Transgrid

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Environmental Impact Statement

EnergyConnect (NSW – Eastern Section)

Technical paper 4 – Agricultural land impact assessment

Tremain Ivey Advisory
Agricultural Consultants

Technical Paper 4 – Agricultural Impact Assessment

EnergyConnect (NSW – Eastern Section)

Final Report

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Contents

Contents (continued)

Tables

Figures

Attachments

Executive summary

Background

Transgrid (electricity transmission operator in New South Wales (NSW)) and ElectraNet (electricity transmission operator in South Australia (SA)) are seeking regulatory and environmental planning approval for the construction and operation of a new High Voltage (HV) interconnector between NSW and SA, with an added connection to north-west Victoria. Collectively, the proposed interconnector is known as EnergyConnect.

The proposal, focusing on the eastern section of EnergyConnect in NSW, would include the construction and operation of new high voltage transmission lines between the existing Buronga substation and existing Wagga Wagga substation, a new 330kV substation (referred to as the proposed Dinawan 330kV substation), upgrade and expansion of the existing Wagga Wagga substation as well as other ancillary infrastructure.

This report assesses the agricultural impacts of the EnergyConnect (NSW – Eastern Section).

The report addresses portions of the Secretary's Environmental Assessment Requirements ('SEARs'), as described in Section 1.4.1.

Methodology

The methodology for the agricultural impact assessment included the following:

- review of the legislation and policy context for assessing agricultural impacts;
- landowner consultations and property inspections;
- analysis and description of the existing environment based on statistics, spatial data, satellite images, property inspections and consultations;
- assessment of impacts on agriculture (including biosecurity impacts) based on satellite images, property inspections, consultations and professional knowledge of agricultural industries and the agricultural study area; and
- provision of mitigation and management measures, based on property inspections, consultations, design information and professional knowledge.

Existing environment

General

The agricultural study area varies from relatively flat dune fields and sand plains in the west to the alluvial Riverine Plains through central areas, and undulating land of low relief in the east.

Rainfall in the study area has low to moderate variability and ranges from an average annual total of approximately 290 millimetres around Buronga to 570 millimetres in the Wagga Wagga area.

Most soils have low to moderate inherent fertility with a general trend to higher fertility in the east of the agricultural study area.

Land and soil capability (LSC) classes 5 and 7 are prevalent west of the Cobb Highway, while further east higher capability land such as classes 3 and 4 become more common.

Land use and agricultural productivity

Agricultural land uses are predominant with livestock, cropping and horticultural enterprises together comprising around 93 per cent of the agricultural study area. The vast majority of the area west of the Urana area is used for grazing livestock, while mixed dryland cropping and livestock grazing dominates in the east. Sheep and cattle account for almost all grazing livestock.

The total gross value of agricultural production across the nine local government areas (LGAs) which include the agricultural study area averaged $208 per hectare in 2015-16. However, this varies from approximately $15,200 per hectare for horticulture production and $733 per hectare for broadacre cropping, to $89 per hectare for grazing production. The value of agricultural production also varies geographically from an average of $71 per hectare in the western LGAs of Wentworth and Balranald to $610 per hectare in the four most easterly LGAs.

Impact assessment

The construction and operation phases of the proposal would have similar agricultural impacts. However, in most cases the potential and expected impacts are greater in the construction phase due to higher activity and a larger impact footprint.

Land use and capability impacts

The potential impact of any disruption to agricultural enterprises caused by the proposal would be limited by the relatively small area permanently and directly affected, the continuation of agricultural enterprises over most of the agricultural study area, and the planned mitigation measures.

The agricultural study area would cover a small fraction of the total existing agricultural land across the nine LGAs which are covered by the agricultural study area. Therefore, the impacts of the proposal on existing agricultural enterprises would be minimal.

Biosecurity

The potential spread of weeds by vehicles, machinery, personnel, soil movements or water movements is the highest priority biosecurity risk. The introduction of plant disease or pests is also a relevant biosecurity risk.

