Appendix J

Land use, soils and agriculture assessment

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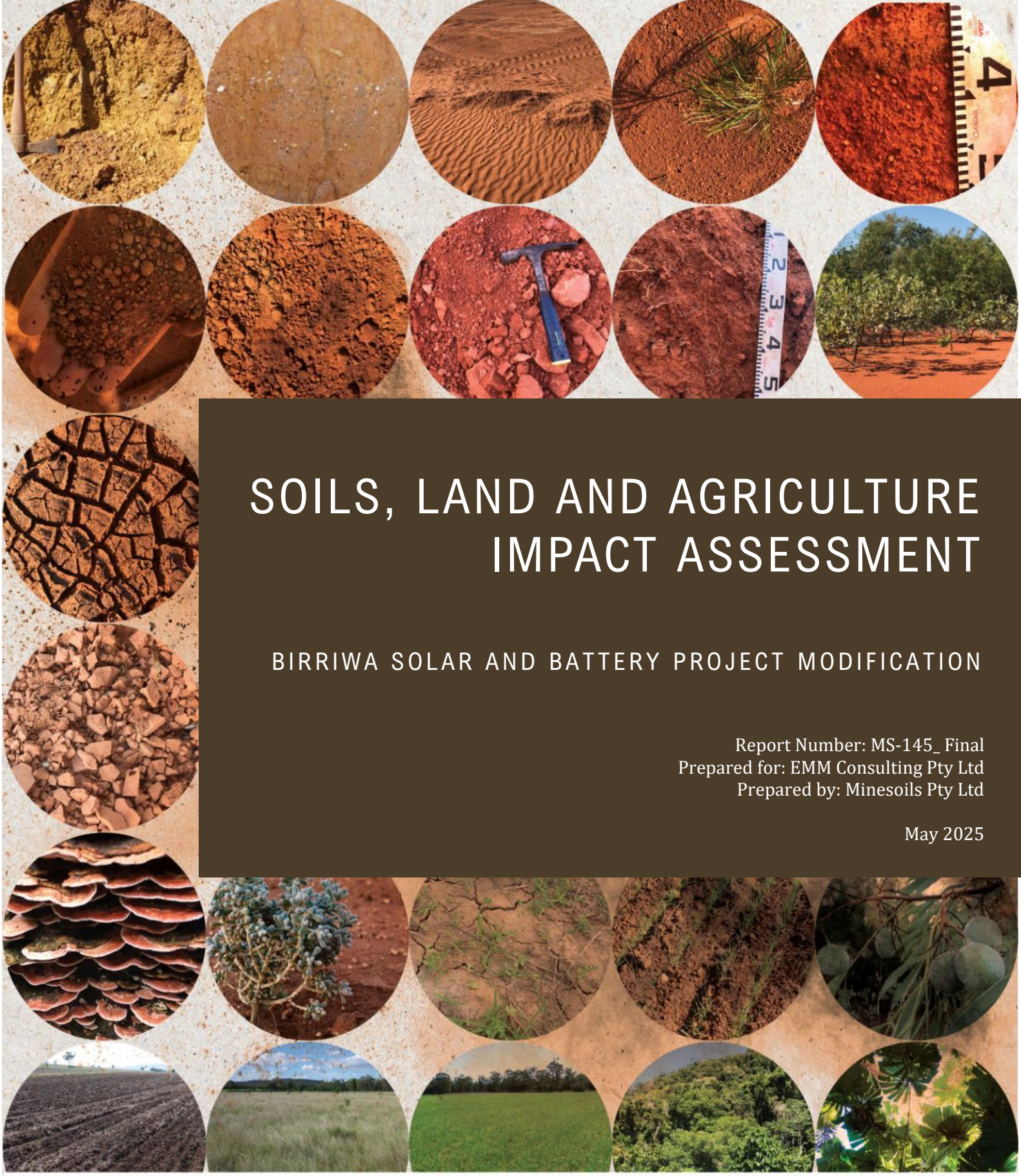

SOILS, LAND AND AGRICULTURE IMPACT ASSESSMENT

BIRRIWA SOLAR AND BATTERY PROJECT MODIFICATION

Report Number: MS-145_ Final
Prepared for: EMM Consulting Pty Ltd
Prepared by: Minesoils Pty Ltd

May 2025

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1 INTRODUCTION

1.1 BACKGROUND

ACEN Australia Pty Ltd (ACEN) has approval to develop the Birriwa Solar and Battery Project, a large scale solar photovoltaic (PV) electricity generation facility along with battery storage and associated infrastructure, including the construction of a temporary accommodation facility (the project). The solar component of the project will have an indicative capacity of around 600 megawatts (MW) and will include a centralised battery energy storage system (BESS) of up to 600 MW for a two-hour duration (1,200 MWh). The project (SSD-29508870) was determined and approved on 16 August 2024 by the NSW Independent Planning Commission, with development consent conditions.

The project site is approximately 15 kilometres (km) south-east of Dunedoo, in the Central-West Orana (CWO) region of New South Wales (NSW), in the localities of Birriwa and Merotherie (refer to **Figure 1**). It is situated within the Mid-Western Regional Local Government Area (LGA). Part of the transport access route to the project site via the Castlereagh Highway is situated within the Warrumbungle Shire LGA. The project is within the CWO Renewable Energy Zone (REZ).

ACEN is seeking approval to modify development consent SSD-29508870 to include additional lots, an alternative secondary access route and upgrade to part of the existing Birriwa Bus Route South, an increase in capacity of the approved temporary accommodation facility, and an increase in the storage capacity and duration of the BESS (the modification).

This Soil, Land and Agriculture Impact Assessment has been prepared to support the application to modify SSD-29508870.

1.2 APPROVED PROJECT OVERVIEW

The approved project comprises the following key components:

- installation of approximately 1 million solar PV panels and associated mounting infrastructure
- a BESS with a capacity of up to 600 MW and a storage duration of up to 2 hours (1,200 MWh)
- an on-site substation with a connection voltage of up to 500 kilovolts (kV)
- electrical collection and conversion systems, including inverter and transformer units, switchyard, control room and staff car park
- underground and aboveground cables
- an operational infrastructure area, including demountable and permanent offices, amenities, and equipment sheds
- internal access roads
- a temporary construction compound (during construction and decommissioning phases)
- an access route upgrade from Castlereagh Highway to the project site via Barneys Reef Road and Birriwa Bus Route South
- a temporary accommodation facility to provide accommodation for up to 500 construction staff during the construction phase of the project
- an emergency access track providing alternative access to the accommodation facility, suitable for emergency vehicles

1.3 MODIFICATION OVERVIEW

ACEN is seeking to modify SSD-29508870 under to Section 4.55(2) of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) to:

- Increase the project area and development footprint to include three additional lots (Lot 11/DP 750755, Lot 40/DP 750755, Lot 60/DP 750755) and the remaining part of Lot 34/DP 750755, allowing for additional land to be used for solar generation, BESS, and associated ancillary infrastructure, as needed.
- Increase the storage capacity and duration of the BESS from up to approximately 600 MW for a two-hour duration up to approximately 900 MW for a four-hour duration. Modifying the project area and development footprint across additional neighbouring lots will enable flexibility in design and construction, optimisation of the solar array layout, and will allow sufficient space for maintenance. The additional capacity will allow the project to increase its energy storage potential, providing additional firming support and greater network system strength.
- Increase the project area and development footprint to allow for an upgrade to part of the existing Birriwa Bus Routh South Road from the Golden Highway via Merotherie Road as secondary access route including a public road crossing. This upgrade will enable access to the project for the purpose of constructing and operating the approved temporary accommodation facility, construction, operation and maintenance of the BESS and EnergyCo's infrastructure associated with the project.
- Increase the approved project's accommodation facility capacity from 500 workers to 650 workers, within the approved accommodation footprint (up to an additional 150 workers will reside at the accommodation facility in peak construction periods).
- Amend the schedule of land to include three additional neighbouring lots.

1.4 MODIFICATION AREA

The modification area (study area) subject to this assessment encompasses the aforementioned three additional lots (Lot 11/DP 750755, Lot 40/DP 750755, Lot 60/DP 750755) and the remaining part of Lot 34/DP 750755. This area covers 257 ha and is shown on **Figure 2**.

The modification area and locality have historically been utilised for agricultural practices primarily consisting of livestock grazing on modified pastures and fodder crops, with evidence of broad native vegetation modification resulting from extensive clearing and agricultural land use. Current land use comprises livestock grazing and cropping.

The Modification Development Footprint is the impact footprint (approximately 216 ha) associated with the proposed modification, within the modification area. All operational components of the modification will be within the modification development footprint. The modification development footprint is the outcome of the iterative process which led to excluding certain areas of environmental or social constraint.

1.5 REPORT PURPOSE

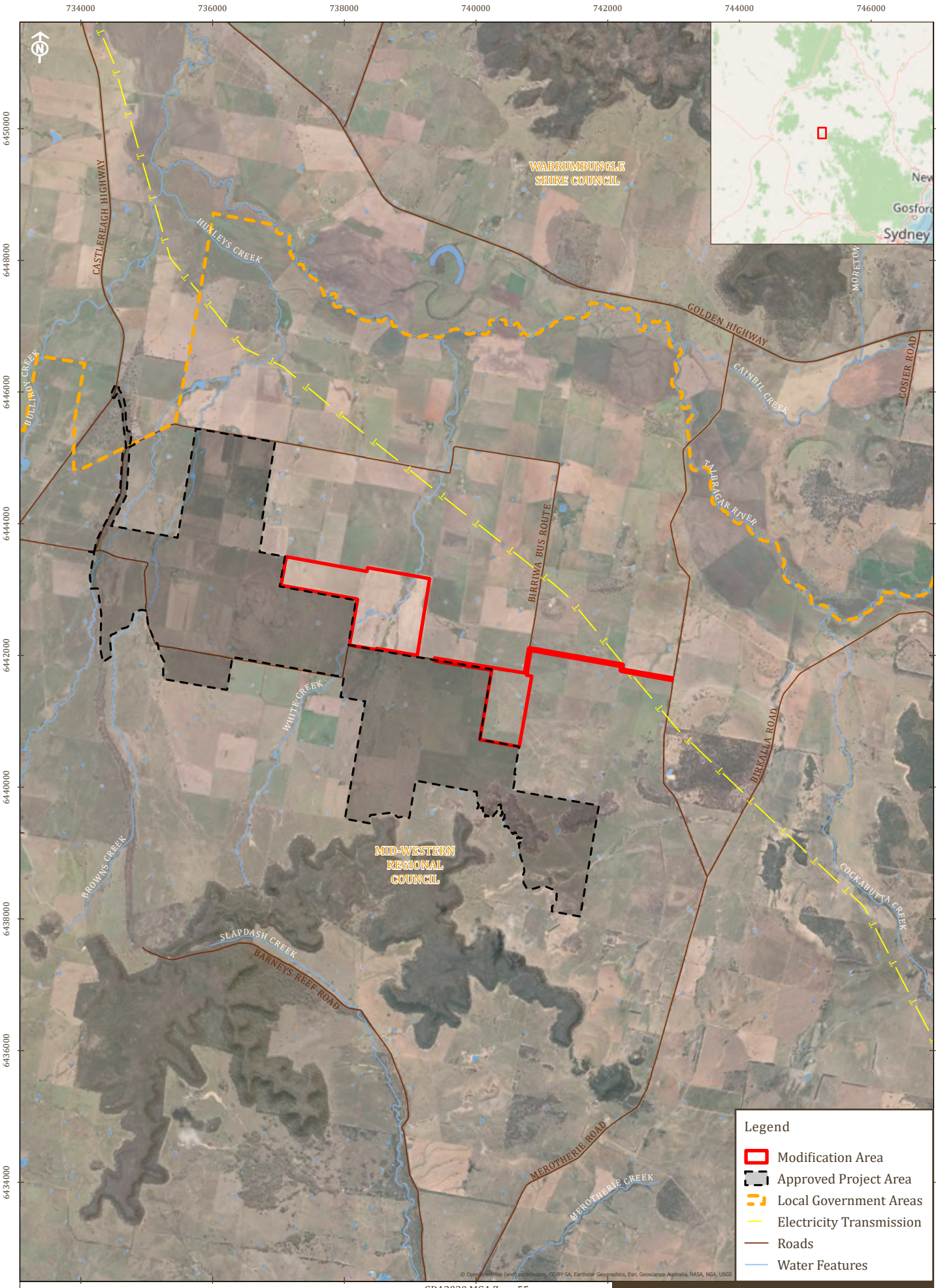
This Soil, Land and Agricultural Impact Assessment report provides an assessment of the potential impacts on soil, land and agriculture resources associated with the proposed modification.

This report has been prepared to accompany the modification report with the specific objectives to:

- Complete a soil survey of the Modification Area to determine the soil characteristics and consider the potential for salinity, acid sulfate soils and erosion to occur in accordance with *Land and Soil Capability Assessment Scheme* (LSC Scheme) (EOH 2012).;
- Complete an assessment of the agricultural impacts in accordance with the *Large-Scale Solar Energy Guidelines* (LSSE Guidelines) (NSW DPIE, 2022);.
- Completion of a Land Use Conflict Risk Assessment in accordance with the *NSW Department of Industry's Land Use Conflict Risk Assessment Guide* (NSW DPI, 2011).

1.6 ASSESSMENT APPROACH

The assessment approach has been undertaken in accordance with the LSSE Guidelines, which includes requirements to undertake a soil survey and verify land and soil capability (LSC) in accordance with the LSC Scheme The results of the site verification, as presented in Section 3.2, determined that the required level of agricultural impact assessment is Level 2 – Reduced, as per the LSSE Guidelines. The assessment requirement pathway for this assessment from the LSSE Guidelines is presented in **Figure 3**. The requirements for this level of assessment, and where these items are addressed in this report, are presented in **Table 1**.



GDA2020 MGA Zone 55

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Meters
0 500 1000 1500
Scale 1:75,000 at A4

Project Locality

FIGURE 1

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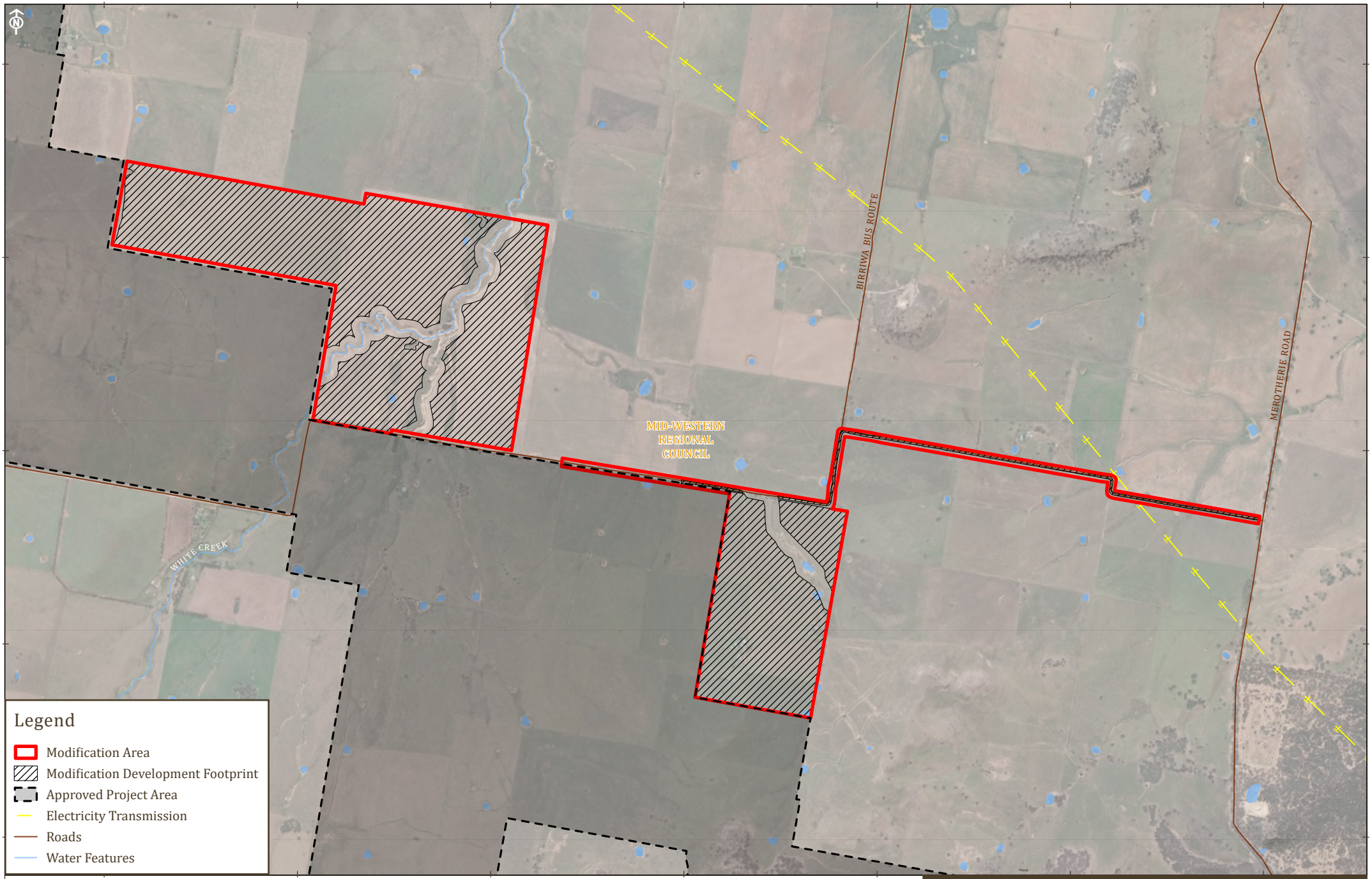

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Modification Area

FIGURE 2

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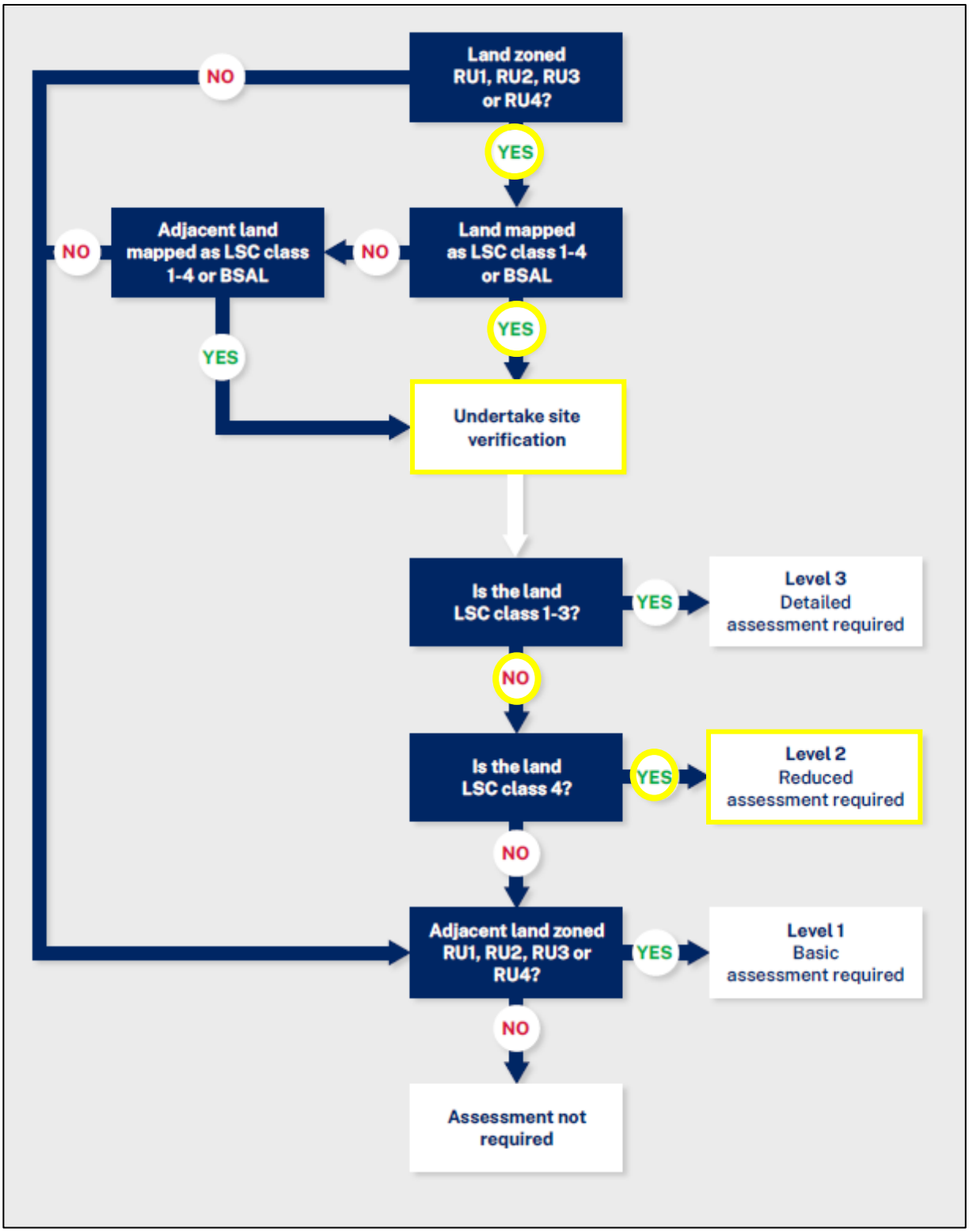
Figure 3. Adopted Agricultural Assessment Pathway



(NSW DPIE, 2022)

Table 1: Requirements of 'Level 2 - Reduced' Assessment and Section Addressed

Assessment	Content and form	Section Addressed
Project description Describe the nature, location, intensity and duration of the project and include a map of the Project Area.	• project description • areas of the site that would be disturbed or temporarily removed from agricultural use • location • duration	**1**
Regional context Describe the regional context.	• zoning of the Modification Area • climate and rainfall • regional landform • regional land use including any significant agricultural industries and/or infrastructure	**2**
Site characteristics and land use description Describe the nature and location of agricultural land with the potential to be impacted by the development. Describe the current agricultural status and productivity of the proposed Project Area and surrounding locality including the land capability as per Office of Environment and Heritage's (OEH) Land and Soil Capability Assessment Scheme.	• describe the land subject to the Modification Area • describe existing agricultural land uses (i.e. orchards, vineyards, breeding paddocks, intensive livestock areas) • describe the history of agricultural practices on the project site • identify soil type, fertility, land and soil capability • provide a map showing the verified LSC class of the project site • provide a map showing topography of the site • describe the agricultural productivity of the site	**3**
LUCRA assessment Conduct an assessment of potential land use conflicts, including completion of an assessment in accordance with the Department of Industries' Land Use Conflict Risk Assessment Guide	• land use compatibility and conflicts • discuss compatibility of the development with the existing land uses on the site and adjacent land during operation and after decommissioning, with reference to the zoning provisions applying to the land	**4** **(Appendix 2)**
Impacts on agricultural land Identify and describe the nature, duration and consequence of any potential impacts on agricultural land subject to the project site and in the wider region	• describe project impacts on identified agricultural lands, including but not limited to, potential weeds, pests, dust, bushfire, livestock, crop production • consider impacts to the agricultural land of the site • consider project potential to temporarily and/or permanently remove agricultural land and/or fragment or displace existing agricultural industries • consider cumulative impacts of multiple solar energy projects on agriculture in the region	**5**
Mitigation strategies Outline strategies which may be adopted to mitigate potential impacts on agricultural land and minimise land use conflict.	• outline and consider strategies to mitigate project impacts on agricultural land • consider co-location with existing agricultural practices and investigate feasibility of agrisolar where it would result in a meaningful benefit (see Clean Energy Council's Australian Guide to Agrisolar for Large -Scale Solar)	**6**

2 REGIONAL CONTEXT

2.1 ZONING

The Modification Area is zoned RU1 Primary Production under the *Mid-Western Regional Local Environmental Plan*. Electricity generation is permitted with consent within this land use zone. Further, clause 2.36(1)(b) of the Transport and Infrastructure State Environmental Planning Policy 2021 (TISEPP) states development for the purpose of electricity generating works may be carried out by any person with consent on any land in a prescribed rural, industrial, or special use zone. Therefore, the Project is permissible with development consent.

