | | Yellowish Brown | .. | | | |
| Mottles Munsell Colour | | | .. | .. | | | |
| | | | .. | .. | | | |
| Degree of Mottling (%) | | | .. | .. | | | |

GRAIN SIZE ANALYSIS (hydrometer and sieving techniques)

51 soil samples supplied by SLR Consulting Australia Pty Ltd on 29 July, 2020 - Lab Job No. J6517
 Analysis requested by Murray Fraser
 10 Kings Road LAMINGTON NSW 2305

| SAMPLE ID | Lab Code | MOISTURE CONTENT (% of water in air- dry sample) | TOTAL GRAVEL > 2 mm (% of total oven- dry equivalent) | GRAVEL > 4.75 mm (% of total oven-dry equivalent) | GRAVEL 2.00-4.75 mm (% of total oven- dry equivalent) | COARSE SAND 200-2000 µm (0.2-2.0 mm) (% of total oven- dry equivalent) | FINE SAND 20-200 µm (0.02-0.2 mm) (% of total oven-dry equivalent) | SILT 2-20 µm ISSS (% of total oven- dry equivalent) | CLAY < 2 µm (% of total oven- dry equivalent) | Total soil fractions (incl. Gravel) |
|----------------------|----------|---|---|---|--|--|--|---|--|--|
| W1 0-10 27/07/2020 | J6517/1 | 13.7% | 2.8% | 0.0% | 2.8% | 7.2% | 32.2% | 32.3% | 25.4% | 100.0% |
| W1 20-30 27/07/2020 | J6517/2 | 13.8% | 0.3% | 0.0% | 0.3% | 2.8% | 20.6% | 19.7% | 56.6% | 100.0% |
| W1 40-50 27/07/2020 | J6517/3 | 15.9% | 7.9% | 0.0% | 7.9% | 3.0% | 13.7% | 12.1% | 63.3% | 100.0% |
| W2 0-10 27/07/2020 | J6517/4 | 14.3% | 6.1% | 0.0% | 6.1% | 17.4% | 34.2% | 15.2% | 27.1% | 100.0% |
| W2 10-20 27/07/2020 | J6517/5 | 13.0% | 1.1% | 0.0% | 1.1% | 14.6% | 32.1% | 22.1% | 30.2% | 100.0% |
| W2 40-50 27/07/2020 | J6517/6 | 10.9% | 1.1% | 0.0% | 1.1% | 19.3% | 26.9% | 14.3% | 38.4% | 100.0% |
| W2 65-75 27/07/2020 | J6517/7 | 8.9% | 19.0% | 12.9% | 6.0% | 24.7% | 18.4% | 12.9% | 25.0% | 100.0% |
| W3 0-10 27/07/2020 | J6517/8 | 20.4% | 5.8% | 0.0% | 5.8% | 30.4% | 20.7% | 21.0% | 22.1% | 100.0% |
| W3 10-20 27/07/2020 | J6517/9 | 10.2% | 8.5% | 0.0% | 8.5% | 28.6% | 29.0% | 13.6% | 20.2% | 100.0% |
| W3 30-40 27/07/2020 | J6517/10 | 12.9% | 2.4% | 0.0% | 2.4% | 32.8% | 18.0% | 9.4% | 37.4% | 100.0% |
| W3 65-75 27/07/2020 | J6517/11 | 13.0% | 24.5% | 13.2% | 11.3% | 28.8% | 8.5% | 6.9% | 31.4% | 100.0% |
| W4 0-10 27/07/2020 | J6517/12 | 23.3% | 1.8% | 0.0% | 1.8% | 7.9% | 20.9% | 17.0% | 52.4% | 100.0% |
| W4 20-30 27/07/2020 | J6517/13 | 16.3% | 0.4% | 0.0% | 0.4% | 5.2% | 21.1% | 27.2% | 46.2% | 100.0% |
| W5 0-10 27/07/2020 | J6517/14 | 6.6% | 9.0% | 0.0% | 9.0% | 2.8% | 31.1% | 21.6% | 35.5% | 100.0% |
| W5 30-40 27/07/2020 | J6517/15 | 11.4% | 0.0% | 0.0% | 0.0% | 2.5% | 21.9% | 16.6% | 59.0% | 100.0% |
| W5 60-70 27/07/2020 | J6517/16 | 10.7% | 0.0% | 0.0% | 0.0% | 2.1% | 32.5% | 14.4% | 51.0% | 100.0% |
| W6 0-10 27/07/2020 | J6517/17 | 11.4% | 11.4% | 0.0% | 11.4% | 5.0% | 29.8% | 22.5% | 31.3% | 100.0% |
| W6 20-30 27/07/2020 | J6517/18 | 12.3% | 0.0% | 0.0% | 0.0% | 0.9% | 10.5% | 22.4% | 66.2% | 100.0% |
| W6 50-60 27/07/2020 | J6517/19 | 30.0% | 0.0% | 0.0% | 0.0% | 1.1% | 9.6% | 28.4% | 61.0% | 100.0% |
| W7 0-10 27/07/2020 | J6517/20 | 18.8% | 2.8% | 0.0% | 2.8% | 16.2% | 28.3% | 22.9% | 29.8% | 100.0% |
| W7 20-30 27/07/2020 | J6517/21 | 17.9% | 0.4% | 0.0% | 0.4% | 12.6% | 16.0% | 16.5% | 54.5% | 100.0% |