Other potential impacts

Other potential impacts include the temporarily restricted movements, disruptions to cropping aerial agriculture and irrigation operations, effect of noise on livestock, radiocommunication and GPS interference and fire risks. However, the impacts are expected to be relatively small and would have minor effect on productivity. The potential for these impacts have also been considered in more detail in separate technical impact assessments undertaken to support the proposal.

Mitigation and management measures

The mitigation measures for the construction and operation phases of the proposal are summarised in Section 8.

Acronyms and abbreviations

ABS	Australian Bureau of Statistics
Agricultural study area	The study area for this assessment, which comprises a four kilometre wide corridor between the existing Buronga substation and the existing Wagga Wagga substation. It encompasses the indicative disturbance area and proposed alignment of the transmission line, which has been applied to identify the constraints nearby to the proposal which may or may not be indirectly impacted by the proposal. Proposed access tracks would be located within the agricultural study area.
AIA	Agricultural Impact Assessment for the proposal – this report
ALC	Agricultural Land Classification system (see Hulme et al 2002)
ANO	Authorised Network Operator
BoM	Bureau of Meteorology
brake/winch sites	A brake and winch site is a temporarily cleared area where plant and equipment is located for the purposes of spooling and winching a conductor into place on erected transmission line structures along a transmission line easement. Dependent upon the angle of line deviation, the location of the brake and winch site at that angle may or may not be within the nominated transmission line easement. The brake and winch site is only required for the construction phase of the proposal. It does not need to be maintained for ongoing operation and / or maintenance of the transmission line.
BSAL	Biophysical strategic agricultural land
CEMP	Construction environmental management plan
Commonwealth	Reference to the Commonwealth of Australia such as Commonwealth land or Commonwealth legislation

Construction impact area	Refers to the area that would be directly impacted by construction of the proposal, comprising the following: • construction of all proposal infrastructure elements (including the proposed transmission line alignment, transmission line easement, substation site works (at both the proposed Dinawan 330kV and upgraded and expanded Wagga Wagga substations), optical repeater infrastructure, and other ancillary works) • locations for construction elements such as construction compounds and accommodation camps, access tracks (excluding public roads proposed to be used for access routes), site access points, water supply points, laydown and staging areas, concrete batching plants, brake/winch sites and site offices. The area is identified based on realistic project component locations and areas however it is indicative at this stage. The area would be confirmed during finalisation of the design and construction methodology and would be developed as part of the consideration of avoidance and impact minimisation. This area includes the operational impact area, including areas required for maintenance (refer to definition below).
CTF	Controlled traffic farming
DPE	Former (NSW) Department of Planning and Environment
DPI	(NSW) Department of Primary Industries
DPIE	(NSW) Department of Planning, Industry and Environment (formerly DPE)
EIS	Environmental Impact Statement
EnergyConnect	An electrical interconnector of around 900 kilometres between the electricity grids of South Australia and New South Wales, with an added connection to north west Victoria. In NSW, EnergyConnect comprises two sections – Western Section (which has been the subject of a separate environmental assessment and approval) and the Eastern Section (the proposal, the subject of this EIS).
EP&A Act	(NSW) *Environmental Planning and Assessment Act 1979*
EPBC Act	(Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999*
GPS	Global positioning system
HV	High voltage
Impacted LGAs	The nine local government areas (LGAs) of Wentworth, Balranald, Murray River, Edward River, Hay, Murrumbidgee, Federation, Lockhart Shire and Wagga Wagga through which the proposal would pass.
LGA	Local government area