2.2 CLIMATE AND RAINFALL

The Modification Area is located in the Central Tablelands, a region is often referred to as the High Rainfall Zone (HRZ), which has a more-or-less uniform year-round rainfall distribution and an average annual rainfall of more than 600mm. In summer, evaporation exceeds rainfall, reducing pasture growth and this is magnified at lower altitude where rainfall is lower and temperatures higher. In winter rainfall exceeds evaporation, but cooler temperatures slow pasture growth and this impact is greater at the higher altitude (EverGraze, 2023).

The climate around the Central Tablelands is strongly influenced by topography and the movement of cold air. During the cooler months, cooler air drops into the valleys and the concentration of this colder air increases the number of frosts in some areas. The frost period ranges from five to eight months of the year, significantly impacting pasture growth.

The Central Tablelands is renowned for their mild summers and cool winters with snow falling in most years, increasing in frequency as elevation increases. There is a strong association between altitude and temperature (EverGraze, 2023).

The closest Bureau of Meteorology (BOM) weather station to the Modification Area is at Dunedoo Post Office (Site Number 064009). This station is located approximately 20 km north west of the site and is considered representative for the Modification Area. The station has a data range from 1912 to present (BOM, 2024). The annual average rainfall is 618.8mm, with the highest average rainfall of 70.8 mm falling in January, and the lowest average rainfall of 40.1 mm falling in August. Rain generally falls over approximately 63 days.

The annual average maximum temperature recorded at the station is 24.1°C and the annual average minimum temperature is 9.7°C. The highest average maximum temperature of 32.2°C is recorded in January, while the lowest average maximum temperature of 15.5°C is recorded in July.

2.3 REGIONAL LANDFORM

The Central Tablelands covers an area of approximately 31,365km^2, and encompasses the major towns of Orange, Bathurst, Lithgow, Mudgee, Cowra, Wellington, Blayney, Oberon, Gulgong, and Portland.

The Central Tablelands is traversed by the Great Dividing Range that runs north to south, with highest altitudes in the Oberon, Orange and Lithgow LGAs. The headwaters of the Macquarie and Lachlan rivers start in the eastern areas around Oberon, and the adjacent Southern Tablelands respectively in elevated areas above 1,000m. The elevation drops to 450m to the western slopes. The eastern third of the Lithgow LGA falls to the Warragamba catchment to the east (DPI, 2020).

The Central Tablelands is made up of sediments with granite outcrops, and igneous remnants that contribute to an array of soils that are reflected in the various agricultural industries located in the area. Mount Canobolas near Orange is recognised as an important horticultural and viticultural area due to the unique combination of volcanic soils, rainfall and climate.

The Cudegong River is the main river that occurs in the uppermost area of the Mid-Western Regional Council area with Windamere Dam impounding waters above Mudgee. This water helps irrigate the viticultural industry in the area, as well as supporting irrigated hay production and contributing to the irrigation industry in the Macquarie River when it joins this river in the Burrendong Dam storage downstream of the Central Tablelands. The Carcoar Dam is situated on the Belubula River six kilometres upstream from Carcoar in the Blayney Shire, where the impounded water is used to support irrigation downstream as well as to supply stock and domestic water. The Wyangala Dam located 48km above Cowra is the major dam that is situated on the confluence of the Lachlan and Abercrombie rivers, and provides regulated irrigation water to the Lachlan Valley. The vegetable, hay and dairy industry is reliant on this supply.

Groundwater supplies are also important to irrigation in the Belubula valley, the Orange basalts, and the Molong limestone. Basic landholder rights exist, with water of high quality and lower yield in the weathered granites at Bathurst, and the Hawkesbury Sandstone to the east. Groundwater has been a vital source of water during droughts especially for livestock (DPI, 2020).

At the scale of the LGA, the Mid-Western Regional Shire covers an area of 8,737 km^2 and supports a population of approximately 25,713 people, as at the 2021 census (ABS, 2023). Mudgee is the largest town in the Mid-Western Regional Shire and is the administrative centre. Other towns and villages include Gulgong, Rylstone, Kandos, Bylong, and Ilford. The LGA relies on the Cudgegong and Goulburn Rivers for potable and irrigation water.

2.4 REGIONAL LAND USE

2.4.1 AGRICULTURAL LAND USE AND ENTERPRISES

Agriculture is a key industry for the Central Tablelands economically and for the scenic and environmental qualities of the rural lands where agriculture is undertaken (DPI, 2020).

Current agriculture practices in the Mid-Western Regional LGA consist of grazing on native and improved pastures, livestock, and cropping including viticulture. Within the Mid-Western Regional Shire LGA, approximately 351,163 ha is land subject to agricultural activity (ABS, 2022a). The area of land use for of the agricultural types for the Mid-Western Regional Shire LGA is presented in **Table 2**, which shows grazing as the dominant land use, accounting for approximately 87% of this area (2022a).

Table 2: Mid-Western Regional Shire LGA Agricultural Land Use by Type 2020 - 2021

Agricultural Land Use	Area	
	ha	%
Grazing	305, 866	87
Cropping	38, 891	11
Forestry	4, 794	1
Other	1, 612	<1
Total	351, 163	100

The Mid-Western Regional Shire LGA is a highly productive agricultural area, with the region's economy dominated by both mining and agriculture. At a scale of the locality, agricultural enterprises and land use surrounding the study area largely consist of grazing of cattle and sheep on modified and improved pastures (refer **Figure 4**). This is generally representative of the agricultural enterprises within the LGA, however, wheat, barley, sorghum and canola

broadacre cropping enterprises, as well as some fruit and nut production, including viticulture, occur over areas subject to cropping.

Sheep grazing for wool production was historically the dominant livestock enterprise across the region. However, when the reserve price scheme for wool was abandoned in 1991, there was a shift from wool production to beef production. Today, beef production is the main livestock industry by land area used and value, both in the Mid-Western LGA and the wider Central Tablelands region. Sheep meat production remains an important industry in both mixed farming and also pure sheep meat farming enterprises in the region, being productive over a wide range of climates and land types (DPI, 2020).

Throughout the Central Tablelands, livestock are typically managed in a system of rotational grazing, with paddocks recuperating after grazing (DPI, 2020)

At the scale of the Mid-Western Regional LGA, for the census year of 2020 – 2021, there were 380 livestock grazing enterprise businesses and 177 cropping enterprise businesses (ABS 2022a). The gross value of agricultural enterprises within the Mid-Western Regional Shire LGA for 2020-2021 is just over $98.7 million (ABS 2022b). As shown in **Table 3**, livestock for slaughter accounts for 60% of the total gross value of agriculture for the LGA. Other key enterprises are cropping and livestock products.

Within the category of cropping, the production of hay is the dominant enterprise, contributing 42% of crop value, along with broadacre cropping of wheat, barley, and oats for grain, and canola (refer Table 4), cumulatively contributing over 41% of crop value (ABS, 2022b).

For livestock slaughtered, cattle and calves make up 65.8% of the gross value with sheep and lambs making up 34% (refer Table 5). Pigs, poultry and other livestock slaughter enterprises contribute <1% combined (ABS, 2022b).

Table 3: Mid-Western Regional Shire LGA Agricultural Commodity Gross Value by Type 2020 - 2021

Agricultural Commodity	Gross Value	
	$	%
Livestock for slaughter	58,836,839	60
Crops	25,094,045	25
Livestock products	14,816,167	15
Total	98,747,051	100

Table 4: Mid-Western Regional Shire LGA Crop Gross Value by Type 2020 - 2021

Crop	Value	
	$	%
Hay	10,651,134	42
Wheat for grain	4,621,810	18
Oats for grain	3,253,212	13
Barley for grain	2,378,428	10
Canola	1,910,868	8
Fruit and nuts (excluding grapes)	814,165	3
Grapes for wine production	418,891	2
Other	589,874	2
Sorghum for grain	333,986	1
Pulses and legumes	121,677	1
Total	25,094,045	100

Table 5: Mid-Western Regional Shire LGA Livestock Gross Value by Type 2020 - 2021

Livestock	Value	
	$	%
Cattle and calves	38,721,373	66
Sheep and lambs	19,967,087	34
Poultry	86,870	<1
Pigs	16,310	<1
Other	45,200	<1
Total	58,836,839	100

2.4.2 REGIONAL AGRICULTURAL INFRASTRUCTURE

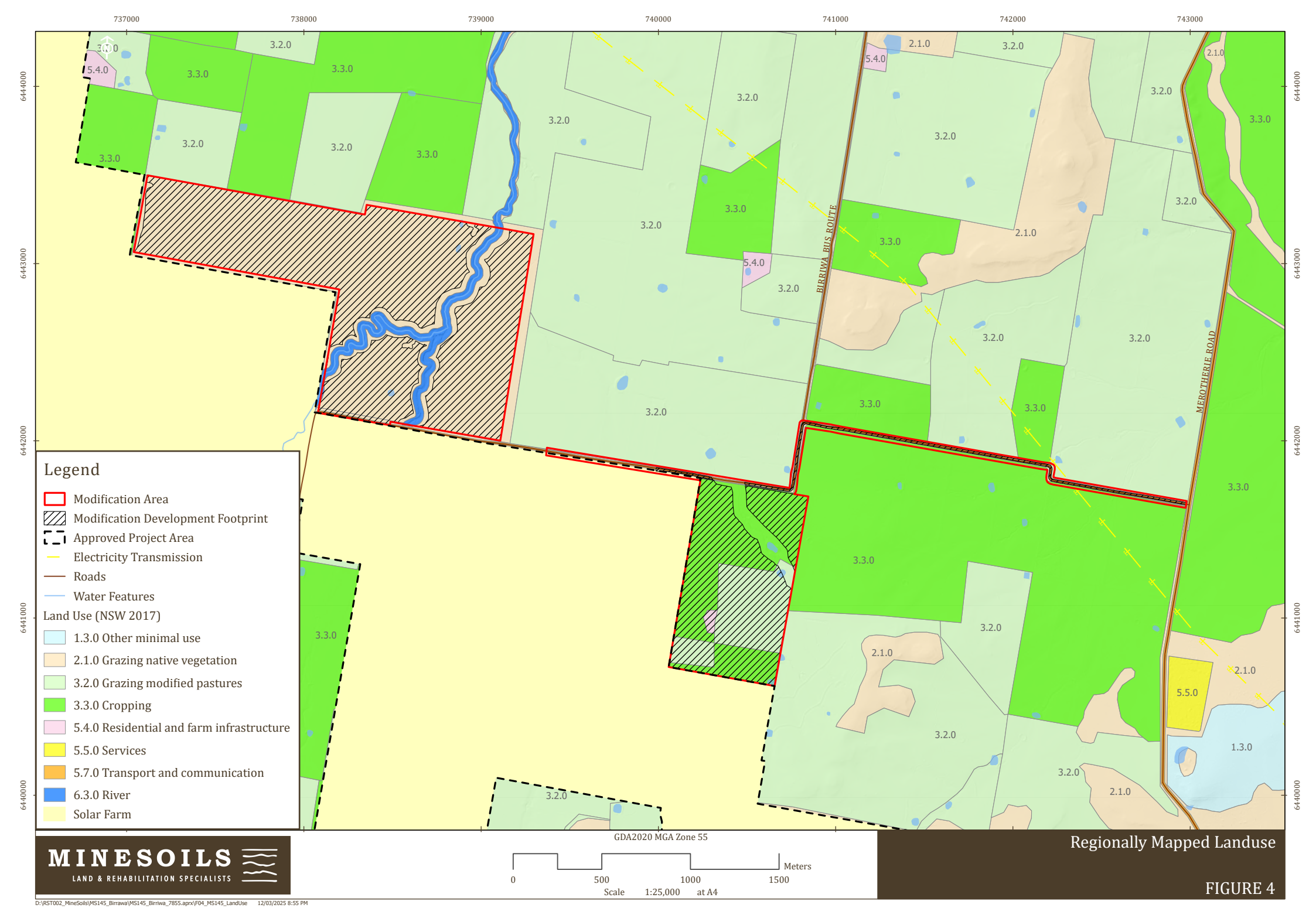
The key infrastructure item assisting agricultural market access and cost of production is the transport network servicing the Southern Tablelands region. Underlining the importance of this issue, total freight costs from farm to port can be as much as 30% of the value of the crop being marketed depending on Australian and world commodity prices in a given season. The region is traversed by the Castlereagh and Golden Highways which link agricultural enterprises to Sydney, Newcastle, and Brisbane, as well as other regional centres. These highways are used for intra-

regional transportation consisting of agricultural trucks, freight trucks and local farming traffic as well as low levels of tourist traffic. The Project is situation between Barneys Reef Road (west) and Merotherie Road (east). Barneys Reef Road meets the Castlereagh Highway to the north west of the site.

In proximity to the Project, the large agricultural service centre of Gulgong (approximately 20km south), Mudgee (approximately 60km south) and Dunedoo (approximately 15km northwest) allows access to businesses providing agricultural equipment and supplies, including animal fencing, animal vaccinations, livestock ID, stock supplements, seed, fertiliser and crop protection.

The closest regional livestock saleyards are located at the undercover Mudgee Saleyards, which have been operating from their current site on Abattoirs Road since 2003. The wider Central Tablelands are serviced by the Central Tablelands Livestock Exchange, the third largest saleyard in NSW.

Other infrastructure critical to agricultural production include energy needs (gas and electricity), telecommunications services, urban water and wastewater services. General agricultural improvements such as stock fences, shedding, dams and access tracks are widespread throughout the locality which reflects the historical and current development of the local lands for agricultural use.



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Regionally Mapped Landuse

FIGURE 4

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3 SITE CHARACTERISTICS AND LAND USE

3.1 SITE CHARACTERISTICS

3.1.1 LANDSCAPE

A site inspection was undertaken by Minesoils in May 2024. The Modification Area was determined to be generally a stable, free draining landform that has been highly disturbed in the past by land clearing for agriculture. The Modification Area contains extensive areas subject to modified and improved pastures, with a varying range in ground cover level, generally between 80 – 100% (**Plates 1** and **2**). Very few isolated native trees occur sporadically throughout the Modification Area.

The Modification Area is within a generally flat to slightly undulating landscape. The topography of the Modification Area ranges in elevation from approximately 420 mAHD in the northwest corner of the site to 500 mAHD along the tops of ridge lines located to the southeast of the site (refer **Figure 5**). Slopes averages 2 – 6%.

Sheet and gullying erosion was observed throughout the Modification Area, indicating dispersive soils, with the most extreme gullying observed along White Creek, that transects the north western portion of the Modification Area (**Plates 3** and **4**).

The Modification Area and surrounding areas are dominated by farming land uses with associated dwellings common. Rural residences are mostly set within surrounding vegetation of varying densities.

3.1.2 AGRICULTURAL LAND USE

The Modification Area is subject to livestock grazing on modified pastures and fodder crops, supporting sheep and lambs (**Plate 5**), and Angus cattle and calves (**Plate 6**), which are grazed on rotation for breeding and fattening.

Based on satellite imagery, site observation, soil and land capability, and discussions with the host landholders, it is determined that cleared areas of land within the Modification Area have historically been primarily used for livestock grazing on improved pastures and fodder crops, with some historical broadacre cropping also undertaken.

Stock are generally watered through a series of surface dams (**Plate 7**), with some troughs for pumped water present. General agricultural improvements are present in the Modification Area, including, cattle yards, shedding, stock fences and gates, tanks, and unsealed access tracks (**Plates 8, 9** and **10**).

At the time of inspection, neighbouring properties consist of agricultural lands and were observed to be used primarily for livestock grazing of sheep and cattle on modified pastures and fodder crops, with some isolated broadacre cropping also being undertaken within the broader locality. Similar agricultural improvements (e.g. cattle yards, stock fences, dams, cattle grids, and existing access tracks) are widespread throughout the locality which reflects the historical and current development of the local lands for these land uses.

No sensitive agricultural activities such as intensive plant or livestock agriculture were identified within the Modification Area or its immediate surrounds.

Plate 1: The Modification Area is characterised by improved pastures for livestock grazing.

Plate 2: The Modification Area contains modified pastures for livestock grazing.

Plate 3: Erosion and evidence of dispersive soils was observed throughout the Modification Area

Plate 4: Severe gully erosion associated with White Creek.

Plate 5: Sheep and lamb grazing within the Modification Area.

Plate 6: Beef cattle grazing within the Modification Area.

Plate 5: The Modification Area contains agricultural improvements including farm dams.

Plate 6: The Modification Area contains agricultural improvements including tanks, water pumps, troughs.

Plate 7: Agricultural infrastructure within the Modification Area includes shedding.

Plate 7: Agricultural infrastructure within the Modification Area includes cattle yards.

3.1.3 AGRICULTURAL PRODUCTIVITY

Agricultural productivity is subject to long term climate and rainfall variables, as well as changes in economic, social and policy frameworks, often at a scale well beyond the Modification Area. There is no set agricultural productivity value for land under agricultural use.

The NSW Department of Primary Industries (2024) Gross Margin Budgets for Livestock can be used to provide a broad estimation of the productivity of the land for grazing within the Study Area. Based on the DPI cattle and sheep enterprise options of 'Growing-out Steers (on improved pasture 240 – 460 kgs)' and 'Merino Ewes (20 micron) – Maternal Rams,' which is considered conservative for the agricultural land use of the study area, the estimated productivity of the Study Area ranges from $73,523 to $85,033 per annum as summarised in **Table 6**.

An alternative method by which to estimate the potential productivity of the Modification Area and Disturbance Footprint that accounts for the land and soil capability and best reflects current land use, is by analysing the information presented from the last agricultural census of 2020 – 2021 in Section 2.3 (ABS 2022a and 2022b). This information shows that within the Mid-Western Regional LGA, 305,866 ha of land was used for grazing activities, of which the gross commodity value of cattle and calves, and sheep and lambs, from livestock slaughtered and wool

and milk from livestock products can be attributed (totalling $73,205,880 combined). This results in an annual $/ha ratio of $239/ ha.

By modelling grazing enterprises over the Modification Area and Disturbance Footprint, based on the ABS LGA data, the potential productivity of the Modification Area is estimated to be up to $61,423 per year, as shown in **Table 7**.

Table 6: Estimated productivity of grazing land within the study area

Enterprise	Estimated Gross Margin ($/ha/year)	Grazing Land (ha)	Modification Area Gross Margin ($/year)
Growing-out Steers 240 – 460kg	330.87	257	85,033
Merino Ewes (20 micron) – Maternal Rams	286.08	257	73,523

*Source: DPI, 2024

Table 7: Estimated Potential Productivity based on LGA Data

Area	Estimated Gross Value in LGA ($/ha/year)	Area (ha)	Estimated Productivity ($/year)
Modification Area	239	257	61,423
Disturbance Footprint	239	216	51,624

3.2 SOIL SURVEY AND SITE VERIFICATION

3.2.1 EXISTING SOILS INFORMATION

The following section presents the NSW state government regional mapping data for soil types, inherent soil fertility and LSC as applied to the Modification Area (NSW and Department of Planning, Industry and Environment, 2024).

Soil Landscapes

The Modification Area lies within the Soil *Landscapes of the Dubbo 1:250,000 Sheet* (Murphy and Lawrie 2010). Soil landscapes are an inventory of soil and landscape information with relatively uniform land management requirements, allowing major soil and landscape qualities and constraints to be identified.