| W7 40-50 27/07/2020 | J6517/22 | 18.7% | 0.7% | 0.0% | 0.7% | 10.8% | 11.9% | 15.4% | 61.2% | 100.0% |
| W8 0-10 27/07/2020 | J6517/23 | 17.8% | 1.0% | 0.0% | 1.0% | 9.0% | 23.6% | 19.9% | 46.5% | 100.0% |
| W8 20-30 27/07/2020 | J6517/24 | 19.3% | 4.4% | 0.0% | 4.4% | 7.2% | 14.0% | 20.6% | 53.9% | 100.0% |
| W8 40-50 27/07/2020 | J6517/25 | 17.0% | 2.1% | 0.0% | 2.1% | 8.9% | 20.8% | 13.7% | 54.6% | 100.0% |
| W8 65-75 27/07/2020 | J6517/26 | 12.0% | 0.4% | 0.0% | 0.4% | 10.5% | 26.1% | 7.6% | 55.4% | 100.0% |
| W9 0-10 27/07/2020 | J6517/27 | 17.6% | 1.2% | 0.0% | 1.2% | 8.7% | 19.8% | 30.1% | 40.2% | 100.0% |
| W9 20-30 27/07/2020 | J6517/28 | 17.8% | 0.3% | 0.0% | 0.3% | 5.1% | 21.5% | 12.8% | 60.3% | 100.0% |
| W9 40-50 27/07/2020 | J6517/29 | 16.3% | 0.9% | 0.0% | 0.9% | 6.5% | 7.5% | 25.5% | 59.6% | 100.0% |
| W10 0-10 27/07/2020 | J6517/30 | 16.3% | 1.0% | 0.0% | 1.0% | 9.6% | 33.3% | 18.5% | 37.5% | 100.0% |
| W10 20-30 27/07/2020 | J6517/31 | 21.1% | 0.5% | 0.0% | 0.5% | 4.7% | 15.4% | 17.2% | 62.1% | 100.0% |
| W10 40-50 27/07/2020 | J6517/32 | 23.0% | 0.1% | 0.0% | 0.1% | 4.3% | 1.9% | 19.7% | 74.0% | 100.0% |
| W10 65-75 27/07/2020 | J6517/33 | 17.6% | 1.3% | 0.0% | 1.3% | 3.4% | 19.7% | 24.2% | 51.4% | 100.0% |
| W11 0-10 27/07/2020 | J6517/34 | 18.6% | 6.8% | 0.0% | 6.8% | 10.1% | 30.0% | 21.7% | 31.4% | 100.0% |
| W11 20-30 27/07/2020 | J6517/35 | 22.2% | 0.6% | 0.0% | 0.6% | 3.0% | 7.4% | 23.9% | 65.0% | 100.0% |
| W11 40-50 27/07/2020 | J6517/36 | 20.1% | 0.7% | 0.0% | 0.7% | 3.8% | 0.2% | 26.3% | 69.0% | 100.0% |
| W11 65-75 27/07/2020 | J6517/37 | 14.9% | 2.4% | 0.0% | 2.4% | 3.1% | 11.1% | 25.2% | 58.2% | 100.0% |
| W12 0-10 27/07/2020 | J6517/38 | 12.7% | 2.4% | 0.0% | 2.4% | 32.9% | 22.0% | 11.1% | 31.5% | 100.0% |
| W12 20-30 27/07/2020 | J6517/39 | 14.7% | 1.8% | 0.0% | 1.8% | 18.2% | 9.1% | 8.9% | 62.0% | 100.0% |
| W13 0-10 27/07/2020 | J6517/40 | 14.8% | 9.5% | 0.0% | 9.5% | 15.4% | 16.0% | 19.4% | 39.7% | 100.0% |
| W13 20-30 27/07/2020 | J6517/41 | 17.7% | 0.8% | 0.0% | 0.8% | 11.0% | 8.4% | 21.2% | 58.6% | 100.0% |
| W13 40-50 27/07/2020 | J6517/42 | 17.2% | 3.5% | 0.0% | 3.5% | 16.9% | 9.8% | 16.0% | 53.8% | 100.0% |
| W13 65-75 27/07/2020 | J6517/43 | 15.1% | 6.5% | 0.0% | 6.5% | 19.0% | 9.4% | 21.8% | 43.3% | 100.0% |
| W14 0-10 27/07/2020 | J6517/44 | 8.0% | 8.6% | 0.0% | 8.6% | 37.5% | 13.7% | 14.1% | 26.1% | 100.0% |
| W14 10-20 27/07/2020 | J6517/45 | 6.0% | 46.7% | 0.0% | 46.7% | 18.7% | 8.8% | 7.5% | 18.3% | 100.0% |
| W14 40-50 27/07/2020 | J6517/46 | 12.7% | 3.5% | 0.0% | 3.5% | 18.5% | 8.0% | 16.2% | 53.8% | 100.0% |
| W14 65-75 27/07/2020 | J6517/47 | 12.2% | 18.7% | 0.0% | 18.7% | 25.5% | 7.7% | 14.8% | 33.3% | 100.0% |
| W15 0-10 27/07/2020 | J6517/48 | 8.8% | 1.7% | 0.0% | 1.7% | 11.6% | 31.6% | 20.3% | 34.8% | 100.0% |
| W15 10-20 27/07/2020 | J6517/49 | 5.5% | 6.1% | 0.0% | 6.1% | 29.1% | 24.5% | 19.0% | 21.3% | 100.0% |
| W15 30-40 27/07/2020 | J6517/50 | 12.5% | 0.0% | 0.0% | 0.0% | 13.3% | 13.2% | 18.3% | 55.2% | 100.0% |
| W15 50-60 27/07/2020 | J6517/51 | 10.1% | 0.3% | 0.0% | 0.3% | 7.3% | 21.9% | 25.6% | 44.9% | 100.0% |