LLS	Local Land Services – A NSW Government agency.
LSC	Land and Soil Capability assessment scheme (see OEH 2012)
NEM	National Electricity Market
NRM	National Resource Management (nrmregionsaustralia.com.au)
NSW	New South Wales
OEH	Former (NSW) Office of Environment and Heritage.
OJD	Ovine Johne's disease
operational impact area	Refers to the area that would be directly impacted by permanent components of the proposal, including all proposed infrastructure elements such as the proposed transmission line easement, transmission line and transmission towers, any new or upgraded substation infrastructure, optical repeater sites and permanent access tracks.
(the) proponent	The proposal is proposed to be undertaken by NSW Electricity Networks Operations Pty Ltd as a trustee for NSW Electricity Operations Trust (referred to as Transgrid). Transgrid is the operator and manager of the main high voltage (HV) transmission network in NSW and the Australian Capital Territory (ACT), and is the Authorised Network Operator (ANO) for the purpose of an electricity transmission or distribution network under the provisions of the *Electricity Network Assets (Authorised Transactions) Act 2015*.
(the) proposal	The proposal is known as 'EnergyConnect (NSW – Eastern Section)' as described in Section 0 of this document.
Rural SEPP	*State Environmental Planning Policy (Primary Production and Rural Development) 2019*
SA	South Australia
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SSI	State Significant Infrastructure
stock units	In this assessment, one sheep or goat is equated to one stock unit and cattle are equated to ten stock units each
TIA	Tremain Ivey Advisory
transmission line easement	An area surrounding and including the transmission lines, which is a legal right allowing for construction of the transmission line, along with ongoing access and maintenance of the lines and will be acquired from landholders either by agreement or pursuant to compulsory acquisition process. The easement width would be 80 metres wide.

WHS	Work health and safety
WSP	WSP Australia Pty Ltd (principal EIS consultant for the proposal)

1 Introduction

1.1 Proposal context and overview

Transgrid (electricity transmission operator in New South Wales (NSW)) and ElectraNet (electricity transmission operator in South Australia (SA)) are seeking regulatory and environmental planning approval for the construction and operation of a new High Voltage (HV) interconnector between NSW and SA, with an added connection to north west Victoria. Collectively, the proposed interconnector is known as EnergyConnect.

EnergyConnect aims to reduce the cost of providing secure and reliable electricity transmission between NSW and SA in the near term, while facilitating the longer-term transition of the energy sector across the National Electricity Market (NEM) to low emission energy sources.

EnergyConnect has been identified as a priority transmission project in the NSW Transmission Infrastructure Strategy (NSW Department of Planning and Environment (DPE) 2018), linking the SA and NSW energy markets and would assist in transporting energy from the South-West Renewable Energy Zone to major demand centres.

EnergyConnect comprises several sections (shown on Figure 1-1) that would be subject to separate environmental planning approvals under the relevant jurisdictions. It includes:

- NSW sections including:
    - Western section, which would extend from:
        - the SA/NSW border (near Chowilla in SA) to Transgrid's existing Buronga substation and
        - Buronga substation to the NSW/Victoria border at Monak (near Red Cliffs in Victoria), and
    - Eastern section, which would extend from the Buronga substation to the existing Wagga Wagga substation, and
- A Victorian section, which would extend from the NSW/Victoria border to Red Cliffs substation, and
- A SA section, which would extend from Robertstown to the SA/NSW border.
- Transgrid is currently seeking planning approval for the NSW – Eastern Section (the proposal), which is the subject of this EIS.

Transgrid has previously sought and received separate environmental planning approvals for the NSW – Western Section of EnergyConnect and Victorian Section. ElectraNet is responsible for obtaining environmental planning approval for the section of EnergyConnect located in SA.

1.1.1 Proposal objectives

The primary objective for EnergyConnect (which the proposal comprises an extensive component of) is to reduce the cost of electricity by providing secure electricity transmission between NSW and SA in the near term and facilitate the longer-term transition of the energy sector across the NEM to low emission energy generation sources. More specifically, EnergyConnect (including the proposal) aims to:

- lower power prices
- improve energy security
- increase economic activity
- support the transition to a lower carbon emission energy system
- support a greater mix of renewable energy in the NEM.

Figure 1-1: Overview of EnergyConnect

1.2 The proposal

Transgrid is seeking approval under Division 5.2, Part 5 of the *Environmental Planning and Assessment Act 1979* (the EP&A Act) to construct and operate the proposal. The proposal has been declared as Critical State Significant Infrastructure under Section 5.13 of the EP&A Act.

The proposal was also declared a controlled action on 30 September 2020 and requires a separate approval under the (Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999*. The proposal is subject to the bilateral assessment process that has been established between the Australian and NSW governments.