The soil landscapes within the Modification Area are shown in **Figure 6** and their description is included below**.**

Home Rule Soil Landscape

The landscape is characterised by the following:

- Rolling hills and low hills with steep rocky slopes and valley sides.
- Narrabeen sandstone, conglomerate sandstone, shale, conglomerate, mudstone, chert, coal and torbanite seams.
- Relief pf 60–240 m.
- Slopes ranging 15– 40%.

Soils are characterised by shallow, sandy soils with extensive rock outcrop, boulder debris slopes and sandstone cliffs. Other soils include grey or Yellow Earths and Yellow Podzolic Soils on lower slopes, shallow acid loams on coal bearing strata, and Podzols on lower slopes.

Qualities and limitations include steep slopes; rock cliffs; very low fertility; very low waterholding capacity; high permeability. Existing minor sheet erosion; acid surface soils.

Rouse Soil Landscape

The landscape is characterised by the following:

- Undulating hills and low hills with granite outcropping as tors and sloping pavements.
- Gulgong Granite, biotite granite, adamellite, granodiorite.
- Relief of 50– 90 m.
- Slopes ranging 5– 15% and 500– 1,000 m long.

Soils are mainly shallow Siliceous Sands and Earthy Sands on mid-slopes and upper slopes. Yellow Soloths and yellow Solodic Soils on lower slopes and in depressions. Deeper A2 horizons on lower slopes adjacent to main drainage lines. Other soils include bleached sands, and Non-calcic Brown Soils and Red Earths on small areas of less siliceous rock.

Qualities and limitations include Very low fertility; acidic surface soils; low available waterholding capacity; seasonal waterlogging; sodic subsoils on lower slopes; high to very high erosion hazard under cultivation. Existing minor sheet and gully erosion, some areas of severe gully erosion.

Soil Types

The NSW regional soil mapping indicates the dominant soil types within the Modification Area are Sodosols, as per Australian Soil Classification (ASC) (Isbell, R. F.,2021) (refer **Figure 7**).

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

Inherent Soil Fertility

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

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

The Modification Area contains soils with Moderately Low (2) fertility (refer **Figure 8**).

Land and Soil Capability

Land capability, as detailed in LSC Scheme, is the inherent physical capacity of the land to sustain a range of land uses and management practices in the long term without degradation to soil, land, air and water resources. Failure to manage land in accordance with its capability risks degradation of resources both on- and off-site, leading to a decline in natural ecosystem values, agricultural productivity, and infrastructure functionality.

The 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 9** and their definition has been based on two considerations:

- The biophysical features of the land to derive the LSC classes associated with various hazards.

- The management of the hazards including the level of inputs, expertise and investment required to manage the land sustainably.

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

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

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

Table 9: Land and Soil Capability Classification

Class	Land and Soil Capability
Land capable of a wide variety of land uses (cropping, grazing, horticulture, forestry, nature conservation)	
1	**Extremely high capability land**: Land has no limitations. No special land management practices required. Land capable of all rural land uses and land management practices.
2	**Very high capability land**: Land has slight limitations. These can be managed by readily available, easily implemented management practices. Land is capable of most land uses and land management practices, including intensive cropping with cultivation.
3	**High capability land**: Land has moderate limitations and is capable of sustaining high-impact land uses, such as cropping with cultivation, using more intensive, readily available and widely accepted management practices. However, careful management of limitations is required for cropping and intensive grazing to avoid land and environmental degradation.
Land capable of a variety of land uses (cropping with restricted cultivation, pasture cropping, grazing, some horticulture, forestry, nature conservation)	
4	**Moderate capability land**: Land has moderate to high limitations for high-impact land uses. Will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology.
5	**Moderate–low capability land**: Land has high limitations for high-impact land uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation.
Land capable for a limited set of land uses (grazing, forestry and nature conservation, some horticulture)	
6	**Low capability land**: Land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation.
Land generally incapable of agricultural land use (selective forestry and nature conservation)	

Class	Land and Soil Capability
7	**Very low capability land**: Land has severe limitations that restrict most land uses and generally cannot be overcome. On-site and off-site impacts of land management practices can be extremely severe if limitations not managed. There should be minimal disturbance of native vegetation.
8	**Extremely low capability land**: Limitations are so severe that the land is incapable of sustaining any land use apart from nature conservation. There should be no disturbance of native vegetation.

The NSW regional based maps of LSC indicate the Modification Area consists of LSC class 5: moderate low capability land (refer **Figure 9**).

Strategic Regional Land Use Policy Mapping

Biophysical Strategic Agricultural Land (BSAL) is land with a rare combination of natural resources highly suitable for agriculture. These lands intrinsically have the best quality landforms, soil and water resources which are naturally capable of sustaining high levels of productivity and require minimal management practices to maintain this high quality. BSAL is able to be used sustainably for intensive and purposes such as cultivation. Such land is inherently fertile and generally lacks significant biophysical constraints (Office of Environment & Heritage and Department of Primary Industries, 2013).

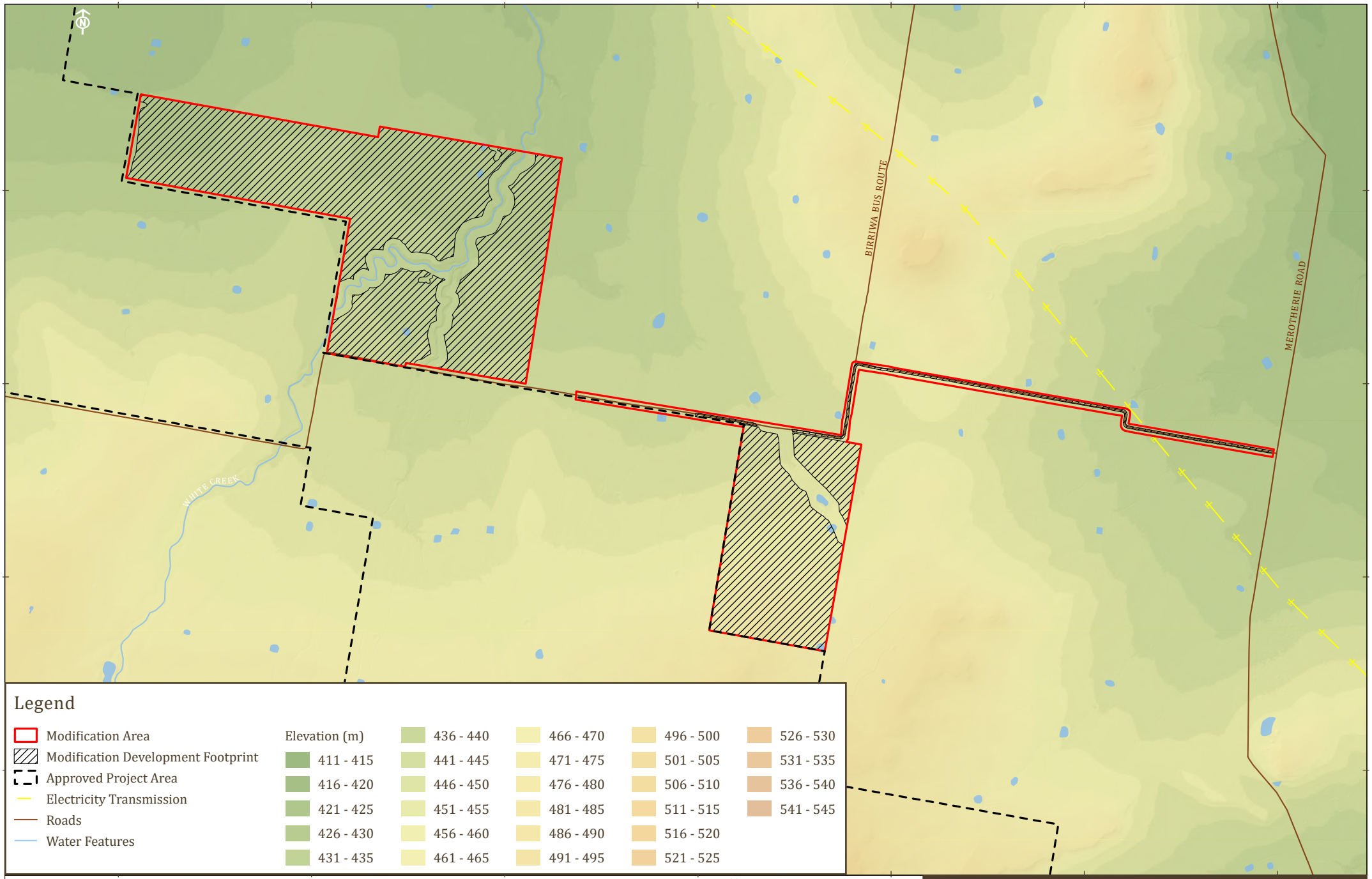
The NSW Government have published statewide mapping that that estimates the presence of approximately 2.8 million hectares of BSAL within New South Wales. Agricultural land across the state was assessed against specific scientific criteria - levels of soil fertility, land and soil capability classes and access to reliable water and rainfall levels. This broad scale mapping was undertaken to assist in identifying and managing competing land uses proposed for high quality agricultural land, specifically for state significant mining or coal seam gas proposals.

There is no BSAL within the Modification Area.

State Significant Agricultural Land

The NSW Department of Primary Industries is undertaking a mapping program to identify State Significant Agricultural Land (SSAL). A map of SSAL is an essential component of agricultural land use planning, enabling clearer local planning with informed prioritisation of future land uses.

There is no SSAL within the Modification Area.



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Topography

FIGURE 5

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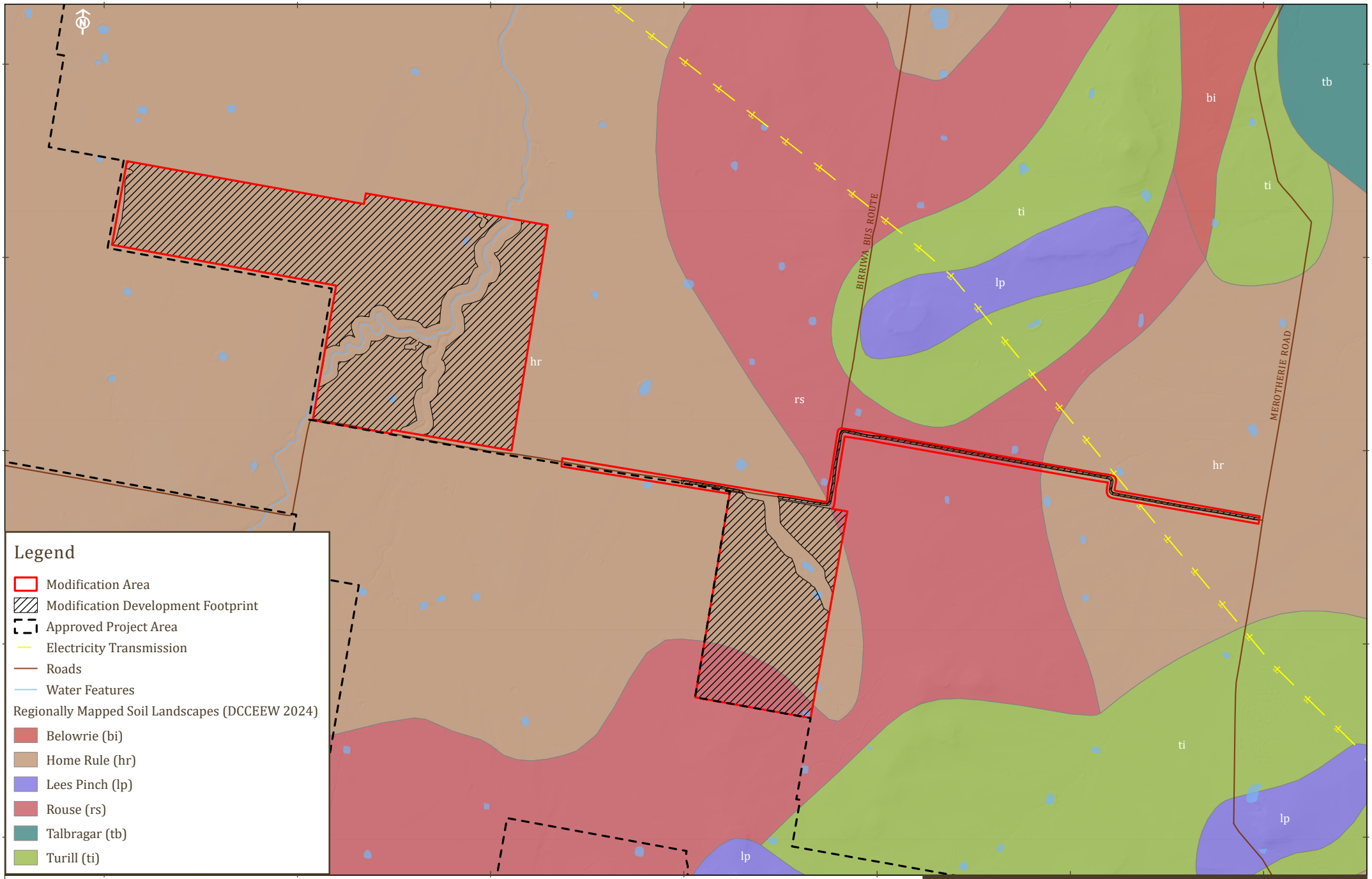
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Legend
Modification Area
Modification Development Footprint
Approved Project Area
Electricity Transmission
Roads
Water Features
Regionally Mapped Soil Landscapes (DCCEEW 2024)
Belowrie (bi)
Home Rule (hr)
Lees Pinch (lp)
Rouse (rs)
Talbragar (tb)
Turill (ti)
GDA2020 MGA Zone 55
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Scale 1:25,000 at A4
MINESOILS
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Regionally Mapped Soil Landscapes
FIGURE 6
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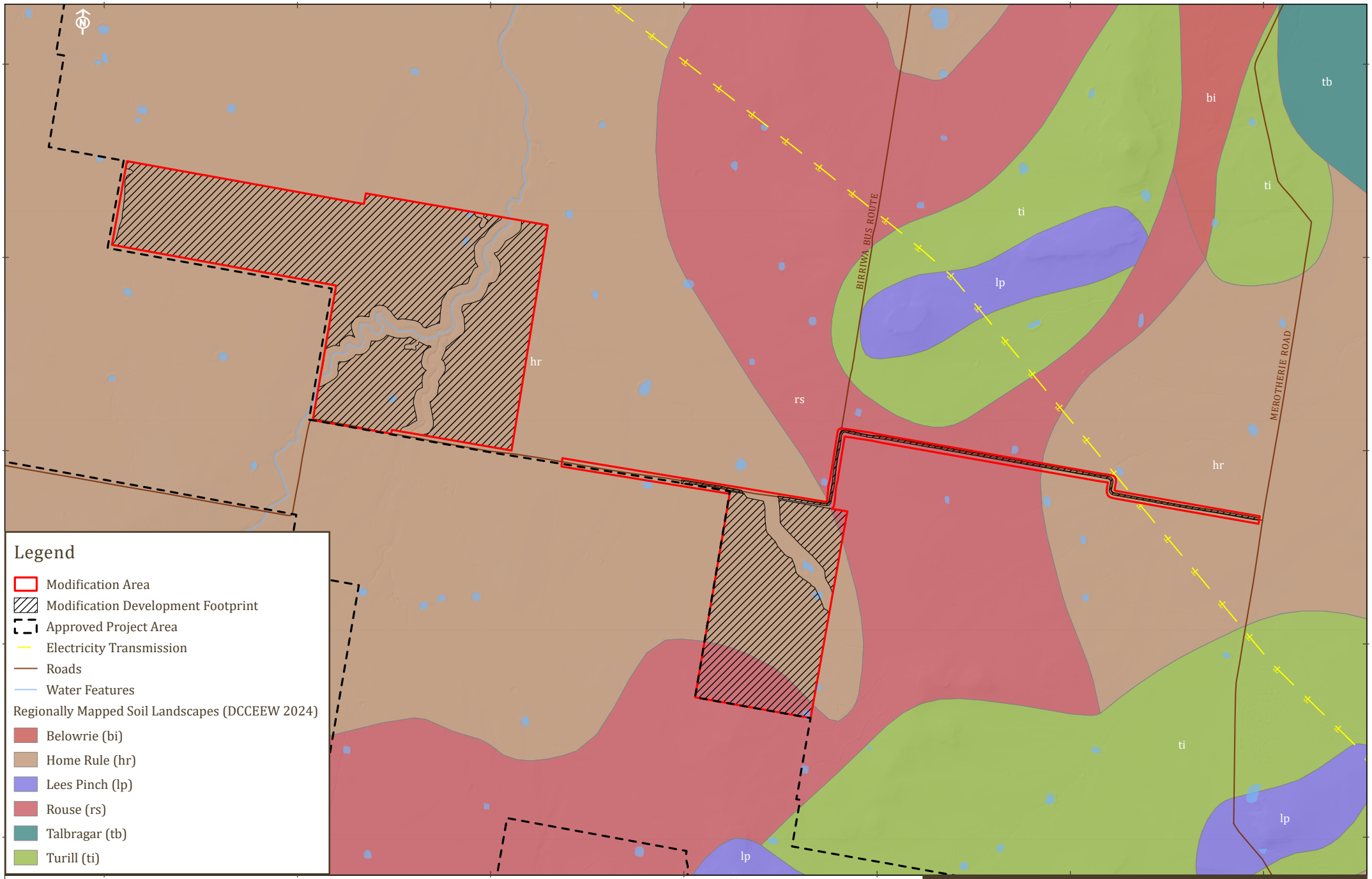

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Regionally Mapped Soil Types

FIGURE 7

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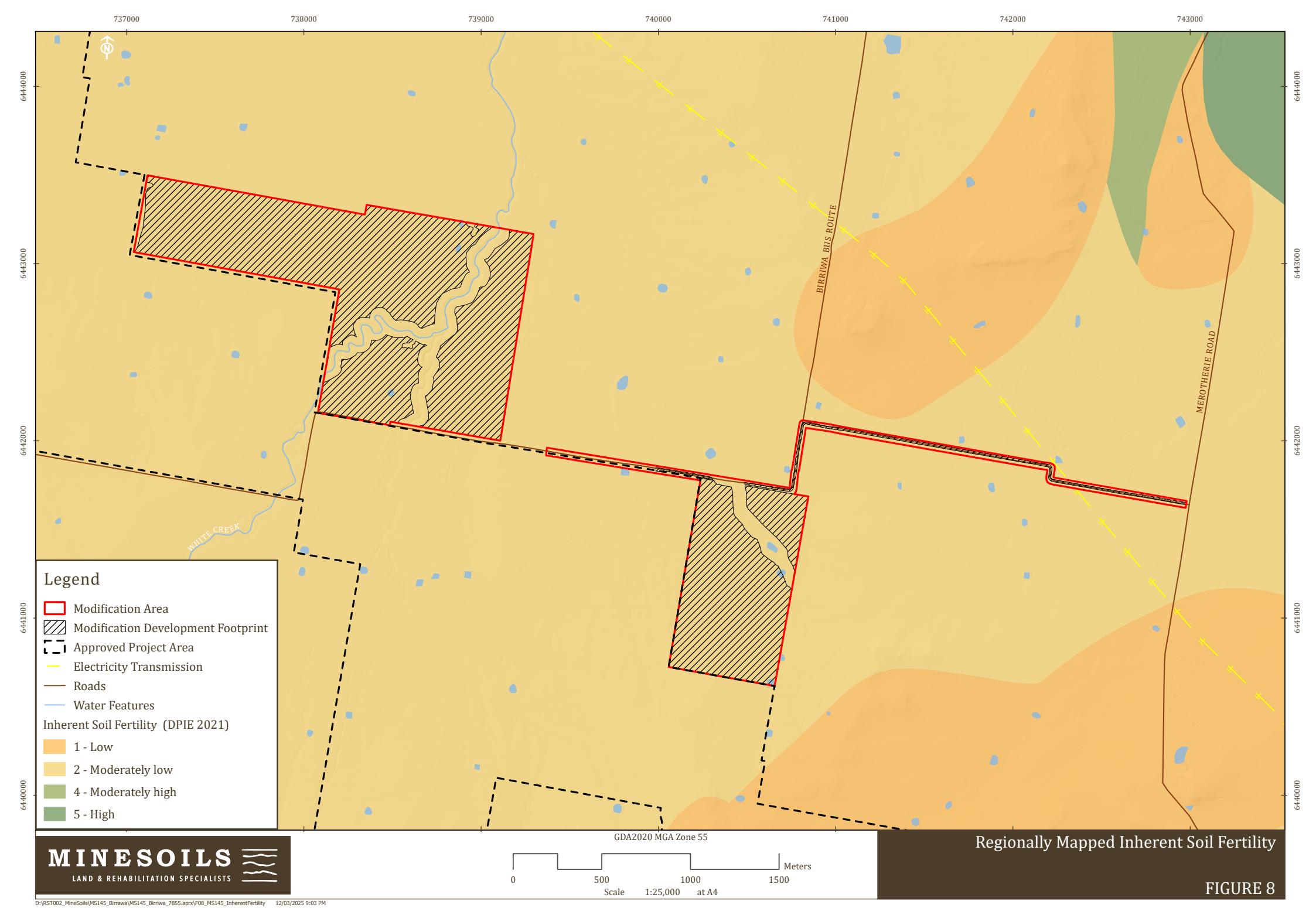

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Regionally Mapped Inherent Soil Fertility