Note:

- 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.
- The texture classification was based on the hydrometer results and the appropriate texture triangle.
- All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (see EAL website: scu.edu.au/eal).
- This report is not to be reproduced except in full.
- This report was issued on 07/08/2020

AGRICULTURAL SOIL ANALYSIS REPORT

14 samples supplied by SLR Consulting Australia Pty Ltd on 9/05/2022 . Lab Job No.M8431

Analysis requested by Murray Fraser. Your Job: PO SLR 630.30258 Wambo Mod BSAL

10 Kings Road NEW LAMBTON NSW 2305

| | | Sample ID: | Sample 1 | Sample 2 | Sample 3 | Sample 4 | Sample 5 | Sample 6 |
|--|--|--|----------|-----------|-----------|-----------|----------|-----------|
| | | Crop: | W17 0-20 | W17 20-30 | W17 40-50 | W17 65-75 | W18 0-10 | W18 20-30 |
| | | Client: | Soil | Soil | Soil | Soil | Soil | Soil |
| | | | WCPL | WCPL | WCPL | WCPL | WCPL | WCPL |
| Parameter | Method reference | | M8431/1 | M8431/2 | M8431/3 | M8431/4 | M8431/5 | M8431/6 |
| pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | | 6.30 | 6.61 | 6.89 | 7.23 | 7.03 | 7.69 |
| Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | | 0.056 | 0.023 | 0.023 | 0.024 | 0.047 | 0.049 |
| Exchangeable Calcium | (cmol./kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 6.7 | 7.6 | 9.0 | 11 | 18 | 17 |
| | (kg/ha) | | 3,030 | 3,390 | 4,020 | 4,786 | 7,864 | 7,805 |
| | (mg/kg) | | 1,353 | 1,514 | 1,795 | 2,137 | 3,511 | 3,485 |
| Exchangeable Magnesium | (cmol./kg) | | 1.7 | 2.5 | 3.5 | 4.4 | 21 | 22 |
| | (kg/ha) | | 471 | 679 | 951 | 1,204 | 5,591 | 6,030 |
| | (mg/kg) | | 210 | 303 | 424 | 538 | 2,496 | 2,692 |
| Exchangeable Potassium | (cmol./kg) | | 0.92 | 0.52 | 0.60 | 0.55 | 0.65 | 0.64 |
| | (kg/ha) | | 803 | 455 | 523 | 486 | 567 | 560 |
| | (mg/kg) | | 359 | 203 | 233 | 217 | 253 | 250 |
| Exchangeable Sodium | (cmol./kg) | | 0.18 | 0.13 | 0.17 | 0.24 | 0.56 | 0.92 |
| | (kg/ha) | | 94 | 66 | 88 | 121 | 290 | 475 |
| | (mg/kg) | | 42 | 30 | 39 | 54 | 130 | 212 |
| Exchangeable Aluminium | (cmol./kg) | **Inhouse S37 (KCl) | 0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | (kg/ha) | | 3 | <1 | <1 | <1 | <1 | <1 |
| | (mg/kg) | | 1 | <1 | <1 | <1 | <1 | <1 |
| Exchangeable Hydrogen | (cmol./kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | (kg/ha) | | <1 | <1 | <1 | <1 | <1 | <1 |
| | (mg/kg) | | <1 | <1 | <1 | <1 | <1 | <1 |
| Effective Cation Exchange Capacity (ECEC) (cmol./kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol./kg) | | 10 | 11 | 13 | 16 | 39 | 41 |
| Calcium (%) | **Base Saturation Calculations - Cation cmol./kg / ECEC x 100 | | 70 | 71 | 68 | 67 | 45 | 42 |
| Magnesium (%) | | | 18 | 23 | 26 | 28 | 52 | 54 |
| Potassium (%) | | | 9.6 | 4.9 | 4.5 | 3.5 | 1.6 | 1.6 |
| Sodium - ESP (%) | | | 1.9 | 1.2 | 1.3 | 1.5 | 1.4 | 2.2 |
| Aluminium (%) | | | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hydrogen (%) | | | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol./kg) | | 3.9 | 3.0 | 2.6 | 2.4 | 0.85 | 0.78 |