1.3 Proposal overview

1.3.1 Agricultural study area

The agricultural study area comprises a generally four kilometre wide corridor between the Buronga substation and the Wagga Wagga substation. It traverses around 540 kilometres in total. The agricultural study area has been applied to identify the constraints nearby to the proposal which may or may not be indirectly impacted by the proposal from an agricultural perspective. Nominated access tracks would also be located within the agricultural study area.

The agricultural study area is located in regional NSW across a number of local government areas (LGAs), comprising the following: Wentworth Shire; Balranald Shire; Murray River; Edward River; Hay Shire; Murrumbidgee; Federation; Lockhart Shire; and Wagga Wagga LGAs.

1.3.2 Key proposal features

The key components of the proposal include:

- about 375 kilometres of new 330 kilovolt (kV) double circuit transmission line and associated infrastructure between the Buronga substation and the proposed Dinawan 330kV substation
- connection of the proposed transmission lines to the existing Buronga 330kV substation
- construction of a new 330kV substation around 30 kilometres south of Coleambally, referred to as the proposed Dinawan 330kV substation
- connection of the proposed transmission lines to the proposed Dinawan substation
- about 162 kilometres of new 500 kilovolt (kV) double circuit transmission line and associated infrastructure between the proposed Dinawan substation and the existing Wagga Wagga substation at Wagga Wagga, NSW
- upgrade and expansion of the Wagga Wagga substation to accommodate the new transmission line connections including the installation of new line bays, relocation and upgrade of existing bays and associated electrical and civil works (road, kerb, gutter, drainage works and earthworks)
- provision of three optical repeater structures and associated connections to existing local electrical supplies
- new and/or upgrade of access tracks as required
- ancillary works required to facilitate the construction of the proposal (e.g. laydown and staging areas, concrete batching plants, brake/winch sites, site offices and accommodation camps).

An overview of the proposal is provided in Figure 1-2 (page 5). Further detail on the key infrastructure components of the proposal and construction activities are provided in Chapter 5 and Chapter 6 of the Environmental Impact Statement (EIS), respectively.

1.3.3 Construction

Key construction works

Key construction works for the proposal would typically include (but not be limited to):

- site establishment works, which may include (but not be limited to):
  - establishment of construction compound and accommodation sites, access tracks and service relocations
  - vegetation clearance
  - transportation of equipment such as steelwork, high voltage plant, switchgear, between dock and site as part of the construction works
- ancillary works to facilitate the construction of the proposal (e.g. intermediate laydown and staging areas, concrete batching plants, brake/winch sites, site offices and accommodation camps)
- construction of the proposed transmission lines, which would include (but not be limited to):
  - access tracks to accommodate safe access of construction machinery and materials to each transmission line structure site
  - earthworks (including establishment of construction pads) and the construction of footings and foundations for each transmission line structure
  - erection of the new transmission line structures using crane(s) and or helicopter(s)
  - stringing of the conductors and overhead earth wires and optical ground wire
  - installation of earthing conductors
  - testing and commissioning of the transmission lines
- construction of the proposed Dinawan 330kV substation, which would include (but not be limited to):
  - civil construction works including earthworks
  - slab construction at the new substation site
  - electrical fit out with new substation equipment;
  - testing and commissioning of the new substation equipment
- upgrade and expansion of the existing Wagga Wagga substation to enable the proposed connection and operation of the new transmission lines which would include (but not be limited to):
  - civil construction works including earthworks and slab construction at the expanded substation site;
  - electrical fit out with new substation equipment;
  - testing and commissioning of the new substation equipment;
  - connection of the proposed transmission lines to the Buronga substation
- connection of the proposed transmission lines to the Buronga substation
- demobilisation and remediation of areas disturbed by construction activities.

A detailed description of construction works for the proposal is further described in Chapter 6 of the Environmental Impact Statement (EIS).