FIGURE 8

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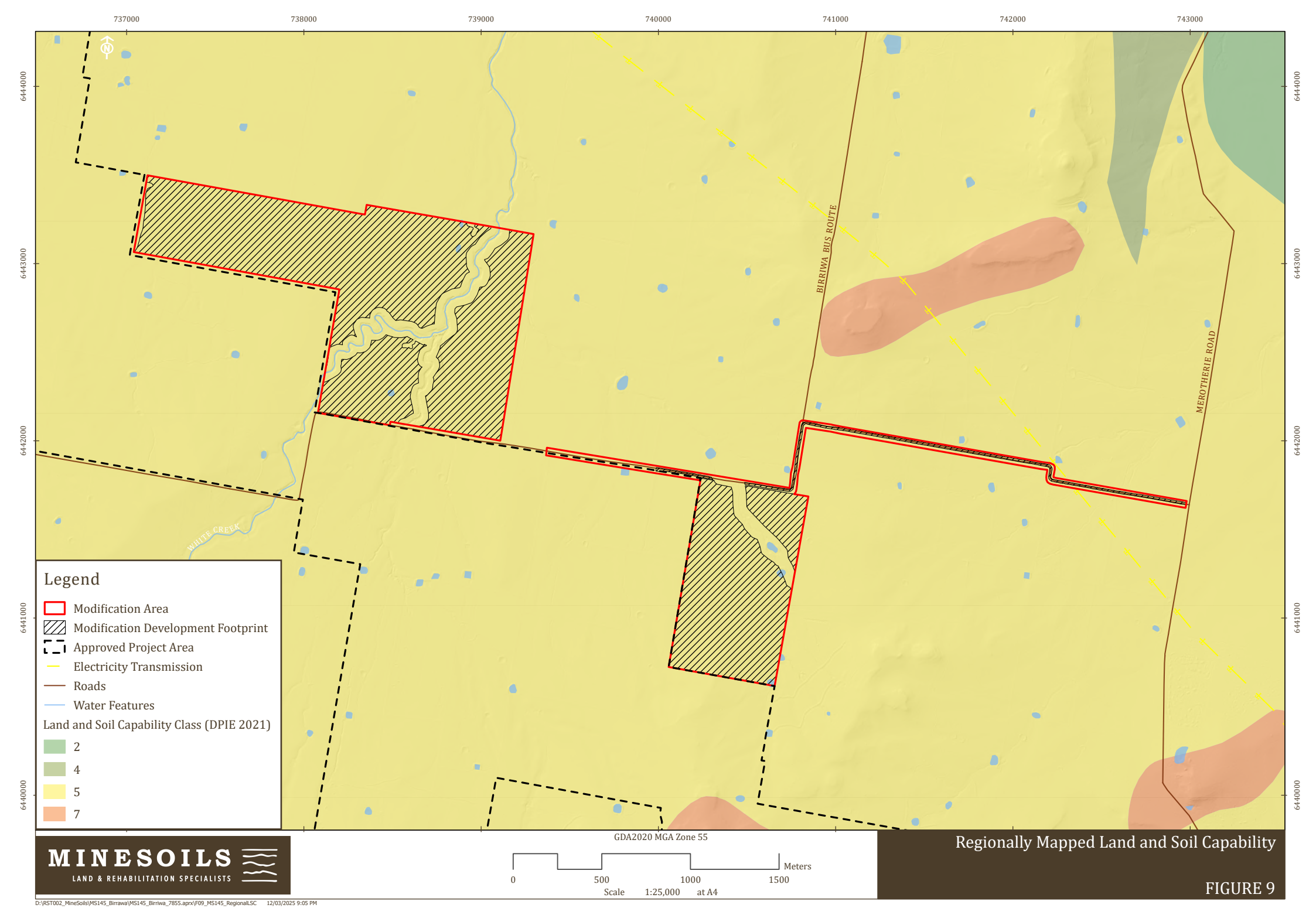

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Regionally Mapped Land and Soil Capability

FIGURE 9

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3.2.2 SOIL SURVEY METHODOLOGY

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

- Soil assessment, identifying soil units, soil qualities and risks including erosion, acid sulfate soils (ASS) risk and salinity.
- Land and soil capability (LSC) verification.
- Management and mitigation measures for mitigating soil erosion during construction, operations and decommissioning.

The objective of the Minesoils fieldwork program was to satisfy the field assessment, sampling and testing requirements related to soil and land resources of the *LSSE Guideline*. The fieldwork plan outlined below was designed to satisfy the following requirements:

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

The field program was designed as an integrated free survey. An integrated survey assumes that many land characteristics are interdependent and tend to occur in correlated sets (NSCT, 2008). Survey points are irregularly located according to the survey teams' judgement to enable the delineation of soil boundaries. Soil boundaries can be abrupt or gradual, and catena and toposequences are used to aid the description of gradual variation. Soil cores were excavated by a soil corer to a depth of approximately 0.8 – 1.0m or to a point of refusal. Site clearances and dial before you dig (DBYD) plans were undertaken as part of the safety planning requirements and found underground service running through the centre of the Modification Area which were avoided during excavation activities.

The survey was over the full 257 ha of the Modification Area. A total of 12 sites were assessed within the Modification Area (plus two additional sites to the north of the Modification Area), resulting in a survey intensity of 1 site per <25 ha. Soil profiles within the Modification Area (refer to **Figure 10**) were assessed in accordance with the 'Australian Soil and Land Survey Field Handbook soil classification procedures' (NCST, 2009). Detailed soil profile descriptions were recorded covering the major parameters specified in **Table 10**. Soil profile logging was undertaken in the field using Minesoils' soil data sheets, including GPS recordings and photographs of the landforms and soil profiles. Soils were keyed out in accordance with the Australian Soil Classification (ASC) Third Edition (2008) (Isbell, R. F.,2021).

Soil samples were collected at each of the assessment site's soil horizons to a depth of 1 m, with a total of 69 samples collected. Minesoils chose 33 of these samples that were considered representative to be subject to laboratory testing. The laboratory testing suite for these sites is detailed in the **Table 11**.

Table 10: Detailed soil profile description parameters

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

Table 11: Soil Sample Laboratory Analysis

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

3.2.3 SOIL SURVEY FINDINGS

Soil Mapping Units

The soil survey undertaken by Minesoils found the Modification Area to contain two dominant soil mapping units, as shown on **Figure 10**, and presented in **Table 12**:

- Soil Unit 1: Sodosols – covering approximately 231 ha; and
- Soil Unit 2: Chromosols – covering approximately 26 ha.

Full soil profile descriptions are included as **Appendix 2**. Laboratory certificates of analysis are included as **Appendix 3**.

Soil Unit 1: Sodosols

As outlined in Section 3.2.1, Sodosols are soils with a clear or abrupt textural B horizon and in which the major part of the upper 0.2 m of the B2t horizon (or the major part of the entire B2t horizon if it is less than 0.2 m thick) is sodic and not strongly acid. Hydrosols and soils with strongly subplastic upper B2t horizons are excluded.

This soil unit characterised by sandy clay loam, loamy sand and sandy loam topsoils with weak to moderate structure overlying sandy clay to heavy clay subsoils with weak to moderate structure. Often a bleached A2 horizon is present. These soils are non-saline, and range from neutral to moderately acidic throughout the profile. Drainage is imperfect and depth ranges from moderately shallow (~0.5m) to deep.

This soil unit generally has low fertility and high erodibility.

These soils occupy the broad undulating plans on lower slopes of the majority of the Modification Area.

Representative sites for this unit, which include detailed laboratory data, consist of sites 4, 8, 13 and 14.

Soil Unit 2: Chromosols

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

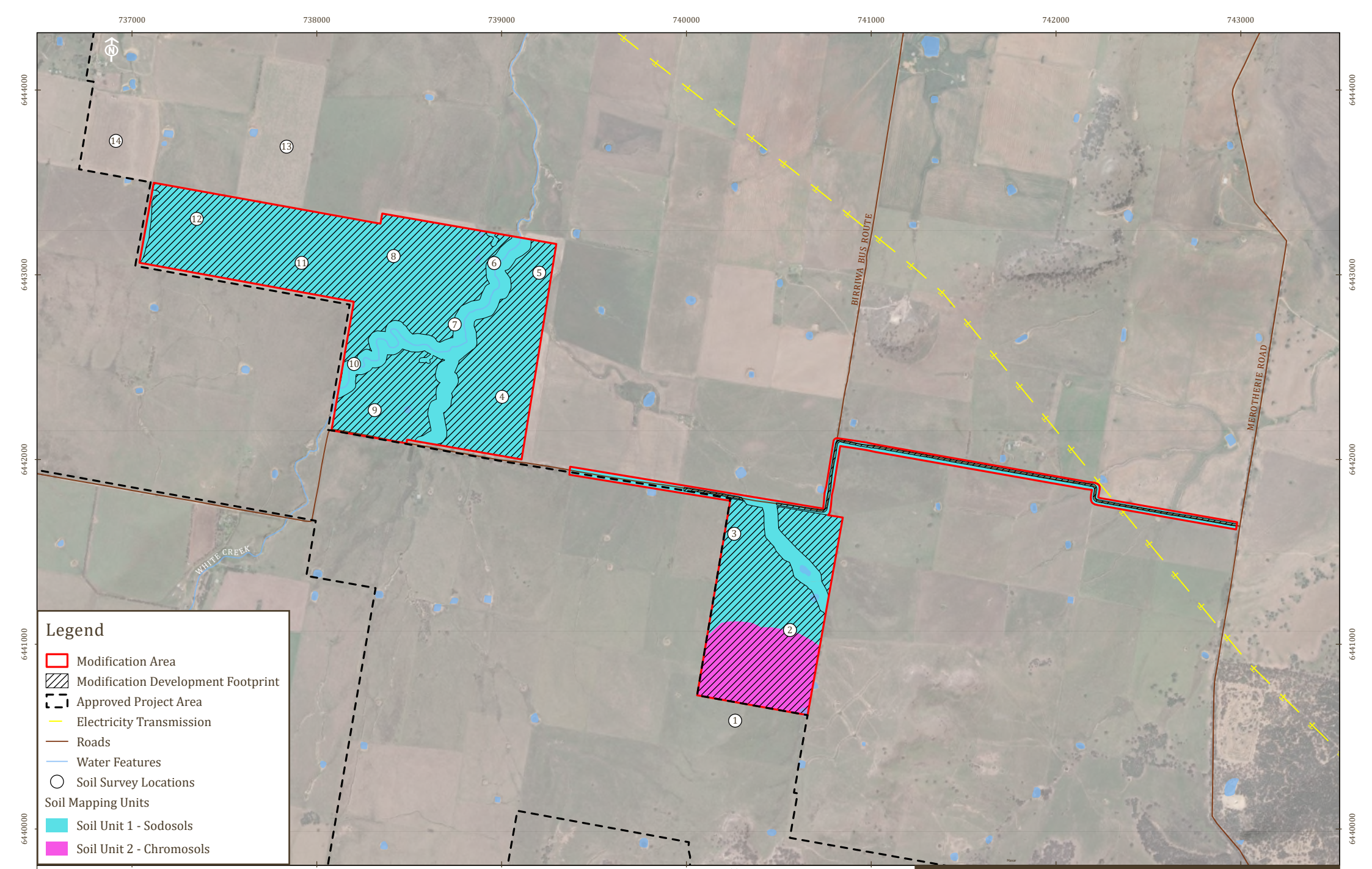
This soil unit is generally similar to Soil unit 1, albeit with a non-sodic subsoil, occurring over a limited area, higher in the landscape in the south east corner of the Modification Area.

These soils are characterised by sandy clay loams with moderate structure over heavy clay subsoils with moderate structure. These soils are non-saline and non-sodic, and have neutral topsoils that trend to moderately acidic subsoils.

Drainage is moderate and depth is moderately shallow (~0.5m) to deep.

This soil unit generally has moderate fertility and low erodibility.

The representative site for this unit, which includes detailed laboratory data, is site 1.



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Soil Survey Locations and Soil Unit Mapping

FIGURE 10

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Table 12: Soil Mapping Units and Soil Units Summary

Site #	Soil Mapping Units		Soil Profile - Australian Soil Classification	ASC Family Criteria
	#	Name		
1	1	Chromosols	Haplic Eutrophic Red Chromosol	BEMOVNR
2	2	Sodosols	Yellow Sodosol	-
3	2	Sodosols	Yellow Sodosol	-
4	2	Sodosols	Eutrophic Subnatric Yellow Sodosol	BEKOWNR
5	2	Sodosols	Yellow Sodosol	-
6	2	Sodosols	Yellow Sodosol	-
7	2	Sodosols	Yellow Sodosol	-
8	2	Sodosols	Eutrophic Subnatric Brown Sodosol	BEKOWNR
9	2	Sodosols	Yellow Sodosol	-
10	2	Sodosols	Yellow Sodosol	-
11	2	Sodosols	Yellow Chromosol	-
12	2	Sodosols	Yellow Sodosol	-
13	2	Sodosols	Eutrophic Subnatric Brown Sodosol	BELOWNR
14	2	Sodosols	Eutrophic Subnatric Brown Sodosol	BELOWNR

Soil Erodibility

Soil aggregate stability refers to the stability of soil structural units (aggregates) when immersed in water. Instability may be indicated by slaking or clay dispersion. A soil with low aggregate stability is likely to be less resilient to mechanical impacts, more likely to be compacted and poorly structured, or be susceptible to tunnelling if used for earthworks. The Emerson Aggregate Test (EAT) classifies the behaviour of soil aggregates, when immersed, on their coherence in water. **Table 13** shows the EAT class and the dispersion degree during testing and resulting risk of dispersion for that soil.

Table 13: Dispersion Degree and Risk Correlation to EAT Class

EAT Class	Dispersion	
	Degree	Risk
1	Complete dispersion	Very High
2	Partial dispersion	High
3	Complete or partial dispersion after remoulding	Moderate
4 - 8	Well aggregated with no dispersion after remoulding	Negligible

Source: Adapted from Hazelton and Murphy (2011)

Emerson Class Numbers of 1 and 2 indicates a high to very high potential for the soil to disperse when inundated with water. These classes represent the greatest erosion and sediment control hazard to surface disturbance works.

Emerson Class Numbers of 3 indicate that while the soil is only slightly dispersive, the remoulding and breaking down of soil bonds can result in increased dispersive behaviour. Remoulding of the soil at a moisture content near the optimum for compaction (simulating the use of these soils in a filling and compaction operation) does not increase the potential for dispersive behaviour, however further breakdown of the soil may occur, by water turbulence or concentrated rapid water flow. Under these circumstances this class of soil may disperse.

Emerson Class Numbers greater than 4 have a low potential for dispersive behaviour. Some swelling or slaking may occur but generally such soils are not readily dispersive.

Table 14 highlights the lowest Emerson Class Number recorded for select laboratory data representative sites of the Modification Area, as an indicator of highest potential risk during disturbance activities.

Table 14: Potential Dispersion Risk

Site No.	Soil Depth (m)	EAT	Potential Risk
1	0.30 - 0.40	4	Moderate
4	0.55 - 0.65	2	High
8	0.50 - 0.60	2	High
13	0.50 - 0.60	2	High
14	0.40 - 0.50	4	Negligible

Based on site observation, which included assessment for indicators of erodibility, such as sheet or gully erosion, it can be concluded that there significant erosion and sedimentation issues currently present at the Modification Area, except in areas of higher slope in the southeastern portion of the Modification Area associated with Soil Unit 2. In all other areas (that is, Soil Unit 1) sheet erosion, gullying and wastage was observed. In addition, the dispersion risk status of Soil Unit 1 indicates high risk of dispersion, while the represented testing for Soil Unit 2 indicates a negligible dispersion risk.

The representative laboratory tested soils also indicate the presence of sodic soils throughout the Modification Area. While sodic soils are generally dispersive, it is important to acknowledge that not all sodic soils disperse, and that not all dispersive soils are sodic. However, given the generally non-saline nature of the soils tested, all sodic soils should be considered dispersive.

Based on these results, there is a high potential risk for dispersion where soils are disturbed by Project construction efforts the Modification Area in areas associated with Soil Unit 1.

Higher impact activities such as where earthworks are necessary for construction of sub-station pads or site facilities are very likely to result in increased dispersive behaviour when soil is remoulded, compacted or pulverised. Erosion and sedimentation controls should be tailored to these dispersive subsoils and applied across the entire Modification Area where any disturbance occurs (including changes to vegetation cover).

A summary of the erodibility of the Soil Units within the Modification Area, which takes into account site observation, sodicity, dispersion risk (EAT), the general physical and chemical characteristics of each unit, is presented in **Table 15**.

The overall risk of erosion and sedimentation impacts on agriculture as a result of the Project should be considered low due to the available mitigation measures.

Table 15: Erosion Risk for Soil Units

Soil Unit #	Soil Unit Name	Erosion Risk
1	Sodosols	High
2	Chromosols	Low

Acid Sulphate Soils

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

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

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

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

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

3.2.4 SITE VERIFICATION OF LSC

The soil test sites within the Modification Area have been assessed and classified ranging from LSC class 4 to class 7, as presented in **Table 16**. The verified LSC classes present within the Modification Area are as follows:

- LSC class 4: moderate capability land – covering approximately 37 ha;
- LSC class 5: moderately low capability land – covering 220 ha.

The spatial extent of each verified LSC class is shown in **Figure 11**.

Class 4 Land

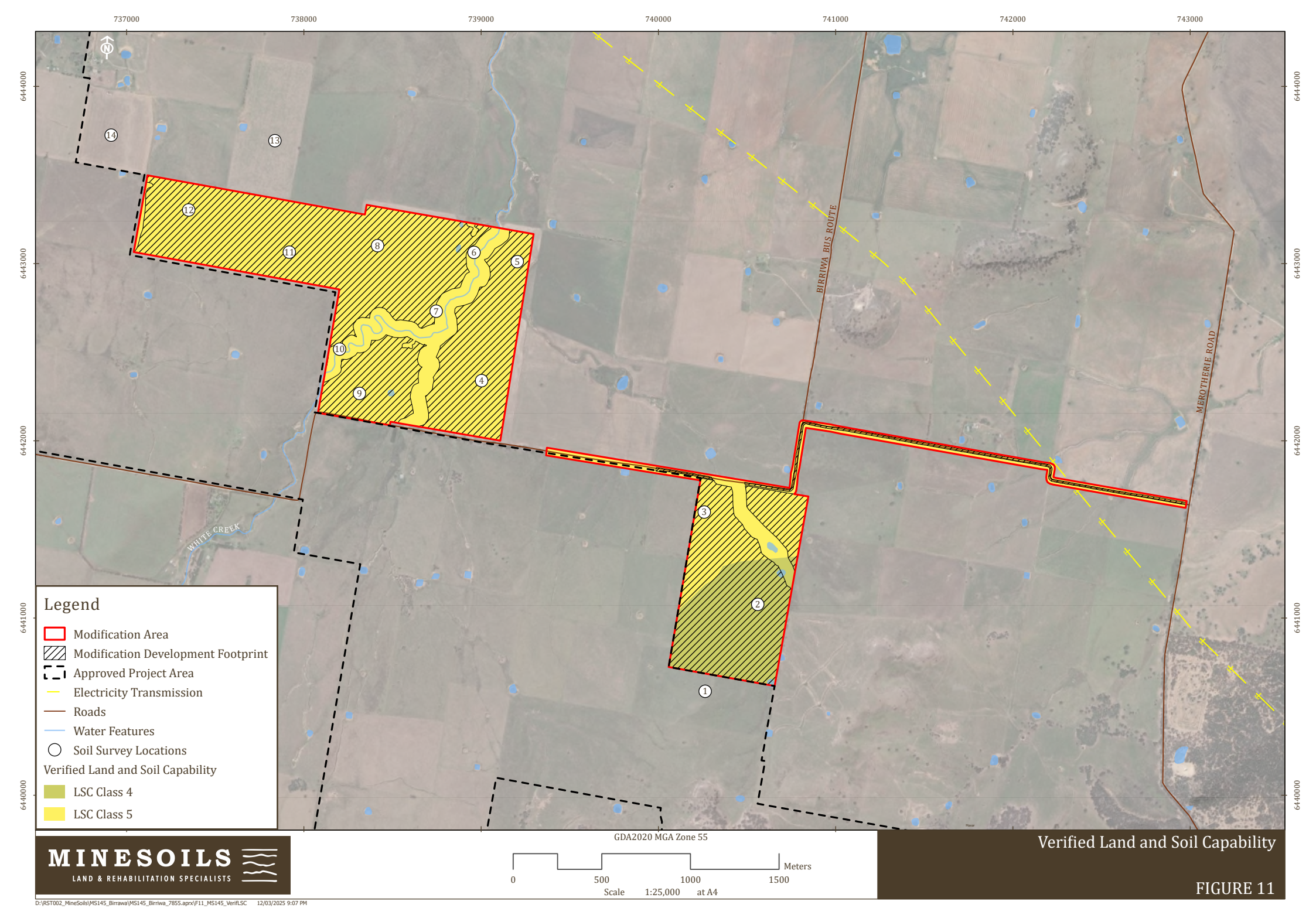
This classification indicates land has moderate to high limitations for high-impact land uses and will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology. The defining constraints to this land class within the Modification Area are water erosion, soil structure decline, soil acidity, soil depths and waterlogging.

Class 5 Land

This classification indicates the land has high limitations for high-impact land uses, which 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. The defining constraints to this land class within the Modification Area are water erosion and soil acidity.