| pH | **Rayment & Lyons 2011 - 4B4 (CaCl ₂) | | 5.42 | 5.57 | 5.85 | 6.17 | 6.17 | 6.73 |

AGRICULTURAL SOIL ANALYSIS REPORT

14 samples supplied by SLR Consulting Australia Pty Ltd on 9/05/2022 . Lab Job No.M8431
 Analysis requested by Murray Fraser. Your Job: PO SLR 630.30258 Wambo Mod BSAL
 10 Kings Road NEW LAMBTON NSW 2305

Analysis requested by: Murray Padden, Post Code: 2205, Phone: 02 9336 5555, Email: murray.padden@wcpl.nsw.gov.au
 10 Kings Road NEW LAMBTON NSW 2305

| | | Sample ID: | Sample 7 | Sample 8 | Sample 9 | Sample 10 | Sample 11 | Sample 12 |
|--|--------------------------------|--|-----------|-----------|----------|-----------|-----------|-----------|
| | | Crop: | W18 40-50 | W18 65-75 | W19 0-10 | W19 20-30 | W19 40-50 | W19 65-75 |
| | | Client: | Soil | Soil | Soil | Soil | Soil | Soil |
| | | | WCPL | WCPL | WCPL | WCPL | WCPL | WCPL |
| | Parameter | Method reference | M8431/7 | M8431/8 | M8431/9 | M8431/10 | M8431/11 | M8431/12 |
| | pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 8.67 | 9.17 | 6.75 | 7.01 | 7.99 | 8.78 |
| | Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.183 | 0.196 | 0.074 | 0.048 | 0.076 | 0.167 |
| | Exchangeable Calcium | (cmol./kg) | 23 | 18 | 11 | 13 | 11 | 7.6 |
| | | (kg/ha) | 10,256 | 7,877 | 5,059 | 5,821 | 5,117 | 3,426 |
| | | (mg/kg) | 4,579 | 3,517 | 2,259 | 2,599 | 2,285 | 1,530 |
| | Exchangeable Magnesium | (cmol./kg) | 24 | 23 | 6.1 | 12 | 14 | 12 |
| | | (kg/ha) | 6,462 | 6,196 | 1,649 | 3,346 | 3,788 | 3,136 |
| | | (mg/kg) | 2,885 | 2,766 | 736 | 1,494 | 1,691 | 1,400 |
| | Exchangeable Potassium | (cmol./kg) | 0.46 | 0.25 | 1.5 | 1.3 | 1.1 | 0.71 |
| | | (kg/ha) | 400 | 217 | 1,273 | 1,153 | 997 | 622 |
| | | (mg/kg) | 179 | 97 | 568 | 515 | 445 | 278 |
| | Exchangeable Sodium | (cmol./kg) | 1.8 | 2.9 | 0.18 | 0.79 | 1.9 | 2.5 |
| | | (kg/ha) | 912 | 1,501 | 95 | 405 | 957 | 1,270 |
| | | (mg/kg) | 407 | 670 | 43 | 181 | 427 | 567 |
| Exchangeable Aluminium | (cmol./kg) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| | (kg/ha) | <1 | <1 | <1 | <1 | <1 | <1 | |
| | (mg/kg) | <1 | <1 | <1 | <1 | <1 | <1 | |
| Exchangeable Hydrogen | (cmol./kg) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| | (kg/ha) | <1 | <1 | <1 | <1 | <1 | <1 | |
| | (mg/kg) | <1 | <1 | <1 | <1 | <1 | <1 | |
| Effective Cation Exchange Capacity (ECEC) (cmol./kg) | | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol./kg) | 49 | 43 | 19 | 27 | 28 | 22 |
| | Calcium (%) | **Base Saturation Calculations - Cation cmol./kg / ECEC x 100 | 47 | 40 | 59 | 47 | 40 | 34 |
| | Magnesium (%) | | 49 | 52 | 32 | 45 | 49 | 52 |
| | Potassium (%) | | 0.94 | 0.57 | 7.7 | 4.8 | 4.0 | 3.2 |
| | Sodium - ESP (%) | | 3.6 | 6.7 | 0.98 | 2.9 | 6.6 | 11 |
| | Aluminium (%) | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Hydrogen (%) | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Calcium/Magnesium Ratio | | **Calculation: Calcium / Magnesium (cmol./kg) | 0.96 | 0.77 | 1.9 | 1.1 | 0.82 | 0.66 |
| pH | | **Rayment & Lyons 2011 - 4B4 (CaCl ₂) | 7.84 | 8.05 | 5.91 | 5.99 | 6.91 | 7.88 |