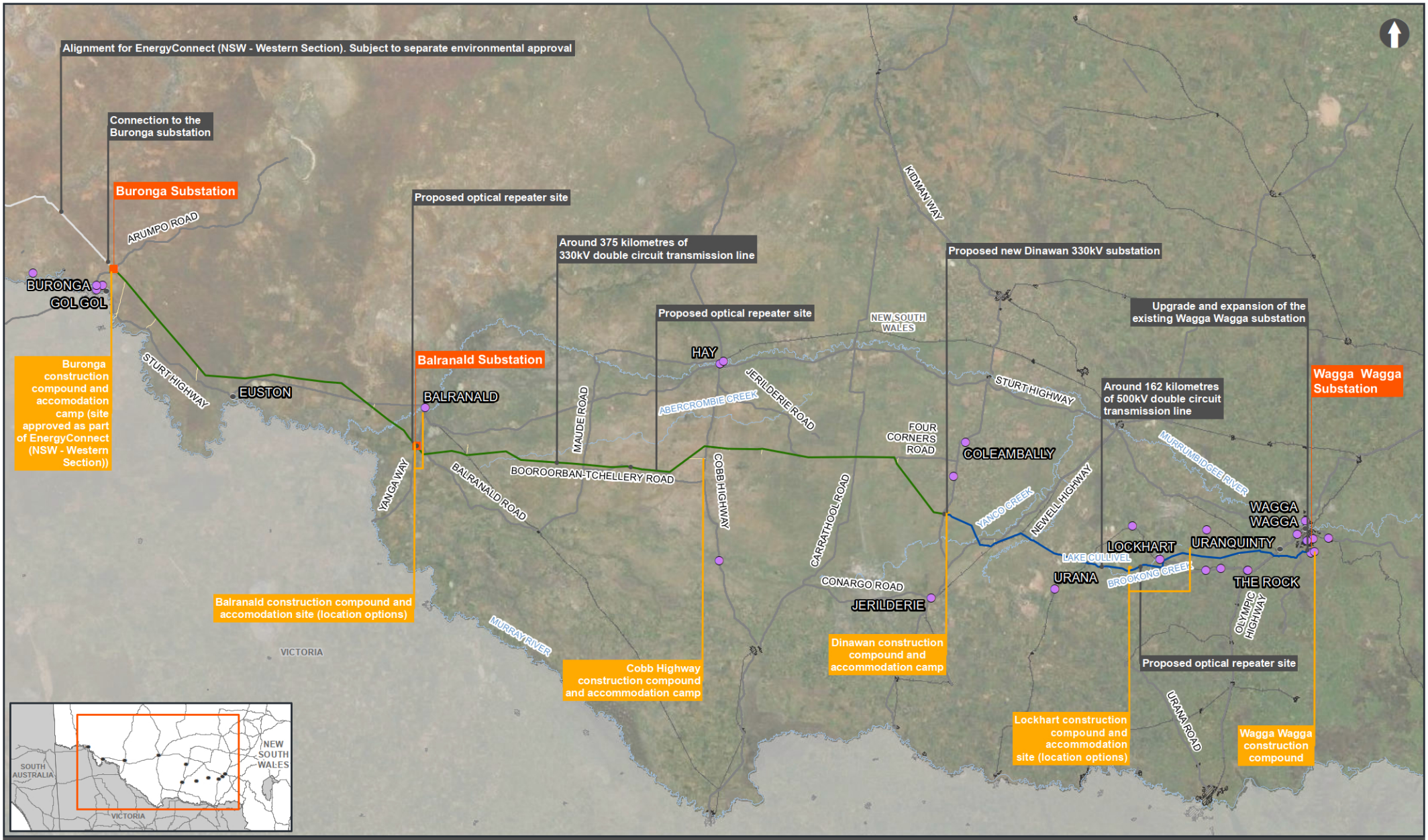

Figure 1-2

Proposal Overview - EnergyConnect (NSW - Eastern section)

Construction program

Construction of the proposal would commence in late-2022 (enabling works phase), subject to NSW Government and Commonwealth planning approvals.