Table 16: LSC Parameters and Overall Class

		Hazard Criteria								
		1	2	3	4	5	6	7	8	Overall
		Water erosion	Wind erosion	Structure	Acidity	Salinity	Water-logging	Soil depth	Movement	Class
1	Haplic Eutrophic Red Chromosol	3	2	3	3	3	2	4	1	**4**
2	Yellow Sodosol	3	2	3	3	3	3	4	1	**4**
3	Yellow Sodosol	2	3	3	5	3	3	4	1	**5**
4	Eutrophic Subnatric Yellow Sodosol	2	5	1	5	3	4	1	1	**5**
5	Yellow Sodosol	2	5	1	5	3	4	1	1	**5**
6	Yellow Sodosol	2	3	3	5	3	4	3	1	**5**
7	Yellow Sodosol	2	3	3	5	3	4	1	1	**5**
8	Eutrophic Subnatric Brown Sodosol	2	5	1	5	3	3	1	1	**5**
9	Yellow Sodosol	2	5	1	5	3	3	1	1	**5**
10	Yellow Sodosol	2	3	3	5	3	3	3	1	**5**
11	Yellow Chromosol	3	3	3	5	3	3	1	1	**5**
12	Yellow Sodosol	3	5	1	5	3	3	1	1	**5**
13	Eutrophic Subnatric Brown Sodosol	3	3	3	5	3	4	1	1	**5**
14	Eutrophic Subnatric Brown Sodosol	2	3	3	4	3	4	1	1	**4**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MEROTHERIE ROAD
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Legend
Modification Area
Modification Development Footprint
Approved Project Area
Electricity Transmission
Roads
Water Features
Soil Survey Locations
Verified Land and Soil Capability
LSC Class 4
LSC Class 5
GDA2020 MGA Zone 55
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FIGURE 11
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4 LAND USE CONFLICT RISK ASSESSMENT

4.1 OVERVIEW

The Land Use Conflict Risk Assessment (LUCRA) (NSW Department of Primary Industries, 2011) is required as part of an Agricultural Impact Assessment as per the LSSE Guideline. The LUCRA is a system to identify and assess the potential for land use conflict to occur between neighbouring land uses. It helps land managers and consent authorities assess the possibility for and potential level of future land use conflict. LUCRA aims to:

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

Land use conflicts occur when one land user is perceived to infringe upon the rights or impact the values or amenity of another. In rural areas land use conflicts commonly occur between agricultural and residential uses. However, land use conflicts can also occur between different agricultural enterprises and other primary industries.

Rural amenity issues are the most common land use conflict issues, followed by environmental protection issues. Rural amenity issues include impacts to air quality due to agricultural and rural industry (odour, pesticides, dust, smoke and particulates); use and enjoyment of neighbouring land e.g., noise from machinery; and visual amenity associated with rural industry e.g., the use of netting, planting of monocultures and impacts on views.

Environmental protection issues include soil erosion leading to land and water pollution, clearing of native vegetation, and stock access to waterways.

Direct impacts from neighbouring land uses on farming operations can also cause conflict, such as: harassment of livestock from straying domestic animals; trespass; changes to storm water flows or water availability; and poor management of pest animals and weeds.

4.2 APPROACH

The LUCRA as presented in **Appendix 1** compares and contrasts the modification against adjoining/surrounding land uses and activities for incompatibility and conflict issues based on the risks and impacts identified in Section 5, and the mitigation measures and controls presented in Section 6. Each potential conflict between the operation of the solar and battery project and adjacent land has been assessed and given a risk ranking based on probability and consequence as outlined in **Appendix 1**. Performance targets will be determined via management plans specified by the revised development consent for the modification (and specialist impact assessments) (if approved). Monitoring will be undertaken in accordance with those management plans. Indicative performance targets are presents in **Appendix 1**.

Given the significant overlap between the agricultural impact assessment and land use conflict considerations, many agriculture-related risk items listed in the LUCRA are further detailed in Section 5. The LUCRA was informed by consultation with non-associated landholders on the following neighbouring properties adjacent to the Modification Area:

- 80/DP750755
- 79/DP750755
- 2/DP1004819

4.3 FINDINGS

The following land use conflict risk items were identified for the Project:

- Construction ground disturbance;
- Construction noise;
- Construction dust;
- Construction biosecurity;
- Construction traffic;
- Construction infrastructure damage;
- Construction workforce;
- Visual amenity;
- Change in land use;
- Fire spread;
- Operational traffic;
- Operational pest control;
- Livestock interaction;
- Dust from neighbours; and
- Electro-magnetic fields.

Within these risk item categories, 20 potential conflicts were considered as part of the LUCRA. The mitigation measures and controls outlined in this assessment and the wider Modification Report reduce the level of risk for the majority of considered potential risks with complaints or conflict being managed within normal operations. However, a number of items of potential conflict remain a moderate risk and may require further consultation and management in addition to standard operations. The moderate potential conflicts are summarised in **Table 17**. The LUCRA methodology including risk ranking matrix and full LUCRA assessment are included as **Appendix 1**.

Table 17: LUCRA Moderate and High Risk Items

Potential Conflict	Mitigation	Risk
Land users in the locality may be concerned about changes to water quality, quantity and surface water flows that may affect the site and locality, including local waterways, from surface disturbances during construction activities.	Consideration of impacts to surrounding water courses and water quality was undertaken for the approved project within the water quality impact assessment for the EIS, which will be expanded to include the additional modification areas. The impact of the modification is anticipated to be a negligible additional impact to that of the currently approved project. Appropriate mitigation measures are specified within the EIS, including soil erosion and sedimentation controls within this report, to minimise impacts to watercourse health and quality. Compliance with mitigation measures is anticipated to reduce the risk of conflict related to watercourse health and quality. Ongoing consultation with stakeholders will identify and address concerns if they arise. Implement all measures specified in management plans identified in the EIS and/or consent conditions, such as a soil management plan and an erosion and sediment control management measures.	**Moderate**

Potential Conflict	Mitigation	Risk
Stakeholders may be concerned about potential impacts to biodiversity conservation within the site locality.	The assessment of biosecurity risk to agriculture has been undertaken as part of this Soil, Land and Agriculture assessment. The impact of the modification is considered a negligible additional impact to that of the currently approved project. Appropriate mitigation measures are specified to minimise the risk for weeds and pests to spread throughout the site and onto neighbouring land. Ongoing consultation with stakeholders will identify and address concerns if they arise. Implement all measures specified in management plans identified in the EIS and/or consent conditions (if approved).	**Moderate**
Stakeholders in the locality who wish to maintain views of the existing agricultural landscape may be concerned about the change in visual amenity resulting from the Project.	The impact of the modification is considered a negligible additional impact to that of the currently approved project. An assessment of visual impacts to surrounding amenity of the approved project has been undertaken via a Visual Impact Assessment (VIA) which determined impacts to be low, however a further assessment will be undertaken for the modification area. Appropriate mitigation measures will be specified within the VIA to minimise the risk of altered amenity for surrounding residents and public within the locality. Compliance with mitigation measures specified within the LVIA is anticipated to further limit visual impact from the Project. Ongoing consultation with stakeholders will identify and address concerns if they arise. Implement all measures specified in management plans identified in the EIS and/or consent conditions (if approved).	**Moderate**
Land users in the locality may be concerned about the risk of fires occurring at the site and their potential to spread to surrounding land, infrastructure, crops or livestock.	Fire emergency management procedures are proposed that include fire awareness, emergency response and evacuation, and monitoring and review procedures. The bushfire management plan for the project will detail measures and procedures to prevent fires igniting during the construction and operation of the Project. An internal emergency access track will be constructed, suitable for emergency vehicles. This will enable an alternative emergency access to the public road network, directed towards the southeastern corner of the property. This emergency access track is not intended for general access. Ongoing consultation with stakeholders will identify and address concerns if they arise.	**Moderate**

The above listed high and medium risk potential conflicts will require further management or design consideration, or will remain as accepted conflict risk as a result of the proposed development.

5 IMPACTS ON AGRICULTURAL LAND

The impacts solar and battery project activities can have on land resources and agricultural productivity range from short term temporary impacts to long term and permanent impacts. Temporary impacts can include the removal of agriculture from disturbance areas over full the life of the Project, including during the construction, operation and decommissioning phases. Permanent impacts may include changes to land and soil capability and agricultural resources of the Modification Area. Permanent impacts are irreversible and can be mitigated by the reinstatement of agricultural lands and land productivity to a pre-disturbance condition and productivity. Australian solar farming practices are generally presented as low risk of permanent and irreversible impacts to agricultural land.

This section identifies and describes the nature, duration and consequence of the potential impacts on agricultural land as a result of the proposed modification, for the Modification Area and in the wider region, across five risk areas:

- Changes in the amount of land used for agriculture.
- Changes to agricultural productivity and agricultural enterprises.
- Changes to agricultural resources.
- Other potential impacts to agriculture considered for the Project.
- Cumulative impacts of the potential for multiple large scale renewable projects within the region.

5.1 LAND USED FOR AGRICULTURE

The modification will be undertaken on an area of up to 257 ha of land that is currently subject to agriculture land use. ACEN will continue to explore with landholders opportunities to support co-location of livestock grazing with the solar project operation. Land being used simultaneously for agriculture and the solar farm is known as agrisolar and is further described in Section 6.4. However, for the purpose of this assessment, it is assumed that the agriculture will cease within the Modification Area for the duration of the Project.

ACEN will develop a decommissioning and rehabilitation plan for the project that will describe how the modification development footprint would be returned, as far as practicable, to its condition prior to the commencement of construction. Therefore, it is anticipated that agricultural land use will be re-established over the entire Modification Area at the time of decommissioning and rehabilitation (unless otherwise agreed with the landowner and/or regulatory authorities). There will be no permanent decrease in land available for agriculture use.

Current agricultural land use immediate to the Modification Area, and in the broader Project locality, will not change as a result of the proposed modification, and there will be no fragmentation or displacement of existing agricultural industries.

5.2 PRODUCTIVITY AND ENTERPRISES

5.2.1 PRIMARY PRODUCTIVITY

The productivity of the Modification Area is described in Section 3.1.3. For the purpose of this assessment, the impact of the Project on productivity of agricultural land based on the change in land use is up to $85,033 per year.

This is considered a negligible impact in the context of the agricultural industry gross value of the Mid-Western Regional LGA as outlined in Section 2.4.1 and **Table 3**, representing 0.6%.

Due to the minimal disturbance to the landform, following the life of the Project, all land removed from agriculture can be returned to agricultural use, with anticipated mitigation controls available to ensure no reductions in land and soil capability. Agricultural enterprises can then re-commence at an equivalent agricultural productivity.

5.2.2 PRODUCTIVITY OF LAND WITHIN LOCALITY

Agricultural productivity of land outside of the Modification Area will not be affected by the proposed modification as the associated agricultural resources will not be affected. Therefore, the proposed modification will not negatively impact any existing agricultural enterprise outside of the Modification Area.

5.2.3 AGRICULTURE SUPPORT SERVICES

The proposed modification will have a negligible impact on the viability local and regional agricultural services and employment. There will be minimal impacts experienced by employees, suppliers or contracting services currently engaged. Changes to the supply and viability of agricultural support services in the main service centres of Dunedoo, Gulgong, Mudgee and Dubbo are driven by social and market trends far exceeding the scale of the negligible reduction in agricultural land use and productivity as a result of the Project.

5.2.4 CRITICAL MASS THRESHOLDS

Due to the limited reduction in agricultural activity as a result of the Project, and given the nature and scale of the established agricultural industries within the region and wider state, there will be no impact to critical mass thresholds of agricultural enterprises needed to attract and maintain investment in agricultural industries and infrastructure.

5.3 AGRICULTURAL RESOURCES

5.3.1 SOILS

Over the majority of the Modification Area, soils will be subject to minor disturbance as part of the construction or maintenance of solar arrays and electrical cabling trenches. In areas where earthworks are necessary for construction of the BESS, other site facilities or access tracks, soils will be subject to higher impact disturbance.

All soil that is proposed to be disturbed as a result of the proposed modification will be stripped and re-used during construction and/or rehabilitation in order to mitigate long term effects on soil resources during operation. Given the limited surface disturbance anticipated, any soil stripping and re-use will be localised; that is, soil may be stripped and stored adjacent to disturbance and respread from where it was stripped. This localised approach will promote reinstatement of the soil profile to its original condition.

Additionally, soils may be stripped only in areas where soil disturbance occurs. The depth of soil salvaged will be as deep as excavations or surface disturbance is required, or to a depth where parent material is encountered.

Impacts on soil biological balance and nutrient availability are linked to the status of vegetation beneath the panels. If grass cover is maintained across the site both between and under the panel rows to provide groundcover, there will be negligible soil composition and productivity impacts as a result of the panels.

However, if vegetation beneath the panels is significantly reduced or eliminated over long periods during operations, the soil may be temporarily sterilised and will require additional efforts and costs at the time of site decommissioning to restore the soil to a level of productivity equivalent to pre-disturbance conditions.

Overall, the impacts to the soils of the solar array component of the Modification Area are expected to be largely minimal and temporary. The impacts to the soils of the BESS component of the Modification Area are expected to be heightened due to the nature of earthworks expected to be required. However, these can also be considered temporary given the available mitigation measures.

There will be no direct or indirect impacts to the soil resources of the locality outside the Modification Area.

Soil impact mitigation measures are outlined in Section 6.2.

5.3.2 LAND AND SOIL CAPABILITY

Due to the nature of the proposed modification which will require only localised and sporadic landform modification including minor soil stripping (for excavation works and leveling), impacts on LSC are expected to be minor.

Following the end of life for the Project, disturbance footprints will be re-graded (where required) and any minor stockpiles of topsoil and subsoil be respread over disturbed areas and rehabilitated with either native vegetation or improved pastures depending on the intended final land use. This strategy, along with good soil management practices as outlined in Section 6.2 will facilitate the rehabilitation in returning the land to an equivalent LSC class.

Therefore, it is anticipated there will be no permanent impacts on LSC classes within the Modification Area as a result of the proposed modification.

5.3.3 EROSION AND SEDIMENTATION

There is a high potential risk for dispersion where sodic soils (i.e., Soil Unit 1: Sodosols) are disturbed by construction efforts within the Modification Area. Higher impact activities such as where earthworks are necessary for construction of sub-station pads or site facilities are very likely to result in increased dispersive behaviour when soil is remoulded, compacted or pulverised. Wind erosion must also be considered and soils exposed as a result of construction should be sown with grass and pasture species with starter fertiliser to provide stabilising ground cover.

However, due to the very gently undulating nature of the landform, the risk of erosion and sedimentation impacts on agriculture as a result of the Project is low.

With the implementation of mitigation measures detailed in Section 6.2, it is expected that direct and indirect erosion and sedimentation risks would be limited and manageable.

5.3.4 AGRICULTURAL INFRASTRUCTURE

The proposed modification will have a negligible impact on local and regional agricultural infrastructure. There will be negligible impacts on the road and rail network that connects the agricultural industry to markets, services and suppliers (refer Section 5.4.4).

Within the Modification Area, enough fences, dams and access tracks will be retained to accommodate potential agrisolar trials.

If dams within the Modification Area are decommissioned during construction they will be reconstructed during the decommissioning phase of the Project. Adequate paddock fencing will be reinstated to suit post-Project land use. Upgrades to access tracks throughout the Project will benefit post-Project agricultural land uses and is considered a positive impact.

5.4 OTHER POTENTIAL IMPACTS ON AGRICULTURE

5.4.1 WEEDS AND PEST SPECIES

A minor presence of weeds were observed within the Modification Area during Minesoils site inspection. Additional weeds, as well as pest species, could be inadvertently brought into the Modification Area with imported materials, machinery, or allowed to invade naturally through removal or damage of current vegetation and cessation of grazing activity. The presence of weed species has the potential to be a major long term hindrance to agricultural endeavours within the neighbouring properties and the wider locality, as well as rehabilitation efforts within the Modification Area.

The impacts of weeds and pest species on agriculture as a result of the proposed modification are anticipated to be minor due to standard mitigation measures readily available, which are described in Section 6.3.

5.4.2 BIOSECURITY

Biosecurity is defined in the NSW Biosecurity and Food Safety Strategy 2022 - 2030 (DPI, 2022) as 'the protection of the economy, environment and community from pests, diseases and weeds.' It includes measures to prevent new pests, diseases and weeds from entering our country and becoming established.

Given the available mitigation measures as described in Section 6.4, it is considered that biosecurity risks as a result of the proposed modification are low and impacts to agricultural resources and enterprises within the region are unlikely to be experienced.

5.4.3 AIR QUALITY AND DUST

Construction and decommissioning activities have the potential to increase dust through movement of traffic on unsealed roads on dry days, vegetation removal, and localised dust emissions generated by land disturbance (such as excavation activities required for infrastructure). Dust control measures will be detailed in a Construction environmental management plan (CEMP). With the implementation of the CEMP, it is expected that the construction and decommissioning activities as a result of the proposed modification would have a negligible impact on local air quality.

During operations, ongoing maintenance of infrastructures and land will result in very minor, localised vehicle emissions and generation of dust from vehicles travelling along unsealed internal access tracks. These impacts are unlikely to affect agriculture and standard dust suppression measures can be readily implemented where required.

5.4.4 TRAFFIC

Agricultural enterprises can be impacted by increased traffic movements through an increase in noise and dust, and also through the cumulative impact of road transport being utilised by energy and industrial operations, leaving fewer transport options for agricultural enterprises.

The roads in proximity to the Project are anticipated to experience an increase in traffic volumes during the peak construction period. However, the Traffic Impact Assessment for the proposed modification determined that the road network is able to accommodate the additional traffic generated by the development during the construction, operation and decommissioning stages (EMM, 2025a).

Further, no increases in levels of noise and dust that would impact agriculture are anticipated to result from increased traffic required by the proposed modification.

Therefore, the traffic impacts of the proposed modification are not likely to have consequences on agricultural enterprises within the Project locality.

5.4.5 NOISE AND VIBRATION

Noise levels during construction and operation are predicted to comply with noise criteria. It is expected that noise will be effectively managed and minimised through the adoption of standard management practices. The proponent will implement practicable measures to reduce noise impacts including for example, the careful location of noise generating components within the site to increase the distance to sensitive receivers. Supportive evidence is provided through a Noise Impact Assessment in the Modification Report (EMM, 2025b).

Generally, agriculture is only impacted by noise when constantly high noise levels or sudden loud noise leads to a decrease in animal production through increased livestock stress. Cattle may tolerate moderate levels of noise and may easily adapt to an intensity level of 60-90 dB. Continuous exposure to noise above 90dB has been known to severely affect animals (Dairy Global, 2017).

Nosie assessment undertaken as part of the EIS and the modification application do not predict continuous noise greater than 90dBA as a result of the Project where livestock will be located on a non-associated property adjacent

to the Project Area/ Modification Area. As such, livestock and other agricultural resources are unlikely to be impacted by noise due to the Project.

5.5 CUMULATIVE IMPACTS

The proposed modification has the potential to generate cumulative impacts with the approved project, as well as other existing, approved or proposed developments in the region, which are numerous and detailed in the EIS and the Modification Report for the Project. These generally consist of other renewables developments within the REZ.

In the context of agriculture, increased cumulative impacts including changes to land used for agriculture, localised productivity, secondary productivity and some agricultural support services are likely to be experienced. This will be a result of agriculture land use being inhibited by landform modification and infrastructure, such as the development footprints for mining leases, BESS's, and solar farms. However, given the nature and scale of the established agricultural industries within the region, significant impacts to critical mass thresholds and regional agricultural infrastructure are unlikely to occur in the foreseeable future.

On a broader scale, the cumulative risk to agricultural land and productivity across NSW because of large-scale solar development is estimated to be very low (DPE 2022). The Australian Energy Market Operator estimates that NSW will need approximately 20,000 MW of large-scale solar generation by 2050. This would require approximately 40,000 ha of land or only 0.06% of rural land in NSW. Even in the highly unlikely scenario that all of NSW's solar generation were located on important agricultural land (this land covers around 13.8% of the state and is 6 to 7 times more agriculturally productive than the remaining 86.2% of the state) only 0.4% of this land would be required (DPE 2022).

6 MITIGATION MEASURES

The modification will include a number of measures to prevent, minimise and manage adverse impacts on agricultural resources, and will be undertaken in consideration of approval obligations and environmental management measures in development consent stipulated environmental management plans.

This section provides additional recommended mitigation measures to mitigate the potential risks of the proposed modification.

6.1 LAND AND SOIL DISTURBANCE MITIGATION

Prior to the commencement of construction, a Soil and Water Management Plan (SWMP) will be prepared and will include management measures to cover:

- erosion and sediment control;
- soil preservation;
- dispersive subsoils;
- any cut and fill activities; and
- drainage and landform design.
- The SWMP will be implemented during construction and operation of the project.

Additional recommended mitigation measures for inclusion in the SWMP to mitigate the potential risks of the proposed modification.

6.1.1 SOIL EROSION MANAGEMENT

Based on site observations, there are significant erosion and sedimentation issues present at the Modification Area. In addition, as the chemical analysis and dispersion risk status of the tested soils indicate, there is a potential moderate to high risk for dispersion for the soils remoulded, compacted or pulverised. However, due to the nature of the landform, the risk of erosion and sedimentation impacts as a result of the proposed modification remains a low.

Erosion and sedimentation risk, albeit low, could result in long term, irreversible agricultural impacts if suitable controls are not implemented. The Project will prepare an erosion and sediment control plan (ESCP) that addresses specific soil dispersion risks based on disturbance activity and phase of the Project. The ESCP should include the following:

Construction Phase

- The Project should utilise the existing landform and not endeavour to undertake broad-scale re-contouring of the existing ground levels without referring to this soil and land resource assessments and implementing erosion and sediment control accordingly. As a result, the existing vegetative cover and soil structure will be maintained intact across much of the Project site.
- Construction areas should be progressively revegetated with grass and pasture species as installation of solar panels proceeds across the site.
- At locations where earthworks are necessary, localised erosion and sediment controls will be placed in accordance with the Landcom (2004) guidelines.
- Preservation and stabilisation of drainageways and minimisation of the extent and duration of any surface disturbance will be prioritised during construction.
- Where sodic clays are subject to high impact disturbance activity, it is recommended to apply gypsum as an ameliorant to displace the sodium and provide the soil with a stronger aggregate and hold structure when wet.

- All areas disturbed during construction that are not in active use for over 3 months should be sown with grass and pasture species with starter fertiliser to provide stabilising ground cover and a healthy topsoil to provide long term protection against erosion.