AGRICULTURAL SOIL ANALYSIS REPORT

14 samples supplied by SLR Consulting Australia Pty Ltd on 9/05/2022 . Lab Job No.M8431
 Analysis requested by Murray Fraser. Your Job: PO SLR 630.30258 Wambo Mod BSAL
 10 Kings Road NEW LAMBTON NSW 2305

| | | Sample ID: | Sample 13 | Sample 14 | Heavy Soil | Medium Soil | Light Soil | Sandy Soil |
|---|--|------------|-----------|--|------------|-------------|------------|------------|
| | | Crop: | W16 0-10 | W16 20-30 | | | | |
| | | Client: | Soil | Soil | Clay | Clay Loam | Loam | Loamy Sand |
| | | | WCPL | WCPL | | | | |
| Parameter | Method reference | M8431/13 | M8431/14 | Indicative guidelines - refer to Notes 6 and 8 | | | | |
| pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 8.33 | 8.69 | 6.5 | 6.5 | 6.3 | 6.3 | |
| Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.261 | 0.148 | 0.200 | 0.150 | 0.120 | 0.100 | |
| Exchangeable Calcium (cmol./kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 27 | 28 | 15.6 | 10.8 | 5.0 | 1.9 | |
| (kg/ha) | | 12,084 | 12,451 | 7000 | 4816 | 2240 | 840 | |
| (mg/kg) | | 5,395 | 5,559 | 3125 | 2150 | 1000 | 375 | |
| Exchangeable Magnesium (cmol./kg) | | 3.7 | 4.1 | 2.4 | 1.7 | 1.2 | 0.60 | |
| (kg/ha) | | 1,020 | 1,127 | 650 | 448 | 325 | 168 | |
| (mg/kg) | | 455 | 503 | 290 | 200 | 145 | 75 | |
| Exchangeable Potassium (cmol./kg) | | 0.78 | 0.57 | 0.60 | 0.50 | 0.40 | 0.30 | |
| (kg/ha) | | 683 | 499 | 526 | 426 | 336 | 224 | |
| (mg/kg) | | 305 | 223 | 235 | 190 | 150 | 100 | |
| Exchangeable Sodium (cmol./kg) | | 0.21 | 0.31 | 0.3 | 0.26 | 0.22 | 0.11 | |
| (kg/ha) | | 106 | 161 | 155 | 134 | 113 | 57 | |
| (mg/kg) | | 47 | 72 | 69 | 60 | 51 | 25 | |
| Exchangeable Aluminium (cmol./kg) | **Inhouse S37 (KCl) | <0.01 | <0.01 | 0.6 | 0.5 | 0.4 | 0.2 | |
| (kg/ha) | | <1 | <1 | 121 | 101 | 73 | 30 | |
| (mg/kg) | | <1 | <1 | 54 | 45 | 32 | 14 | |
| Exchangeable Hydrogen (cmol./kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | 0.6 | 0.5 | 0.4 | 0.2 | |
| (kg/ha) | | <1 | <1 | 13 | 11 | 8 | 3 | |
| (mg/kg) | | <1 | <1 | 6 | 5 | 4 | 2 | |
| Effective Cation Exchange Capacity (CEC) (cmol./kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol./kg) | 32 | 33 | 20.1 | 14.3 | 7.8 | 3.3 | |
| Calcium (%) | **Base Saturation Calculations - Cation cmol./kg / CEC x 100 | 85 | 85 | 77.6 | 75.7 | 65.6 | 57.4 | |
| Magnesium (%) | | 12 | 13 | 11.9 | 11.9 | 15.7 | 18.1 | |
| Potassium (%) | | 2.5 | 1.7 | 3.0 | 3.5 | 5.2 | 9.1 | |
| Sodium - ESP (%) | | 0.65 | 0.96 | 1.5 | 1.8 | 2.9 | 3.3 | |
| Aluminium (%) | | 0.00 | 0.00 | 6.0 | 7.1 | 10.5 | 12.1 | |
| Hydrogen (%) | | 0.00 | 0.00 | | | | | |
| Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol./kg) | 7.2 | 6.7 | 6.5 | 6.4 | 4.2 | 3.2 | |
| pH | **Rayment & Lyons 2011 - 4B4 (CaCl ₂) | 7.71 | 7.85 | .. | | | | |