The construction of the transmission lines and substation facilities would take around 18 months. The upgraded Wagga Wagga substation and new Dinawan 330kV substation are expected to be operational by late-2024. Site decommissioning and remediation would extend around six months beyond the commissioning (operational) phase, with estimated completion in mid-2025.

The final program would be confirmed following approval of the proposal.

Indicative duration of transmission line construction activities

Construction at each transmission line structure would be intermittent and construction activities would not occur for the full duration at any one location. Figure 1-3 presents an indicative duration of construction activities associated with the transmission line structures. These durations could vary and breaks between activities may be shorter which may lead to longer inactive periods in subsequent stages of construction at an individual transmission line structure. Durations of any particular construction activity, and respite periods, may vary for a number of reasons including (but not limited to), multiple work fronts, resource and engineering constraints, works sequencing and location.

These activities would also have multiple work fronts, therefore (for example) foundation works or tower erection would be occurring in several locations along the easement at the same time.

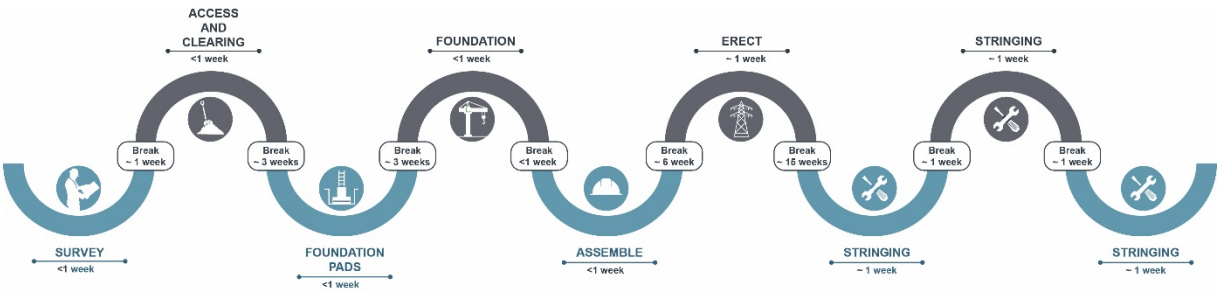

Figure 1-3: Indicative duration of construction activities at transmission line structures

1.4 Purpose of this technical report

This technical paper is one of a number of technical papers that form part of the EIS for the proposal.

The purpose of this technical paper is to identify and assess the potential impacts of the proposal in relation to agriculture. It responds directly to the Secretary's environmental assessment requirements (SEARs) (refer to Section 1.4.1).

This report has the following objectives:

- Describe the current socio-economic and environmental situation relevant to agricultural enterprises in the study area.
- Assess the impacts of the proposal on agriculture in the study area and in the surrounding region.
- Formulate mitigation and management measures to minimise the impacts on agriculture in the study area and in the surrounding region.

1.4.1 Secretary's environmental assessment requirements

The NSW Department of Planning, Industry and Environment (DPIE) has provided the SEARs for the EIS. The requirements specific to this assessment and where these aspects are addressed in this technical report are outlined in Table 1.1.

Table 1.1
Secretary's Environmental Assessment Requirements

Land, and Social and Economic

Reference	Requirement	Where addressed in this document
Key Issue - Land:	An assessment of impacts of the project on soils and land capability of the site and surrounds.	Assessment of impacts of the project on soils and land capability of the site and surrounds is provided in Section 5.1 and Section 6.1 of this report.
	Assessment of impact of the project on agricultural land, Crown lands, travelling stock reserves, mineral resources and exploration licenses, rail reserves and pipeline corridors;	Assessment of impact of the proposal on agricultural land and travelling stock reserves is provided throughout Chapters 5 and 6 of this report. Assessment of impact of the proposal on travelling stock reserves is provided in Section 5.3.7. Consideration of Crown lands, mineral resources, exploration licenses, rail reserves and pipeline corridors is not within the scope of this assessment, and have been addressed elsewhere in the main EIS document.
Key Issue – Social & Economic:	Including an assessment of the social and economic impacts and benefits of the project (including the workers accommodation facility) for the region and the State as a whole, including consideration of any increase in demand for community infrastructure and services.	Potential economic impacts on agricultural operations are considered in Chapters 5, 6 and 7 of this report. Additional consideration of social and economic impacts is elsewhere in the main EIS document, the *Social Impact Assessment* (Technical paper 6) and the *Economic Impact Assessment* (Technical paper 7).