Operation Phase

- Soil disturbance during operation of the Project should be minimal and limited to maintenance activities, involving very small, localised impacts on an infrequent basis.
- Standard erosion and sediment control measures should be implemented to minimise the potential for sediment export within areas to be disturbed during operations. These measures would be developed on a case-by-case basis referring to this soil assessment and are likely to include measures such as sediment fencing, localised sediment traps, and progressive stabilisation with vegetation.
- During operation, mounted solar panels will change orientation during the day, with any rainfall runoff being distributed in the area around each panel, and not drained permanently to a single point on the ground.
- Measures to manage any bare areas and erosion that develop beneath the solar arrays over time should be included in an operational management plan for implementation during ongoing operation of the proposal.

Decommissioning and Rehabilitation Phase

- A detailed Decommissioning and Rehabilitation Plan should be prepared within 18 months of the planned closure of the Project. This plan will detail all aspects of decommissioning and removal of all infrastructure unwanted for post Project land use (some infrastructure may remain for post Project land use purposes i.e., constructed internal roads may be kept as part of the agricultural infrastructure), which may require temporary erosion and sediment control measures.
- During decommissioning, where potential erosive impacts have been identified due to the disturbance of sodic subsoils in locations of significant disturbance, soil amelioration should be undertaken as part of remediation earthworks. Standard temporary erosion and sediment control measures are to be put in place for high Development Footprints.

6.1.2 SOIL STRIPPING FOR REHABILITATION

The very minor amount of soil that is proposed to be disturbed during the Project will be stripped and re-used in construction and/or rehabilitation efforts in order to mitigate long term effects on the land and soil capability of the Modification Area.

Given the limited surface disturbance and lack of a soil bank for the site, it is anticipated that all soil stripping and re-use will be localised; that is, soil will be respread from where it is stripped during construction, reinstating the soil profile to its original condition.

Additionally, soils will be stripped only in areas where soil disturbance occurs. The depth of soil salvaged should be as deep as excavations or surface disturbance is required, or to a depth where parent material is encountered.

Due to the sodic nature and dispersion risk, targeted controls must be implemented to manage the risk of surface water erosion with potential to occur once excavated. Upon respreading, clay subsoils that have been excavated for trenching will be used exclusively as a subsoil, and encapsulated by the more chemically stable, coarser (i.e., sandy, sandy loam) topsoils where possible.

It is recommended that proposed long term small scale stockpiles in areas associated with the higher impact activities where larger amounts of soil will be displaced should be stripped of topsoil. Then the excavated subsoil (only if requiring disturbance) should be placed on the exposed subsoil of the stockpile area to create a low-profile landform of subsoil. A thin layer of sandy or loamy topsoil material from the stripped areas should be placed as a

'cap' over the subsoil stockpiles to promote vegetation growth. Topsoil materials should otherwise be stockpiled separately to subsoils. Sodic subsoils should be treated gypsum prior to stockpiling.

Topsoil and subsoil depths for these areas should be recorded in GIS and rehabilitated with target species to build up the seedbank over the years of stockpiling.

The following soil handling techniques are recommended to prevent excessive soil deterioration and dispersion. It is not anticipated the Project will involve major amounts of soil excavation requiring long-term stockpile solutions, however small scale potential soil stockpiling from trenched areas and hardstand locations should abide by the following measures where practicable:

- Strip soil material to maximum excavation depths only.
- Soil should ideally be stripped in a slightly moist condition, where practicable. Material should not be stripped in either an excessively dry or wet condition.
- Push soil into windrows or small stockpiles with graders. This technique is an example of preferential less aggressive soil handling. This minimises compression effects of the heavy equipment that is often necessary for economical transport of soil material.
- The surface of soil stockpiles should be left in as coarsely structured a condition as possible in order to promote infiltration and minimise erosion until vegetation is established, and to prevent anaerobic zones forming.
- Where necessary, a flow diversion bank or catch drain should be placed up-slope of a stockpile to direct surface water flows away. All stockpiles shall remain in a free-draining location to avoid long term soil saturation.
- Where necessary, silt fences or cleared vegetation should be installed around topsoil stockpiles or stripped areas as a form of erosion and sediment control. Mulch or wood chip from cleared vegetation can also be applied as a veneer over topsoil stockpiles to slow erosion, weed establishment and to maintain moisture content.
- As a general rule, maintain a maximum stockpile height of 3 m. Clayey soils should be stored in lower stockpiles for shorter periods of time compared to coarser textured sandy soils.
- Seed and fertilise stockpiles as soon as possible. An annual cover crop species that produce sterile florets or seeds may be sown. A rapid growing and healthy annual pasture sward will provide sufficient competition to minimise the emergence of undesirable weed species. The annual pasture species will not persist in the rehabilitation areas but will provide sufficient competition for emerging weed species and enhance the desirable micro-organism activity in the soil. Final rehabilitation target species should be established on stockpiles to build up a desirable species seed bank in the topsoil.
- An inventory of available soil should be maintained to ensure adequate materials are available for planned rehabilitation activities when the time comes.
- Prior to re-spreading stockpiled topsoil onto the Development Footprint, an assessment of weed infestation on stockpiles should be undertaken to determine if individual stockpiles require herbicide application and / or "scalping" of weed species prior to topsoil spreading.

The Project does not anticipate large volumes of topsoil to require significant stockpile and respreading management measures, however the following re-spreading and seedbank preparation techniques are recommended to prevent excessive soil deterioration and dispersion for any minor areas of topsoil removal.

- Topsoil should be spread to a depth that reflects pre-disturbance soil horizons.
- Topsoil should be spread, treated with fertiliser and seeded in one consecutive operation, to reduce the potential for topsoil loss to wind and water erosion. Thorough seedbed preparation should be undertaken to ensure optimum establishment and growth of vegetation.

- All topsoiled areas should be lightly contour ripped (after topsoil spreading or following removal of hardstand from topsoil areas) to create a "key" between the soil and material below. Ripping should be undertaken on the contour. Best results will be obtained by ripping when soil is moist and when undertaken immediately prior to sowing.
- The respread soil surface should be scarified prior to, or during seeding, to reduce run-off and increase infiltration. This can be undertaken by contour tilling with a fine-tyned plough or disc harrow.

6.1.3 SOIL MICROBIOLOGY MANAGEMENT

During the approximately 30 year life of the Project soil microbial processes may be impacted. In addition to reducing the landscape's ability to support ecosystem services during the solar facility's lifespan, these changes may leave legacy effects that persist long after the installation is removed, if effective rehabilitation is not undertaken post decommissioning.

Based on the intensity of the panel array layout and potential for stock to graze under the panels, the soil will be able to retain and store nutrients and support microbiology. Upon decommissioning the areas under the panels may be seen to have a short term decrease in microbiology productivity compared to adjacent areas, however commitments to achieve a groundcover level during the post operative period will be sufficient to increase soil microbiology biomass to match adjacent analogue areas.

Several mitigation measures are available for the operational phase to mitigate the long term impacts of the Projects on soil microbiological balance and nutrient availability. These include:

- Routine vegetation monitoring and maintenance.
- Erosion and sediment controls to preserve topsoil material.
- Routine monitoring and management of visible surface erosion, such as rilling caused by concentrated flows from infrastructure.
- Weed management strategies to promote continued presence of pasture species and seedbank within topsoil.

These should be incorporated into the Operational Environmental Management Plan, which will guide operational environmental management following the final design of the Project and would be approved by the relevant statutory authority.

Soil sterilisation, localised or widespread, remains a minor risk throughout the Project. However, soil rehabilitation measures at the decommissioning stage can be employed to restore soil biological balance and nutrient availability. Measures include the application of mulch and organic materials, fertilisers, soil ameliorants and regenerative farming practices. Further, the spacing between each of the solar panel rows are anticipated to remain biologically active and act as an established source of bioactivity for spreading into potentially sterilised islands following the removal of panels.

6.2 PEST SPECIES

Pest species will be managed across the site through a detailed protocol targeting weeds and pest species. This will include an ongoing effort to identify and eliminate existing weed populations on-site over the life of the Project. The spread of declared noxious weeds will be prevented by using site specific measures such as direct spraying.

Weed control, if required, will be undertaken in a manner that will minimise soil disturbance. Any use of herbicides will be carried out in accordance with the regulatory requirements, and in consideration of adjacent agricultural operations (i.e., avoiding spray drift). Records will be maintained of weed infestations and control programs will be implemented according to best management practice for the weed species concerned.

Feral animals may include foxes, rabbits, cats, pigs, and dogs and will be controlled in accordance with Livestock Health and Pest Authority procedures. Feral animal control may be undertaken in consultation with host and

neighbouring landholders, as required. Programs to control feral animals will include the determination of appropriate control practices, consultation with appropriate authorities, obtaining appropriate approvals, implementing control practices, and undertaking follow-up monitoring and control as required. If a substantial increase in the numbers of any known feral fauna species, or the occurrence of a previously unrecorded feral fauna species, is discovered, advice will be sought from a suitably qualified and experienced person on the management and control options for that species and appropriate measures for mitigating any impacts caused by its management on native species.

6.3 BIOSECURITY

At the local level, the mitigation measures outlined for pest species will reduce biosecurity risks. On a regional level, any import of equipment or machinery from overseas will follow the standard procurement safeguards and quarantine procedures as per Australian requirements.

Further, a detailed protocol relating to biosecurity detailing construction and operational risks and controls in relation to pests, weeds, and diseases will be prepared for the Project. This document will address the biosecurity risk to agricultural operations immediately adjacent to the Project and wider locality by detailing the mitigation measures available the project.

6.4 MONITORING PROGRAMS

Monitoring programs are instituted to assess predicted versus actual impacts as the Project progresses in order to implement controls where required. All operations associated with the Project undertaken in accordance with approved environmental management plans and strategies. The management plans will include environmental monitoring programs, where required. Key management plans, or chapters housed within a larger CEMP, that will assist in managing impacts on agricultural land will be stipulated in conditions of development consent.

These management plans, which will include mitigation measures to control impacts to soils and agriculture, will be reviewed and revised where necessary to incorporate the requirements associated with the Project prior to commencement.

6.5 AGRISOLAR

Agrisolar refers to co-developing the same area of land for both use as a solar farm as well as for agriculture activities (Clean Energy Council, 2021). By implementing complementary solar energy and agricultural production, impacts to existing agricultural land use and enterprises, including primary and secondary productivity, can be reduced.

Solar farms typically require access to relatively flat or gently sloping land in sunny areas within proximity to electricity transmission networks, where biodiversity impacts can be avoided or minimised. This often means that land which has been previously cleared or zoned for agricultural use is well-situated to host solar farm developments.

Where solar farms are proposed and developed, there is increasing interest in exploring the opportunities for complementary agricultural activities which can benefit from a number of the valuable characteristics of solar arrays, including:

- the provision of partial shading and weather protection (including sun, rain, hail and wind).
- improved soil moisture retention, which can lead to improved vegetation growth beneath the panels.
- protection from predators for sheep.

Sheep grazing delivers benefits for the operation of solar farms, as the vegetation is maintained in a cost-effective and safe manner by reducing the need for mowing or spraying. This maintenance reduces the risk of fire hazard,

protecting the solar assets and neighbouring properties. Further, agrisolar can strengthens relationships, communication and interaction with local landholders and farming communities and mitigate land use conflicts.

With the development of solar farms commencing in Australia from around 2015 onwards, the local experience of agrisolar practices is still developing and currently dominated by the practice of sheep grazing on solar farms (Clean Energy Council, 2021).

ACEN will continue to explore with landholders opportunities to support co-location of livestock grazing with the solar project operation as a means of mitigating the impacts to agriculture.

6.6 MITIGATION SUMMARY

The mitigation measures pertaining to soils and agriculture that have been referenced in this assessment are summarised in **Table 17**.

Table 17: Summary of Mitigation Measures

Risk Category	Mitigation Measure
Agricultural Land Use	Agriculture land use will be re-established over all agricultural land removed from agriculture at the time of decommissioning (unless otherwise agreed with the landowner and/or regulatory authorities).
Agricultural Productivity	The Modification Area will be returned to an approximately equivalent potential agricultural productivity following the Project via soil management and LSC class reinstatement.
Soil	All soil that is proposed to be disturbed as a result of the proposed modification will be handled in accordance with the SWMP containing strategy outlined in Section 6.2.1 that includes soil management measures relating to soil stripping, stockpiling, respread/reuse, and land rehabilitation. This will inform the CEMP, OEMP and a Decommissioning and Rehabilitation Plan.
LSC	Return all disturbed land within the Modification Area to an equivalent LSC class following the end of life for the Project, through site rehabilitation and good soil management practices as outlined in Section 6.2 and in accordance with the SWMP prepared for the Project.
Erosion and Sedimentation	All soil resources within the Modification Area are to be managed throughout construction, operation and decommissioning phases of the Project in accordance with a SWMP which should include erosion and sediment control recommendations outlined in Section 6.2.1.
Agricultural Improvements	Stock fences, dams and irrigation infrastructure to be reinstated during decommissioning to suit post-Project land use as required.
Pest Species	Pest species will be managed in accordance with measures outlined in Section 6.2, and a detailed protocol relating to weed and pest control.
Biosecurity	Biosecurity will be managed in accordance with measures outlined in Section 6.2 and a detailed protocol relating to biosecurity.

7 SUMMARY

There is a high level of certainty about the status of agricultural resources and enterprises in the Modification Area, locality and broader region, based on the soil survey and site verification assessment undertaken and desktop studies carried out. Further, there is a high level of confidence regarding the proposed modification activities, surface disturbance requirements and commitments to returning land to pre-disturbance agricultural status following the life of the Project.

Based on these factors, the impacts on agriculture as a result of the Project are determined to be generally minor, temporary, and limited to the development footprint. These impacts can be summarised as the following:

- Temporary removal of up to 257 ha of land from agricultural land use for the duration of the Project.
- Temporary removal of potential agricultural primary productivity to the estimated value of up to $85,033 per year for the duration of the Project.
- Temporary impacts on soil resources and LSC classes 4 and 5 within the Modification Area where surface disturbance occurs.

The temporary impacts on agriculture listed above are considered negligible in the context of the gross commodity values and land use coverage of the agricultural enterprises and industries operating within the Mid-West Regional LGA. Given the nature and scale of the established agricultural industries within the region and wider state, there will be no impact to critical mass thresholds of agricultural enterprises needed to attract and maintain investment in agricultural industries and infrastructure. At the scale of the enterprises operating within the Modification Area, the anticipated impacts are considered offset as the involved landowners would be financially compensated.

A summary of mitigation measures and management recommendations have been provided at Section 6.6 as key controls to the risks of the Project on land and soil resources. The reinstatement of soil growth medium over disturbed areas is critical to ensure rehabilitation commitments are able to be met and the agricultural land being disturbed is able to be returned to a pre-disturbance agricultural status.

It is anticipated that by adopting a soil management strategy and targeted soil and erosion management during construction and operation and implementing effective decommissioning and rehabilitation at the end of Project life, the proposed modification will have minor impact on the soils and agricultural productivity of the Modification Area, and negligible impact on agriculture industries operating within the region.

8 REFERENCES

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Appendix 1

Land Use Conflict Risk Assessment

Overview

LUCRA is a system to identify and assess the potential for land use conflict to occur between neighbouring land uses. It helps land managers and consent authorities assess the possibility for and potential level of future land use conflict.

The LUCRA compares and contrasts the Project against adjoining/surrounding land uses and activities for incompatibility and conflict issues based on the risks and impacts identified in Section 5, and the mitigation measures and controls presented in Section 6. Each potential conflict between the operation of the solar farm and adjacent land has been assessed and given a risk ranking based on probability and consequence as outlined in the following section.

Assumption

The current status of rural land use in the area is not considered likely to change significantly during the life of the Project. For example, due to the location of the Modification Area relative to major regional towns, it is considered unlikely that surrounding properties will undergo subdivision to accommodate residential or small-block rural developments. Accordingly, it is not expected that future changes to land use will occur that will generate new land use conflicts in addition to those identified.

Methodology

A risk ranking matrix (**Table A1**) provided by the DPI (2011) is used to rank the identified potential land use conflicts. The risk ranking matrix assesses the economic, social and environmental impacts according to the probability of occurrence and consequence of the impact.

Table A1: Risk Ranking Matrix

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

(Source: DPI, 2011)

The risk ranking matrix yields a risk ranking from 25 to 1. It covers each combination of five levels of 'probability' (a letter A to E as defined in **Table A2**) and 5 levels of 'consequence', (a number 1 to 5 as defined in **Table A3**) to identify the risk ranking of each impact. For example, an activity with a 'probability 'of D and a 'consequence' of 3 yields a risk rank of 9. A rank of 25 is the highest magnitude of risk; a highly likely, very serious event. A rank of 1 represents the lowest magnitude of risk; an almost impossible, very low consequence event. Low risk is a ranking score of 10 or below.

Table A2: Probability Definitions

Level	Descriptor	Description
A	Almost Certain	Common or repeating occurrence.
B	Likely	Known to occur or it has happened.
C	Possible	Could occur or 'I've heard of it happening.'
D	Unlikely	Could occur in some circumstances but not likely to occur.
E	Rare	Practically impossible or 'I've never heard of it happening.'

(Source: DPI, 2011)

Table A3: Consequence Definitions

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

(Source: DPI, 2011)

Risk	Potential Conflict	Initial Risk Rating			Risk Reduction Control	Final Risk Rating			Performance Target
		Probability	Consequence	Rating		Probability	Consequence	Rating	
Construction Ground Disturbance	Land users in the locality may be concerned about changes to water quality, quantity and surface water flows that may affect the site and locality, including local waterways, from surface disturbances during construction activities.	C	3	13	Consideration of impacts to surrounding water courses and water quality was undertaken for the approved project within the water quality impact assessment for the EIS, which will be expanded to include the additional modification areas. The impact of the modification is anticipated to be a negligible additional impact to that of the currently approved project. Appropriate mitigation measures are specified within the EIS, including soil erosion and sedimentation controls within this report, to minimise impacts to watercourse health and quality. Compliance with mitigation measures is anticipated to reduce the risk of conflict related to watercourse health and quality. Ongoing consultation with stakeholders will identify and address concerns if they arise. Implement all measures specified in management plans identified in the EIS and/or consent conditions, such as a soil management plan and an erosion and sediment control management measures.	C	4	8	Effectiveness of mitigation measures will be measured as part of the Environmental Management Strategy (EMS), specifically the CEMP and Erosion and Sediment Control (ESC) management measures.
Construction Ground Disturbance	Stakeholders may have concerns that the construction and operation of the solar farm may alter and disturb existing soil properties, undermining the suitability of the land for future agricultural production.	C	2	18	The assessment of soil characteristics, erodibility and land and soil capability has been undertaken within this soils and agricultural impact assessment. Anticipated impacts and appropriate mitigation measures are provided within this report. Compliance with mitigation measures is anticipated to reduce the risk of potential conflicts related to future land capability for agriculture. Implement all measures specified in this report and associated management plans identified in the EIS and/or consent conditions (if approved).	E	3	6	Effectiveness of mitigation measures will be measured as part of the EMS, specifically the soil and water management measures to be outlined in the CEMP and OEMP

Risk	Potential Conflict	Initial Risk Rating			Risk Reduction Control	Final Risk Rating			Performance Target
		Probability	Consequence	Rating		Probability	Consequence	Rating	
Construction Ground Disturbance	Stakeholders may be concerned about impacts to heritage items or values at the site and locality.	D	3	9	An assessment of impacts to heritage has been undertaken for the approved project with the preparation of an Aboriginal Cultural Heritage Assessment Report (ACHAR) and a historic heritage assessment, which will be expanded to include the additional modification areas. The impact of the modification is anticipated to be a negligible additional impact to that of the currently approved project. Appropriate mitigation measures specified within the ACHAR and the historic heritage assessment aim to minimise impacts to heritage. Compliance with mitigation measures specified within the ACHAR and the historic heritage assessment is anticipated to reduce the risk of conflict related to environmental features, culturally sensitive land and heritage. Implement all measures specified in management plans identified in the EIS and/or consent conditions (if approved).	D	4	5	Effectiveness of mitigation measures will be measured as part of the EMS, specifically through the CEMP, OEMP and an Aboriginal Cultural Heritage Management Plan (ACHMP).
Construction Noise	Land users in the locality may be concerned construction activity disturbances may affect livestock behaviour and/or breeding at neighbouring properties.	D	3	9	The assessment of potential noise impacts has been undertaken for the approved project via a Noise Impact Assessment (NIA), which will be expanded to include the additional modification areas. The impact of the modification is anticipated to be a negligible additional impact to that of the currently approved project. Appropriate mitigation measures will be specified within the NIA to minimise noise impacts. Compliance with mitigation measures is anticipated to reduce the risk of conflict related to noise impacts on agricultural land users. Ongoing consultation with stakeholders will identify and address concerns if they arise.	D	4	5	Any complaints from neighbours regarding effects to livestock can be managed within normal operations.

Risk	Potential Conflict	Initial Risk Rating			Risk Reduction Control	Final Risk Rating			Performance Target
		Probability	Consequence	Rating		Probability	Consequence	Rating	
Construction Noise	Increased noise generated by construction activities and heavy vehicle movements may be perceived as nuisance to nearby residential properties.	B	3	17	Construction noise impacts have been assessed for the approved project as part of the noise and vibration impact assessment. The impact of the modification is anticipated to be a negligible additional impact to that of the currently approved project. No additional significant noise impacts are expected as a result of the modification, however additional modelling will be completed for the modification. Noise generated during construction will be minimised through implementation of best practice requirements outlined in the Interim Construction Noise Guideline (DECC 2009). Construction noise management and mitigation will be addressed in the CEMP. Compliance with mitigation measures is anticipated to reduce the risk of conflict related to noise impacts on agricultural land users. Ongoing consultation with stakeholders will identify and address concerns if they arise.	D	4	5	Effectiveness of mitigation measures will be measured as part of the EMS, which will include reference to relevant noise criteria.
Construction Dust	Land users in the locality may be concerned that dust generated by construction activities may have adverse health implications for residential land users within the locality.	D	3	9	The assessment of potential dust impacts has been undertaken as part of the EIS and will be expanded to include the additional modification areas. The impact of the modification is considered a negligible additional impact to that of the currently approved project. With readily available mitigation measures, the Project is expected to be constructed without any significant impact to local air quality. Compliance with mitigation measures is anticipated to reduce the risk of conflict related to air quality impacts. Ongoing consultation with stakeholders will identify and address concerns if they arise. Implement all measures specified in management plans identified in the EIS and/or consent conditions (if approved).	E	4	3	Effectiveness of mitigation measures will be measured as part of the EMS and CEMP that outlines dust suppression strategies.