GRAIN SIZE ANALYSIS (hydrometer and sieving techniques)

14 soil samples supplied by SLR Consulting Australia Pty Ltd on 09th May, 2022 - Lab Job No. M8431.

Analysis requested by Murray Fraser. You Job: PO SLR 630.30258 Wambo Mod BSAL.

10 Kings Road, New Lambton, NSW, 2305

| SAMPLE ID | Lab Code | MOISTURE CONTENT (% of water in sample) | TOTAL GRAVEL > 2 mm (% of total oven- dry equivalent) | GRAVEL > 4.75 mm (% of total oven-dry equivalent) | GRAVEL 2.00-4.75 mm (% of total oven- dry equivalent) | COARSE SAND 200-2000 µm (0.2-2.0 mm) (% of total oven- dry equivalent) | FINE SAND 20-200 µm (0.02-0.2 mm) (% of total oven- dry equivalent) | SILT 2-20 µm ISSS (% of total oven-dry equivalent) | CLAY < 2 µm (% of total oven-dry equivalent) |
|------------------|----------|--|---|---|--|--|---|---|--|
| W17 0-20 | M8431/1 | 23.4% | 2.6% | 0.0% | 2.6% | 30.2% | 37.4% | 18.0% | 11.9% |
| W17 20-30 | M8431/2 | 16.6% | 3.0% | 0.0% | 3.0% | 29.4% | 26.0% | 20.7% | 20.8% |
| W17 40-50 | M8431/3 | 17.6% | 25.7% | 22.5% | 3.2% | 20.4% | 22.1% | 12.7% | 19.1% |
| W17 65-75 | M8431/4 | 18.2% | 4.1% | 2.4% | 1.7% | 17.9% | 31.2% | 18.8% | 28.1% |
| W18 0-10 | M8431/5 | 26.8% | 0.5% | 0.0% | 0.5% | 9.4% | 32.5% | 11.7% | 45.9% |
| W18 20-30 | M8431/6 | 26.1% | 0.2% | 0.0% | 0.2% | 8.4% | 23.1% | 11.9% | 56.5% |
| W18 40-50 | M8431/7 | 23.1% | 0.4% | 0.0% | 0.4% | 10.8% | 22.0% | 18.6% | 48.3% |
| W18 65-75 | M8431/8 | 16.6% | 16.1% | 14.2% | 1.9% | 34.7% | 29.6% | 6.7% | 12.8% |
| W19 0-10 | M8431/9 | 18.9% | 1.1% | 0.0% | 1.1% | 17.0% | 39.6% | 17.0% | 25.3% |
| W19 20-30 | M8431/10 | 22.7% | 0.3% | 0.0% | 0.3% | 7.3% | 19.9% | 21.9% | 50.6% |
| W19 40-50 | M8431/11 | 21.8% | 0.2% | 0.0% | 0.2% | 5.1% | 33.7% | 20.0% | 41.0% |
| W19 65-75 | M8431/12 | 17.1% | 0.0% | 0.0% | 0.0% | 1.0% | 22.1% | 36.6% | 40.4% |
| W16 0-10 | M8431/13 | 10.5% | 1.9% | 0.0% | 1.9% | 15.6% | 19.6% | 22.4% | 40.5% |
| W16 20-30 | M8431/14 | 11.8% | 0.1% | 0.0% | 0.1% | 2.6% | 16.5% | 35.0% | 45.8% |

Note:

- 1: The Hydrometer Analysis method was used to determine the percentage sand, silt and clay, modified from SOP meth004 (California Dept of Pesticide Regulation), using method of Gee & Bauder (1986), in *Methods of Soil Analysis. Part 1* Agron. Monogr. 9 (2nd Ed). Klute, A., American Soc. of Agronomy Inc., Soil Sci. Soc. America Inc., Madison WI: 383-411.
- 2: Australian Standard 1289.3.8.1-1997 (see attached)
3. Analysis conducted between sample arrival date and reporting date.
4. This report is not to be reproduced except in full. Results only relate to the item tested.
5. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer scu.edu.au/eal).
6. This report was issued on 27/05/2022.



MUNSELL COLOUR ANALYSIS

14 soil samples supplied by SLR Consulting Australia Pty Ltd on 09th May, 2022 - Lab Job No. M8431.

Analysis requested by Murray Fraser. You Job: PO SLR 630.30258 Wambo Mod BSAL.

10 Kings Road, New Lambton, NSW, 2305

| SAMPLE ID | Lab Code | MOIST MUNSELL COLOUR | | MOTTLE MUNSELL COLOUR | | DEGREE OF MOTTLING (%) |
|------------------|----------|----------------------|-------------------------|-----------------------|-------------|------------------------|
| | | Code | Description | Code | Description | |
| W17 0-20 | M8431/1 | 10 YR 2/2 | Very Dark Brown | .. | .. | .. |
| W17 20-30 | M8431/2 | 7.5 YR 2.5/2 | Very Dark Brown | .. | .. | .. |
| W17 40-50 | M8431/3 | 10 YR 3/2 | Very Dark Grayish Brown | .. | .. | .. |
| W17 65-75 | M8431/4 | 10 YR 2/1 | Black | .. | .. | .. |
| W18 0-10 | M8431/5 | 7.5 YR 2.5/2 | Very Dark Brown | .. | .. | .. |
| W18 20-30 | M8431/6 | 7.5 YR 2.5/2 | Very Dark Brown | .. | .. | .. |
| W18 40-50 | M8431/7 | 7.5 YR 2.5/2 | Very Dark Brown | .. | .. | .. |
| W18 65-75 | M8431/8 | 7.5 YR 3/4 | Dark Brown | .. | .. | .. |
| W19 0-10 | M8431/9 | 10 YR 2/1 | Black | .. | .. | .. |
| W19 20-30 | M8431/10 | 10 YR 3/2 | Very Dark Grayish Brown | .. | .. | .. |
| W19 40-50 | M8431/11 | 10 YR 4/3 | Brown | .. | .. | .. |
| W19 65-75 | M8431/12 | 2.5 Y 6/3 | Light Yellowish Brown | .. | .. | .. |
| W16 0-10 | M8431/13 | 7.5 YR 5/2 | Brown | .. | .. | .. |
| W16 20-30 | M8431/14 | 10 YR 6/1 | Gray | .. | .. | .. |

Note:

- 1: The Hydrometer Analysis method was used to determine the percentage sand, silt and clay, modified from SOP meth004 (California Dept of Pesticide Regulation), using method of Gee & Bauder (1986), in *Methods of Soil Analysis. Part 1* Agron. Monogr. 9 (2nd Ed). Klute, A., American Soc. of Agronomy Inc., Soil Sci. Soc. America Inc., Madison WI: 383-411.
- 2: Australian Standard 1289.3.8.1-1997 (see attached)
3. Analysis conducted between sample arrival date and reporting date.
4. This report is not to be reproduced except in full. Results only relate to the item tested.
5. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer scu.edu.au/eal).
6. This report was issued on 27/05/2022.