Risk	Potential Conflict	Initial Risk Rating			Risk Reduction Control	Final Risk Rating			Performance Target
		Probability	Consequence	Rating		Probability	Consequence	Rating	
Construction Biosecurity	Land users in the locality may be concerned about biosecurity risks to agriculture, including weed, plant pest, plant disease or pest animal introduction and/or spread, as a result of the cessation of agricultural activity (i.e., grazing pressure) and increased personnel, vehicles and materials entering the Development Footprint during construction of the Project.	B	2	21	The assessment of biosecurity risk to agriculture has been undertaken as part of this Soil, Land and Agriculture assessment. The impact of the modification is considered a negligible additional impact to that of the currently approved project. Appropriate mitigation measures are specified to minimise the risk for weeds and pests to spread throughout the site and onto neighbouring land. Ongoing consultation with stakeholders will identify and address concerns if they arise. Implement all measures specified in management plans identified in the EIS and/or consent conditions (if approved).	D	3	9	Effectiveness of mitigation measures will be measured as part of the EMS, specifically biosecurity management measures included in the CEMP and OEMP.
Construction Traffic	Use of local roads during construction of the solar farm may cause conflict by interacting with agricultural and/or local transport activities, and/or resulting in additional travel time for road users	C	4	8	The assessment of potential traffic impacts has been undertaken via a Traffic Impact Assessment (TIA), which found the road network can accommodate the traffic generated by the currently approved Project during the construction stage, however further assessment will be undertaken to include the additional modification areas. The impact of the modification is considered a negligible additional impact to that of the currently approved project. Appropriate mitigation measures, including design controls, will be specified within the TIA to minimise impacts to the traffic environment. Compliance with mitigation measures is anticipated to reduce the risk of conflict related to traffic for surrounding land users. Ongoing consultation with stakeholders will identify and address concerns if they arise. Implement all measures specified in management plans identified in the EIS and/or consent conditions (if approved)	D	4	5	The EMS, specifically the Traffic Management Plan (TMP), will include a complaint resolution as a mechanism to address any issues identified by neighbouring land users.

Risk	Potential Conflict	Initial Risk Rating			Risk Reduction Control	Final Risk Rating			Performance Target
		Probability	Consequence	Rating		Probability	Consequence	Rating	
Construction Infrastructure Damage	Stakeholders may have concerns that construction activities associated with the Project may damage existing infrastructure including transmission lines and public infrastructure.	C	4	8	Consideration of potential impacts to surrounding service provider infrastructure has been undertaken as part of the EIS for the approved project, however further assessment will be undertaken to include the additional modification areas. Appropriate mitigation measures will be specified within the EIS and will be detailed in a CEMP to minimise the risk of construction activities damaging existing infrastructure. Compliance with construction management measures anticipated to reduce the risk of conflict related to damaging existing infrastructure. Ongoing consultation with stakeholders will identify and address concerns if they arise. Implement all measures specified in management plans identified in the EIS and/or consent conditions (if approved).	D	4	5	No damage to existing infrastructure including transmission lines during the construction phase due to project activities. Any impacts to public infrastructure will be remedied.
Visual Amenity	Stakeholders in the locality who wish to maintain views of the existing agricultural landscape may be concerned about the change in visual amenity resulting from the Project.	B	3	17	The impact of the modification is considered a negligible additional impact to that of the currently approved project. An assessment of visual impacts to surrounding amenity of the approved project has been undertaken via a Visual Impact Assessment (VIA) which determined impacts to be low, however a further assessment will be undertaken for the modification area. Appropriate mitigation measures will be specified within the VIA to minimise the risk of altered amenity for surrounding residents and public within the locality. Compliance with mitigation measures specified within the LVIA is anticipated to further limit visual impact from the Project. Ongoing consultation with stakeholders will identify and address concerns if they arise. Implement all measures specified in management plans identified in the EIS and/or consent conditions (if approved).	D	3	9	Effectiveness of mitigation measures will be measured as part of the EMS which will include reference to measures proposed to minimise visual impacts.

Risk	Potential Conflict	Initial Risk Rating			Risk Reduction Control	Final Risk Rating			Performance Target
		Probability	Consequence	Rating		Probability	Consequence	Rating	
Land Use Change	Stakeholders in the locality may be concerned about the reduction of land used for agricultural purposes or the reduction of productivity of the land.	A	4	16	The assessment of the reduction of land used for agriculture and the productivity of land has been undertaken within this agricultural assessment. The negligible anticipated impacts and appropriate mitigation measures are provided within the agricultural impact assessment report for stakeholder consideration.	D	4	5	Rehabilitation objectives and strategies (including performance measures) will be established in a
Land Use Change	Land users in the locality may be concerned about impacts to agricultural support infrastructure in the Project locality and wider region.	D	4	5	The assessment of the impacts to agricultural support infrastructure in the Project locality and wider region has been undertaken within this agricultural assessment. Anticipated impacts are determined to be negligible and presented in this report for land user consideration. Ongoing consultation with stakeholders will identify and address concerns if they arise.	D	5	2	No complaints from agriculture enterprises regarding impact to agricultural support infrastructure due to project activities.

Risk	Potential Conflict	Initial Risk Rating			Risk Reduction Control	Final Risk Rating			Performance Target
		Probability	Consequence	Rating		Probability	Consequence	Rating	
Fire Spread	Land users in the locality may be concerned about the risk of fires occurring at the site and their potential to spread to surrounding land, infrastructure, crops or livestock.	C	2	18	Fire emergency management procedures are proposed that include fire awareness, emergency response and evacuation, and monitoring and review procedures. The bushfire management plan for the project will detail measures and procedures to prevent fires igniting during the construction and operation of the Project. An internal emergency access track will be constructed, suitable for emergency vehicles. This will enable an alternative emergency access to the public road network, directed towards the southeastern corner of the property. This emergency access track is not intended for general access. Ongoing consultation with stakeholders will identify and address concerns if they arise.	E	2	10	Effectiveness of mitigation measures will be measured as part of the CEMP, OEMP, Emergency Management Plan and EMS.
Operation Traffic	Land users in the locality may be concerned about an increase in traffic volume on local roads throughout the operational phase of the Project, which may cause conflict by interacting with agriculture transport activities or increasing travel times over the life of the Project.	D	4	5	The assessment of potential traffic impacts during the operational phase of the approved Project has been undertaken via a Traffic Impact Assessment (TIA), however further assessment will be undertaken to include the proposed modification. Anticipated impacts are expected to be negligible and presented in the EIS for land user consideration. Ongoing consultation with stakeholders will identify and address concerns if they arise.	E	5	1	Effectiveness of mitigation measures will be measured as part of the EMS which will include a complaint handling system.

Risk	Potential Conflict	Initial Risk Rating			Risk Reduction Control	Final Risk Rating			Performance Target
		Probability	Consequence	Rating		Probability	Consequence	Rating	
Operation Traffic	Land users in the locality may be concerned that dust generated by increased vehicle movements along access roads during the operational phase of the Project has the potential to impact air quality and may have adverse health implications for residential land users within the locality and host land personnel.	D	3	9	The assessment of potential dust impacts during the operational phase of the approved Project has been undertaken as part of the EIS, however further assessment will be undertaken to include the modification. The impact of the modification is considered a negligible additional impact to that of the currently approved project, Ongoing consultation with stakeholders will identify and address concerns if they arise. Implement all measures specified in management plans identified in the EIS and/or consent conditions (if approved).	E	5	1	Effectiveness of mitigation measures will be measured as part of the EMS which will include a complaint handling system.
Operation Pest Control	Neighbouring agricultural operations, may be concerned about sprays drift from weed control herbicides on the Development Footprint adversely affecting adjacent crop or pasture performance, or livestock wellbeing.	C	4	8	Weed mitigation measures would be undertaken as per methodology specified in management plans identified in the EIS and/or consent conditions (if approved), including spraying in a manner to prevent spray drift. Ongoing consultation with stakeholders would identify and address concerns if they arise.	D	4	5	No complaints from neighbouring agricultural operators regarding overspray of herbicides

Risk	Potential Conflict	Initial Risk Rating			Risk Reduction Control	Final Risk Rating			Performance Target
		Probability	Consequence	Rating		Probability	Consequence	Rating	
Operation Pest Control	Land users in the locality may be concerned that waste generated by the development may increase the presence of pest animals and/or vermin which could impact agricultural productivity.	D	4	5	Consideration of waste related impacts for the approved project has been undertaken as part of the EIS, however further assessment will be undertaken to include the modification. Appropriate mitigation measures will be specified within the EIS and in a Waste Management Plan (WMP) to minimise the risk of attracting pest animals and/or vermin. Compliance with mitigation measures specified in the EIS is anticipated to reduce the risk of conflict related to pest animals and/or vermin. Ongoing consultation with stakeholders will identify and address concerns if they arise.	E	4	3	Effectiveness of mitigation measures will be measured as part of the EMS, and CEMP.
Livestock Interaction	Neighbouring landowners may be concerned about their livestock entering the Development Footprint and becoming injured or causing damage.	D	4	5	Operational management plans will include a provision to ensure boundary fences are maintained to a suitable standard. Regular inspection of fences should be conducted to assess the condition of the fence, and any issues rectified as soon as practical. If livestock enter the site, the surrounding landowners should be contacted. Efforts will be made to ensure the animal is not distressed and kept away from public roads. Ongoing consultation with stakeholders will identify and address concerns if they arise.	E	4	3	Effectiveness of mitigation measures will be measured as part of the EMS.
Dust from Neighbours	Dispersion of construction dust and/or agricultural/ products from surrounding land uses may impact the productivity of the solar farm panels, potentially causing conflict between agriculture, wind farm and solar farm land uses.	C	4	8	Compliance with mitigation measures specified within the EIS together within the ongoing maintenance of solar panels and site infrastructure, is anticipated to reduce the risk of conflict related to the functioning of the solar farm panels.	D	5	2	No impact to solar farm operations or infrastructure.

Risk	Potential Conflict	Initial Risk Rating			Risk Reduction Control	Final Risk Rating			Performance Target
		Probability	Consequence	Rating		Probability	Consequence	Rating	
Electro-magnetic Fields	Land users in the locality and personnel on host lands may be concerned about electro-magnetic fields (EMF) resulting from electrical infrastructure associated with the Project.	D	2	14	Consideration of EMF impacts resulting from the development has been undertaken as part of the EIS. The EIS finds that the potential for the EMF to exceed the accepted levels is considered negligible. This finding is presented in the EIS for stakeholder consideration.	E	5	1	Nil.

Appendix 2

Soil Profile Descriptions

Site Description – Site 1				
Site Reference	1	**ASC Name**	Haplic Eutrophic Red Chromosol (BEMOVNR)	
Average Slope	9%	**Land Use**	Livestock Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderate	MGA 55
Landform Element	Upper Slope	**Drainage**	Moderately Well	X: 740264
Surface Condition	Soft	**Permeability**	Moderate	Y: 6440586

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.20**	Very dark brown (Munsell 7.5YR 2.5/3) Sandy Clay Loam with moderate pedality, earthy fabric and weak consistence. Neutral pH, non-saline and non-sodic. No coarse fragments. Many roots and well drained. Clear boundary.
B2	**0.20 – 0.65**	Dark reddish brown (Munsell 5YR 3/4) Heavy Clay with moderate pedality, rough fabric and moderate consistence. Moderately acidic pH, non-saline and non-sodic. No coarse fragments. Few roots and moderately well drained.
C	**0.60+**	Decomposing parent material. Root barrier.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.6	Non-saline	6.6	Neutral	1.2	Non sodic
0.30 – 0.40	0.2	Non-saline	5.8	Moderately Acidic	0.7	Non sodic
0.60 – 0.70	0.2	Non-saline	5.6	Moderately Acidic	1.2	Non sodic

Site Description – Site 2				
Site Reference	2	**ASC Name**	Yellow Sodosol	
Average Slope	3%	**Land Use**	Livestock Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Mid Slope	**Drainage**	Imperfect	X: 740561
Surface Condition	Soft	**Permeability**	Moderate	Y: 6441077

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.25**	Dark brown (Munsell 10YR 3/3) Sandy Clay Loam with moderate pedality, earthy fabric and weak consistence. No coarse fragments. Many roots and well drained. Gradual boundary.
A2	**0.25 – 0.55**	Bleached light grey (Munsell 10YR 7/1) Sandy Loam with weak pedality, earthy fabric and weak consistence. No coarse fragments. Many roots and well drained. Clear boundary.
BC	**0.55 – 0.65**	Yellowish brown (Munsell 10YR 5/8) Medium Clay with weak pedality, rough fabric and moderate consistence. No coarse fragments. Trace roots and imperfectly drained.
C	**0.65**	Decomposing parent material. Root barrier.

Site Description – Site 3				
Site Reference	3	**ASC Name**	Yellow Sodosol	
Average Slope	2%	**Land Use**	Livestock Grazing	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Lower Slope	**Drainage**	Imperfect	X: 740259
Surface Condition	Soft	**Permeability**	Moderate	Y: 6441598

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.20**	Dark brown (Munsell 10YR 3/3) Sandy Loam with moderate pedality, earthy fabric and weak consistence. No coarse fragments. Many roots and well drained. Clear boundary.
A2	**0.20 – 0.45**	Pale brown (Munsell 10YR 6/3) Sandy Loam with weak pedality, earthy fabric and weak consistence. No coarse fragments. Many roots and well drained. Clear boundary.
BC	**0.45 – 0.65**	Yellowish brown (Munsell 10YR 5/4) Medium Clay with weak pedality, rough fabric and moderate consistence. No coarse fragments. Very few roots and imperfectly drained.
C	**0.65**	Decomposing parent material. Root barrier.

Site Description – Site 4				
Site Reference	4	**ASC Name**	Eutrophic Subnatric Yellow Sodosol (BEKOWNR)	
Average Slope	2%	**Land Use**	Fodder Cropping	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Flat	**Drainage**	Imperfect	X: 739002
Surface Condition	Soft	**Permeability**	Moderate	Y: 6442339

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.15**	Brown (Munsell 10YR 4/3) Loamy Sand with weak pedality, earthy fabric and weak consistence. Moderately acidic pH, non-saline and non-sodic. No coarse fragments. Many roots and well drained. Clear boundary.
A2	**0.15 – 0.40**	Brown (Munsell 10YR 5/3) Loamy Sand with weak pedality, earthy fabric and weak consistence. Slightly acidic pH, non-saline and non-sodic. No coarse fragments. Few roots and well drained. Abrupt boundary.
B2	**0.35 +**	Brownish yellow (Munsell 10YR 6/8) Sandy Clay with moderate pedality, rough fabric and moderate consistence. Neutral pH, non-saline and sodic. No coarse fragments. Trace roots and imperfectly drained. 20% grey mottling. 10% orange mottling.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	1.0	Non-saline	5.9	Moderately Acidic	2.1	Non sodic
0.25 – 0.35	0.4	Non-saline	6.1	Slightly Acidic	2.7	Non sodic
0.55 – 0.65	1.1	Non-saline	7.0	Neutral	8.1	Sodic

Site Description – Site 5				
Site Reference	5	**ASC Name**	Yellow Sodosol	
Average Slope	2%	**Land Use**	Fodder Cropping	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Flat	**Drainage**	Imperfect	X: 739204
Surface Condition	Loose	**Permeability**	Moderate	Y: 6443011

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.15**	Pale brown (Munsell 10YR 6/3) Loamy Sand with very weak pedality, earthy fabric and weak consistence. No coarse fragments. Many roots and well drained. Clear boundary.
A2	**0.15 – 0.40**	Bleached very pale brown (Munsell 10YR 7/3) apedal Sand with sandy fabric. No coarse fragments. Few roots and well drained. Abrupt boundary.
B2	**0.40 +**	Brownish yellow (Munsell 10YR 6/8) Medium Clay with moderate pedality, rough fabric and moderate consistence. No coarse fragments. Trace roots and imperfectly drained. 10% grey mottling. 10% orange mottling.

Site Description – Site 6				
Site Reference	6	**ASC Name**	Yellow Sodosol	
Average Slope	2%	**Land Use**	Livestock Grazing	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Flat (Creekline)	**Drainage**	Imperfect	X: 738960
Surface Condition	Crusted	**Permeability**	Moderate	Y: 6443063

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.15**	Greyish brown (Munsell 10YR 5/2) Sandy Loam with very weak pedality, earthy fabric and weak consistence. 5% coarse fragments 10mm. Many roots and well drained. Clear boundary.
A2	**0.15 – 0.30**	Bleached very pale brown (Munsell 10YR 7/3) Loamy Sand with weak pedality, earthy fabric and weak consistence. No coarse fragments. Few roots and well drained. Abrupt boundary.
B2	**0.30 – 0.80**	Brownish yellow (Munsell 10YR 6/6) Medium Clay with weak pedality, rough fabric and moderate consistence. 10% coarse fragments 10mm. No roots and imperfectly drained. 10% grey mottling.
R	**0.80**	Parent material.

Site Description – Site 7				
Site Reference	7	**ASC Name**	Yellow Sodosol	
Average Slope	2%	**Land Use**	Fodder Cropping	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Flat	**Drainage**	Imperfect	X: 738746
Surface Condition	Soft	**Permeability**	Moderate	Y: 6442731

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.20**	Brown (Munsell 10YR 4/3) Sandy Loam with weak pedality, earthy fabric and weak consistence. No coarse fragments. Many roots and well drained. Clear boundary.
A2	**0.20 – 0.45**	Bleached very pale brown (Munsell 10YR 7/3) Sandy Loam with very weak pedality, earthy fabric and weak consistence. No coarse fragments. Few roots and well drained. Abrupt boundary.
B2	**0.45 +**	Brownish yellow (Munsell 10YR 6/6) Sandy Clay with moderate pedality, rough fabric and moderate consistence. No coarse fragments. Trace roots and imperfectly drained. 10% grey mottling. 20% orange mottling.

Site Description – Site 8				
Site Reference	8	**ASC Name**	Eutrophic Subnatric Brown Sodosol (BEKOWNR)	
Average Slope	2%	**Land Use**	Fodder Cropping	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Flat	**Drainage**	Imperfect	X: 738415
Surface Condition	Soft	**Permeability**	Moderate	Y: 6443101

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.25**	Dark yellowish brown (Munsell 10YR 3/4) Sand with weak pedality, earthy fabric and weak consistence. Moderately acidic pH, non-saline and non-sodic. Many roots and well drained. Clear boundary.
A21	**0.25 – 0.45**	Dark yellowish brown (Munsell 10YR 4/4) Sand with weak pedality, earthy fabric and weak consistence. Moderately acidic pH, non-saline and non-sodic. Many roots and well drained. Clear boundary.
A22	**0.45 – 0.65**	Light olive brown (Munsell 2.5Y 5/4) Sandy Loam with weak pedality, rough fabric and moderate consistence. Neutral pH, non-saline and non-sodic. Few roots and imperfectly drained. 10% grey mottling. Clear boundary.
B2	**0.65+**	Light yellowish brown (Munsell 2.5Y 6/4) Sandy Clay Loam with weak pedality, rough fabric and moderate consistence. Slightly acidic pH, non-saline and sodic. Trace roots and imperfectly drained. Clear boundary,

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	1.0	Non-saline	5.8	Moderately Acidic	1.9	Non sodic
0.30 – 0.40	0.7	Non-saline	5.6	Moderately Acidic	1.3	Non sodic
0.50 – 0.60	0.4	Non-saline	7.2	Neutral	5.2	Non sodic
0.80 – 0.90	0.3	Non-saline	6.5	Slightly Acidic	6.8	Sodic

Site Description – Site 9				
Site Reference	9	**ASC Name**	Yellow Sodosol	
Average Slope	2%	**Land Use**	Fodder Cropping	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Flat	**Drainage**	Imperfect	X: 738313
Surface Condition	Soft	**Permeability**	Moderate	Y: 6442267

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.15**	Brown (Munsell 10YR 4/3) Loamy Sand with weak pedality, earthy fabric and weak consistence. No coarse fragments. Many roots and well drained. Clear boundary.
A2	**0.15 – 0.45**	Bleached very pale brown (Munsell 10YR 7/3) apedal Sand with sandy fabric and weak consistence. No coarse fragments. Many roots and well drained. Clear boundary.
B21	**0.45 – 0.65**	Yellowish brown (Munsell 10YR 5/6) Medium Clay with moderate pedality, rough fabric and moderate consistence. No coarse fragments. Few roots and imperfectly drained. 10% grey mottling.
B22	**0.65+**	Reddish brown (Munsell 5YR 5/4) Medium Clay with weak pedality, rough fabric and moderate consistence. No coarse fragments. Trace roots and imperfectly drained. Clear boundary,

Site Description – Site 10				
Site Reference	10	**ASC Name**	Yellow Sodosol	
Average Slope	2%	**Land Use**	Fodder Cropping	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Flat	**Drainage**	Imperfect	X: 738201
Surface Condition	Crusted	**Permeability**	Moderate	Y: 6442517

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Pale brown (Munsell 10YR 6/3) Sandy Loam with massive pedality, earthy fabric and weak consistence. No coarse fragments 10mm. Many roots and well drained. Clear boundary.
A2	**0.10 – 0.40**	Bleached very pale brown (Munsell 10YR 7/3) Sandy Loam with massive pedality, earthy fabric and weak consistence. No coarse fragments. Few roots and well drained. Abrupt boundary.
B2	**0.40 – 0.90**	Yellowish brown (Munsell 10YR 5/6) Sandy Clay with weak pedality, rough fabric and moderate consistence. 10% coarse fragments 10mm. No roots and imperfectly drained. 10% grey mottling.
C	**0.90**	Soft, partially decomposed parent material.

Site Description – Site 11				
Site Reference	11	**ASC Name**	Yellow Chromosol	
Average Slope	3%	**Land Use**	Fodder Cropping	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Mid Slope	**Drainage**	Imperfect	X: 737918
Surface Condition	Soft	**Permeability**	Moderate	Y: 6443065

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.20**	Dark brown (Munsell 10YR 3/3) Sandy Loam with weak pedality, earthy fabric and weak consistence. No coarse fragments. Many roots and well drained. Gradual boundary.
A2	**0.20 – 0.45**	Light brownish grey (Munsell 10YR 6/2) Loamy Sand with weak pedality, earthy fabric and weak consistence. No coarse fragments. Few roots and well drained. Clear boundary.
B2	**0.45 +**	Brownish yellow (Munsell 10YR 6/8) Sandy Clay with moderate pedality, rough fabric and moderate consistence. No coarse fragments. Trace roots and imperfectly drained. 20% orange mottling.

Site Description – Site 12				
Site Reference	12	**ASC Name**	Yellow Sodosol	
Average Slope	3%	**Land Use**	Fodder Cropping	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Mid Slope	**Drainage**	Imperfect	X: 737350
Surface Condition	Soft	**Permeability**	Moderate	Y: 6443303

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.20**	Dark reddish brown (Munsell 5YR 3/4) Loamy Sand with weak pedality, earthy fabric and weak consistence. No coarse fragments. Many roots and well drained. Clear boundary.
A2	**0.20 – 0.45**	Pale brown (Munsell 10YR 6/3) apedal Sand with sandy fabric and weak consistence. No coarse fragments. Many roots and well drained. Clear boundary.
B21	**0.45 – 0.60**	Brownish yellow (Munsell 10YR 6/6) Sandy Clay with moderate pedality, rough fabric and moderate consistence. No coarse fragments. Few roots and imperfectly drained. Clear boundary.
B22	**0.60+**	Strong brown (Munsell 7.5YR 4/6) Medium Clay with weak pedality, rough fabric and moderate consistence. No coarse fragments. Trace roots and imperfectly drained. Clear boundary,

Site Description – Site 13				
Site Reference	13	**ASC Name**	Eutrophic Subnatric Brown Sodosol (BELOWNR)	
Average Slope	4%	**Land Use**	Fodder Cropping	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Mid Slope	**Drainage**	Imperfect	X: 737836
Surface Condition	Soft	**Permeability**	Moderate	Y: 6443694

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.15**	Brown (Munsell 10YR 4/3) Sandy Loam with weak pedality, earthy fabric and weak consistence. Moderately acidic pH, non-saline and non-sodic. No coarse fragments. Many roots and well drained. Gradual boundary.
A2	**0.15 – 0.35**	Brown (Munsell 10YR 4/3) Sandy Loam with weak pedality, earthy fabric and weak consistence. Strongly acidic pH, non-saline and non-sodic. No coarse fragments. Many roots and well drained. Clear boundary.
B2	**0.35 +**	Light olive brown (Munsell 2.5Y 5/6) Heavy Clay with moderate pedality, rough fabric and moderate consistence. Neutral pH, non-saline and sodic. No coarse fragments. Trace roots and imperfectly drained. 10% orange mottling. 10% grey mottling.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.9	Non-saline	5.6	Moderately Acidic	1.2	Non sodic
0.20 – 0.30	0.9	Non-saline	5.3	Strongly Acidic	2.3	Non sodic
0.50 – 0.60	0.3	Non-saline	7.0	Neutral	7.3	Sodic

Site Description – Site 14				
Site Reference	14	**ASC Name**	Eutrophic Subnatric Brown Sodosol (BELOWNR)	
Average Slope	2%	**Land Use**	Fodder Cropping	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 55
Landform Element	Lower Slope	**Drainage**	Imperfect	X: 736912
Surface Condition	Soft	**Permeability**	Moderate	Y: 6443725

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.20**	Brown (Munsell 10YR 4/3) Sandy Loam with weak pedality, earthy fabric and weak consistence. Neutral pH, non-saline and non-sodic. No coarse fragments. Many roots and well drained. Gradual boundary.
A2	**0.20 – 0.35**	Bleached light grey (Munsell 10YR 7/2) apedal Sandy Loam with sandy fabric. No coarse fragments. Many roots and well drained. Abrupt boundary.
B2	**0.35 +**	Yellowish brown (Munsell 10YR 5/6) Medium Clay with moderate pedality, rough fabric and moderate consistence. Neutral pH, non-saline and sodic. No coarse fragments. No roots and imperfectly drained. 20% grey mottling.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.5	Non-saline	7.2	Neutral	1.4	Non sodic
0.40 – 0.50	0.4	Non-saline	6.8	Neutral	8.2	Sodic

Appendix 3

Laboratory Certificates of Analysis

GRAIN SIZE ANALYSIS (hydrometer and sieving techniques)

15 soil samples supplied by Minesoils Pty. Ltd. on 27th May, 2024 - Lab Job No. R4664
Analysis requested by Matt Hemingway. Job ref: **MS145 Birriwa**
PO Box 11034 TAMWORTH NSW 2340

SAMPLE ID	Lab Code	MOISTURE CONTENT (% of water in sample)	TOTAL GRAVEL > 2 mm (% of total oven-dry equivalent)	GRAVEL > 4.75 mm (% of total oven-dry equivalent)	GRAVEL 2.00-4.75 mm (% of total oven-dry equivalent)	COARSE SAND 200-2000 µm (0.2-2.0 mm) (% of total oven-dry equivalent)	FINE SAND 20-200 µm (0.02-0.2 mm) (% of total oven-dry equivalent)	SILT 2-20 µm (% of total oven-dry equivalent)	CLAY < 2 µm (% of total oven-dry equivalent)
1 0 - 10	R4664/1	14.1%	19.6%	1.5%	18.1%	39.1%	16.9%	6.9%	17.5%
1 30 - 40	R4664/2	14.7%	2.1%	0.0%	2.1%	25.0%	14.1%	8.8%	49.9%
1 60 - 70	R4664/3	11.0%	1.7%	0.0%	1.7%	25.0%	18.8%	10.8%	43.7%
4 0 - 190	R4664/4	8.3%	9.7%	2.7%	7.1%	36.3%	36.4%	10.3%	7.2%
4 25 - 35	R4664/5	5.7%	9.7%	2.4%	7.3%	41.8%	32.2%	10.0%	6.4%
4 55 - 65	R4664/6	13.3%	2.4%	0.0%	2.4%	25.5%	29.2%	1.3%	41.6%
8 0 - 10	R4664/7	6.2%	9.8%	1.8%	7.9%	57.1%	25.7%	1.3%	6.2%
8 30 - 40	R4664/8	6.0%	18.8%	4.5%	14.3%	54.0%	20.5%	0.7%	6.1%
8 50 - 60	R4664/9	7.6%	8.6%	2.0%	6.6%	43.7%	29.0%	4.9%	13.8%
8 80 - 90	R4664/10	9.9%	7.9%	1.9%	6.0%	18.6%	54.3%	0.5%	18.8%
13 0 -10	R4664/11	8.6%	12.8%	7.2%	5.6%	44.7%	30.1%	2.7%	9.7%
13 20 -30	R4664/12	7.4%	17.2%	8.5%	8.7%	42.4%	26.3%	5.9%	8.2%
13 50 - 60	R4664/13	17.5%	0.8%	0.0%	0.8%	17.8%	20.1%	2.2%	59.2%
14 0 - 10	R4664/14	5.3%	3.0%	0.0%	3.0%	51.2%	32.8%	4.4%	8.6%
14 40 - 50	R4664/15	15.2%	3.2%	0.0%	3.2%	24.7%	20.5%	3.4%	48.1%

Note:

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

2: Australian Standard 1289.3.8.1-1997 (see attached)

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

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

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

6. This report was issued on 13/6/2024.

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

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AGRICULTURAL SOIL ANALYSIS REPORT

15 samples supplied by Minesoils Pty. Ltd. on 27/05/2024. Lab Job No.R4664
Analysis requested by Matt Hemingway. Your Job: MS145 Birriwa
PO Box 11034 TAMWORTH NSW 2340

		Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
	Sample ID:	1 0 - 10	1 30 - 40	1 60 - 70	4 0 - 190	4 25 - 35
	Crop:	N/G	N/G	N/G	N/G	N/G
	Client:	EMM	EMM	EMM	EMM	EMM
Parameter	Method reference	R4664/1	R4664/2	R4664/3	R4664/4	R4664/5
pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.60	5.75	5.64	5.85	6.05
Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.065	0.032	0.024	0.044	0.019
Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	5.4	3.1	2.4	0.87	0.64
Exchangeable Calcium (kg/ha)		2,425	1,413	1,076	391	287
Exchangeable Calcium (mg/kg)		1,082	631	480	175	128
Exchangeable Magnesium (cmol+/kg)		2.7	3.5	4.8	0.38	0.23
Exchangeable Magnesium (kg/ha)		735	966	1,312	103	63
Exchangeable Magnesium (mg/kg)		328	431	586	46	28
Exchangeable Potassium (cmol+/kg)		1.7	0.92	0.36	0.63	0.29
Exchangeable Potassium (kg/ha)		1,485	805	312	556	255
Exchangeable Potassium (mg/kg)		663	360	139	248	114
Exchangeable Sodium (cmol+/kg)		0.12	<0.065	0.11	<0.065	<0.065
Exchangeable Sodium (kg/ha)		63	<33	56	<33	<33
Exchangeable Sodium (mg/kg)		28	<15	25	<15	<15
Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.02	0.80	0.70	0.16	0.08
Exchangeable Aluminium (kg/ha)		4.7	162	142	32	15
Exchangeable Aluminium (mg/kg)		2.1	72	63	14	6.9
Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	0.24	0.31	0.11	0.23
Exchangeable Hydrogen (kg/ha)		<1	5.5	7.0	2.5	5.1
Exchangeable Hydrogen (mg/kg)		<1	2.4	3.1	1.1	2.3
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	9.9	8.7	8.7	2.2	1.5
Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	54	36	28	40	42
Magnesium (%)		27	41	55	17	15
Potassium (%)		17	11	4.1	29	19
Sodium - ESP (%)		1.2	0.65	1.2	2.1	2.7
Aluminium (%)		0.24	9.2	8.1	7.3	5.1
Hydrogen (%)		0.00	2.8	3.6	5.2	15
Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	2.0	0.89	0.50	2.3	2.8
Emerson Aggregate Test (EAT)	**AS1289.3.8.1-2017	..	4 (Calcite present)	..	..	..
Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	7.5YR 2.5/3 Very Dark Brown	5YR 3/4 Reddish Brown	10YR 5/4 Yellowish Brown	10YR 4/3 Brown	10YR 5/3 Brown
Mottles Munsell Colour		..	10YR 2/1	5YR 4/6	..	..
Degree of Mottling (%)		..	7	50	..	..

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AGRICULTURAL SOIL ANALYSIS REPORT

15 samples supplied by Minesoils Pty. Ltd. on 27/05/2024. Lab Job No.R4664

Analysis requested by Matt Hemingway. Your Job: MS145 Birriwa

PO Box 11034 TAMWORTH NSW 2340

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Sample ID:	1 0 - 10	1 30 - 40	1 60 - 70	4 0 - 190	4 25 - 35
Crop:	N/G	N/G	N/G	N/G	N/G
Client:	EMM	EMM	EMM	EMM	EMM

Parameter	Method reference	R4664/1	R4664/2	R4664/3	R4664/4	R4664/5

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwood.
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013,
   Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil results'.
10. Conversions for 1 cmol$_+$/kg = 230 mg/kg Sodium, 390 mg/kg Potassium,
    122 mg/kg Magnesium, 200 mg/kg Calcium
11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimate
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17. This report was issued on 7/06/2024.

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

Quality Checked: Kris Saville
Agricultural Co-Ordinator

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			Sample 6	Sample 7	Sample 8	Sample 9	Sample 10
		Sample ID:	4 55 - 65	8 0 - 10	8 30 - 40	8 50 - 60	8 80 - 90
		Crop:	N/G	N/G	N/G	N/G	N/G
		Client:	EMM	EMM	EMM	EMM	EMM
	Parameter	Method reference	R4664/6	R4664/7	R4664/8	R4664/9	R4664/10
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	7.00	5.80	5.58	7.16	6.48
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.048	0.045	0.031	0.025	0.031
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	2.7	1.2	0.78	2.8	2.4
	Exchangeable Calcium (kg/ha)		1,220	529	351	1,255	1,083
	Exchangeable Calcium (mg/kg)		545	236	157	560	483
	Exchangeable Magnesium (cmol+/kg)		6.4	0.49	0.15	1.9	2.6
	Exchangeable Magnesium (kg/ha)		1,755	133	41	509	714
	Exchangeable Magnesium (mg/kg)		784	59	18	227	319
	Exchangeable Potassium (cmol+/kg)		0.33	0.48	0.29	0.17	0.14
	Exchangeable Potassium (kg/ha)		288	416	255	149	127
	Exchangeable Potassium (mg/kg)		129	186	114	67	57
	Exchangeable Sodium (cmol+/kg)		0.84	<0.065	<0.065	0.27	0.39
	Exchangeable Sodium (kg/ha)		430	<33	<33	137	198
	Exchangeable Sodium (mg/kg)		192	<15	<15	61	89
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.02	0.11	0.26	0.02	0.05
	Exchangeable Aluminium (kg/ha)		3.7	22	51	3.4	11
	Exchangeable Aluminium (mg/kg)		1.6	10	23	1.5	4.9
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	0.75	0.95	<0.01	0.03
	Exchangeable Hydrogen (kg/ha)		<1	17	21	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	7.5	9.5	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	10	3.1	2.5	5.1	5.7
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	26	38	32	55	43
	Magnesium (%)		62	16	6.1	37	46
	Potassium (%)		3.2	15	12	3.3	2.6
	Sodium - ESP (%)		8.1	1.9	1.3	5.2	6.8
	Aluminium (%)		0.18	3.6	10	0.33	0.96
	Hydrogen (%)		0.00	25	39	0.00	0.56
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	0.42	2.4	5.2	1.5	0.92
	Emerson Aggregate Test (EAT)	**AS1289.3.8.1-2017	2	..	..	2	..
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	10YR 5/2 Grayish Brown	10YR 3/4 Dark Yellowish Brown	10YR 4/4 Dark Yellowish Brown	2.5Y 5/4 Light Olive Brown	2.5Y 6/4 Light Yellowish Brown
	Mottles Munsell Colour		10YR 5/6 2.5YR 2.5/4 Yellowish Brown Reddish Brown	.. ..	.. ..	2.5Y 7/1 Light Gray	7.5YR 4/6 10YR 2/1 Strong Brown Black
	Degree of Mottling (%)		30, 3	..	..	10	50, 2

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AGRICULTURAL SOIL ANALYSIS REPORT

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Analysis requested by Matt Hemingway. Your Job: MS145 Birriwa

PO Box 11034 TAMWORTH NSW 2340

		Sample 6	Sample 7	Sample 8	Sample 9	Sample 10
	Sample ID:	4 55 - 65	8 0 - 10	8 30 - 40	8 50 - 60	8 80 - 90
	Crop:	N/G	N/G	N/G	N/G	N/G
	Client:	EMM	EMM	EMM	EMM	EMM
Parameter	Method reference	R4664/6	R4664/7	R4664/8	R4664/9	R4664/10

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwood.
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil results'.
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11. Conversions to kg/ha = mg/kg x 2.24
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Analysis requested by Matt Hemingway. Your Job: MS145 Birriwa
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			Sample 11	Sample 12	Sample 13	Sample 14	Sample 15
		Sample ID:	13 0 -10	13 20 -30	13 50 - 60	14 0 - 10	14 40 - 50
		Crop:	N/G	N/G	N/G	N/G	N/G
		Client:	EMM	EMM	EMM	EMM	EMM
	Parameter	Method reference	R4664/11	R4664/12	R4664/13	R4664/14	R4664/15
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.60	5.32	7.04	7.24	6.82
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.061	0.067	0.045	0.033	0.058
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	1.1	0.80	4.4	3.3	4.8
	Exchangeable Calcium (kg/ha)		509	359	1,992	1,502	2,176
	Exchangeable Calcium (mg/kg)		227	160	889	671	971
	Exchangeable Magnesium (cmol+/kg)		0.21	0.18	6.9	0.31	5.9
	Exchangeable Magnesium (kg/ha)		56	50	1,868	85	1,616
	Exchangeable Magnesium (mg/kg)		25	22	834	38	721
	Exchangeable Potassium (cmol+/kg)		0.53	0.26	0.22	0.15	0.21
	Exchangeable Potassium (kg/ha)		462	229	191	134	186
	Exchangeable Potassium (mg/kg)		206	102	85	60	83
	Exchangeable Sodium (cmol+/kg)		<0.065	<0.065	0.91	<0.065	0.99
	Exchangeable Sodium (kg/ha)		<33	<33	467	<33	509
	Exchangeable Sodium (mg/kg)		<15	<15	208	<15	227
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.19	0.21	0.02	0.03	0.02
	Exchangeable Aluminium (kg/ha)		39	43	4.8	6.3	4.6
	Exchangeable Aluminium (mg/kg)		17	19	2.1	2.8	2.0
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.09	0.07	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		2.0	1.7	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	2.2	1.6	12	3.9	12
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	52	51	36	86	40
	Magnesium (%)		9.5	12	55	8.0	49
	Potassium (%)		24	17	1.8	3.9	1.8
	Sodium - ESP (%)		1.2	2.3	7.3	1.4	8.2
	Aluminium (%)		8.8	14	0.19	0.80	0.19
	Hydrogen (%)		4.1	4.8	0.00	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	5.5	4.4	0.65	11	0.82
	Emerson Aggregate Test (EAT)	**AS1289.3.8.1-2017	..	..	2	..	4 (Calcite present)
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	10YR 4/3 Brown	10YR 4/3 Brown	2.5Y 5/6 Light Olive Brown	10YR 4/3 Brown	10YR 5/6 Yellowish Brown
	Mottles Munsell Colour		..	..	2.5Y 6/2 2.5Y 4/2 5YR 4/6	..	2.5Y 6/2 2.5YR 4/4
	Degree of Mottling (%)		..	..	Light Brownish Gray Dark Grayish Brown Yellowish Red 40, 7	..	Light Brownish Gray Reddish Brown 40, 5

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15 samples supplied by Minesoils Pty. Ltd. on 27/05/2024. Lab Job No.R4664

Analysis requested by Matt Hemingway. Your Job: MS145 Birriwa

PO Box 11034 TAMWORTH NSW 2340

		Sample 11	Sample 12	Sample 13	Sample 14	Sample 15
	Sample ID:	13 0 -10	13 20 -30	13 50 - 60	14 0 - 10	14 40 - 50
	Crop:	N/G	N/G	N/G	N/G	N/G
	Client:	EMM	EMM	EMM	EMM	EMM
Parameter	Method reference	R4664/11	R4664/12	R4664/13	R4664/14	R4664/15

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwood.
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil results'.
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11. Conversions to kg/ha = mg/kg x 2.24
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			Heavy Soil	Medium Soil	Light Soil	Sandy Soil
		Sample ID:				
		Crop:				
		Client:	Clay	Clay Loam	Loam	Loamy Sand
	Parameter	Method reference	Indicative guidelines - refer to Notes 6 and 8			
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.5	6.5	6.3	6.3
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.200	0.150	0.120	0.100
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	15.6	10.8	5.0	1.9
	Exchangeable Calcium (kg/ha)		7000	4816	2240	840
	Exchangeable Calcium (mg/kg)		3125	2150	1000	375
	Exchangeable Magnesium (cmol+/kg)		2.4	1.7	1.2	0.60
	Exchangeable Magnesium (kg/ha)		650	448	325	168
	Exchangeable Magnesium (mg/kg)		290	200	145	75
	Exchangeable Potassium (cmol+/kg)		0.60	0.50	0.40	0.30
	Exchangeable Potassium (kg/ha)		526	426	336	224
	Exchangeable Potassium (mg/kg)		235	190	150	100
	Exchangeable Sodium (cmol+/kg)		0.3	0.26	0.22	0.11
	Exchangeable Sodium (kg/ha)		155	134	113	57
	Exchangeable Sodium (mg/kg)		69	60	51	25
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.6	0.5	0.4	0.2
	Exchangeable Aluminium (kg/ha)		121	101	73	30
	Exchangeable Aluminium (mg/kg)		54	45	32	14
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.6	0.5	0.4	0.2
	Exchangeable Hydrogen (kg/ha)		13	11	8	3
	Exchangeable Hydrogen (mg/kg)		6	5	4	2
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	20.1	14.3	7.8	3.3
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	77.6	75.7	65.6	57.4
	Magnesium (%)		11.9	11.9	15.7	18.1
	Potassium (%)		3.0	3.5	5.2	9.1
	Sodium - ESP (%)		1.5	1.8	2.9	3.3
	Aluminium (%)		6.0	7.1	10.5	12.1
	Hydrogen (%)					
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	6.5	6.4	4.2	3.2
	Emerson Aggregate Test (EAT)	**AS1289.3.8.1-2017	Class 3–8			
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	..			
	Mottles Munsell Colour		..			
	Degree of Mottling (%)		..			

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Analysis requested by Matt Hemingway. Your Job: MS145 Birriwa

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

Notes:

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