APPENDIX D

Agricultural Productivity Gross Margin Data



BEEF CATTLE GROSS MARGIN BUDGET

Farm enterprise Budget Series: April 2019

Enterprise: Inland store weaners

Enterprise Unit: 100 cows

Pasture: Native pasture

| | | | | | Standard Budget | Your Budget |
|--|------------------|---------|-------------|--|-----------------|-------------|
| INCOME: | | | | | | |
| 42 | steer weaners @ | | \$725 /hd | | \$30,467 | |
| 21 | heifer weaners @ | | \$463 /hd | | \$9,727 | |
| 1 | CFA Bull @ | | \$1,554 /hd | | \$1,554 | |
| 6 | CFA cows @ | | \$963 /hd | | \$5,779 | |
| 0 | Dry cows @ | | \$963 /hd | | \$0 | |
| 13 | Other culls @ | | \$963 /hd | | \$12,522 | |
| 83 | | | | | | |
| A. Total Income: | | | | | \$60,049 | |
| VARIABLE COSTS: | | | | | | |
| Replacements | 1 Bull @ | \$3,500 | /hd | | \$3,500 | |
| Livestock and vet costs: see section titled beef health costs for details. | | | | | \$1,244 | |
| Hay & Grain or silage. Low level supplementary feeding for 3 months | | | | | \$2,250 | |
| Drought feeding costs. | | | | | \$0 | |
| Pasture maintenance (372 Ha of native pasture) | | | | | \$0 | |
| Livestock selling cost (see assumptions on next page) | | | | | \$4,776 | |
| B. Total Variable Costs: | | | | | \$11,770 | |
| GROSS MARGIN (A-B) | | | | | \$48,279 | |
| GROSS MARGIN/COW | | | | | \$482.79 | |
| GROSS MARGIN/DSE* | | | | | \$32.45 | |
| GROSS MARGIN/HA | | | | | \$129.78 | |

Change in gross margin (\$/cow) for change in price &/or the weight of sale stock

(Note: Table assumes that the price and weight of other stock changes in the same proportion as steers. As an example if steer sale price falls to 269c/kg and steer weight to 240 kg, gross margin would fall to \$419 per cow. This assumes that price and weight of all other sale stock falls by the same percentage.

| Liveweight (kg's) of Stock sold | Steer sale price cents/kg live | | | | | GM \$ per Cow |
|------------------------------------|--------------------------------|-----|-----|-----|-----|------------------|
| | 259 | 269 | 279 | 289 | 299 | |
| Steer wt. | | | | | | |
| -40 kgs 220 | 358 | 375 | 393 | 411 | 429 | |
| -20 kgs 240 | 399 | 419 | 438 | 457 | 477 | |
| 0 260 | 441 | 462 | 483 | 504 | 525 | |
| +20 kgs 280 | 483 | 505 | 528 | 550 | 572 | |
| +40 kgs 300 | 524 | 548 | 572 | 596 | 620 | |

An increase of 5% in weaning percentage increases gross margin per cow by \$27.08

Assumptions Inland store weaners

Enterprise unit is 100 cows weighing on average 480 kg

Weaning rate: 84% - conception rate 90%

Sales

| | | |
|--|--------|-------------------------|
| Steers sold at 9 months | 260 kg | @279c/kg live weight |
| Heifers sold at 9 months | 230 kg | @201c/kg live weight |
| 21 heifers retained for replacement. | | |
| Cull cows cast for age at 10 years | 240 kg | @401c/kg dressed weight |
| 100% of preg tested empty cows culled | " | " |
| 4% cows culled for other reasons | " | " |
| Bulls run at 3% & sold after 4 years use | 420 kg | @370c/kg dressed weight |

Selling costs include: Commission 4%; yard dues \$8.00/hd; MLA levy \$5/hd; average freight cost to saleyards \$12/hd; NLIS tags \$3.60

Cows: age at first calf : 24 months

Mortality rate of adult stock: 2%

The average feed requirement of a cow + followers is rated at 2.21 LSU or 15.25 dse's. This is an average figure and will vary during the year.

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Age structure

| Age | Number | |
|--------------|--------|--------------|
| 2 | 21 | |
| 3 | 18 | |
| 4 | 15 | |
| 5 | 13 | |
| 6 | 11 | |
| 7 | 9 | |
| 8 | 7 | |
| 9 | 6 | |
| Total Joined | 100 | |
| 10 | 6 | → 6 sold cfa |

| | | | | |
|-----------|---|------------|---|--------------------------|
| 84 calves | → | 42 heifers | → | 21 sold |
| | | | → | 21 retained for breeding |
| | → | 42 steers | → | 42 sold |

Marketing Information:

Mainly sold to grass back-grounders for growing out.

Steers likely to end up in feedlots after further weight gain on grass.

Following sale, heifers either grown out to become breeders or fattened for the local trade market.

Production Information:

Mixed sex weaners sold from March to June from lighter country or at heavier stocking rates than for vealers. Common on unimproved areas with some supplementary feed in normal years.

This enterprise is the most drought susceptible.

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