Socio-economic impacts are also addressed in Chapter 14 (Social and economic) of the EIS, and Technical Paper 6 (social impact) and Technical Paper 7 (economic impact).

The AIA partially addresses both the 'land' and 'social & economic' key issues. The parts of 'land' key issue relevant to agriculture are the impact on land capability and agricultural land. The impacts on Crown lands, mineral resources, exploration licenses, rail reserves and pipeline corridors are not within the scope of this assessment, and have been addressed elsewhere in the main EIS document.

Similarly, the economic impact associated with reduced agricultural production and increased operating costs arising from the proposal are the most relevant parts of the 'social & economic' key issue. Social impacts and general economic impacts are not within the scope of this assessment and are detailed in Technical Paper 6 (social impact) and Technical Paper 7 (economic impact).

The AIA assesses the impacts of the proposal on access; agricultural operations; livestock & machinery movements; crop production activities; biosecurity risks; work, health and safety (WHS) risks; and bush fire management. The impact on agricultural productivity is quantified, and mitigation strategies to minimise resource loss, biosecurity risks, WHS risks and other impacts are addressed.

1.5 Structure of this report

The structure and content of this report is as follows:

- *Chapter 1* – Introduction*:* Outlines the background and need for the proposal, and the purpose of this report.
- *Chapter 2 – Legislation and policy context:* Provides an outline of the key legislative requirements and policy guidelines relating to the proposal.
- *Chapter 3 – Methodology:* Provides an outline of the methodology used for the preparation of this AIA.
- *Chapter 4 – Existing environment:* Describes the existing agricultural environment.
- *Chapter* 5 – *Assessment of construction impacts:* Describes the potential construction impacts associated with the proposal.
- *Chapter 6 – Assessment of operational impacts:* Describes the potential operational impacts associated with the proposal.
- *Chapter 7 – Assessment of cumulative impacts:* Outlines the potential cumulative impacts with respect to other known developments within the vicinity of the proposal.
- *Chapter 8 – Mitigation measures:* Outlines the proposed mitigation measures for the proposal.
- *Chapter 9 – Conclusion:* Provides a conclusion on the potential impacts of the proposal on agriculture.
- *Chapter 10 – References:* Identifies the reports and documents used to generate this report.

Attachments to this report are:

- *Attachment 1 Inherent soil fertility maps*
- *Attachment 2 Land use maps*
- *Attachment 3 Land and soil capability maps*
- *Attachment 4 Other regional weeds*

1.6 Limitations

We have relied on information about the proposal's design supplied by Transgrid. We have not verified the accuracy of this information.

We have not inspected all lands or interviewed all landholders in the agricultural study area. Inspections and interviews were limited to six representative landowners across the agricultural study area as discussed further in Section 3.1.1.

2 Legislation and policy context

2.1 Legislation

The proposal is subject to environmental assessment under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Other legislation specific to the agricultural impact assessment are the *Biosecurity Act 2015,* the *Soil Conservation Act 1938* and the *State Environmental Planning Policy (Primary Production and Rural Development) 2019* (Rural SEPP). A summary of the relevance of this legislation is provided in the following sections.

2.1.1 Biosecurity Act 2015

The NSW *Biosecurity Act 2015* came into effect on 1 July 2017[1] and replaced the previous *Noxious Weeds Act 1993*. The NSW Act complements the Federal *Biosecurity Act 2015*[2]. The primary objective of the Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks. The Act is tenure neutral, that is, it applies to all lands in NSW, both public and private tenure.

The Act *defines key concepts such as biosecurity matter, carrier, biosecurity impact, biosecurity risk and pests and* specifies a wide range of prohibited matter including pests and diseases of plants (including weeds) and animals.

Under the Act, the responsibility for biosecurity risk is shared among the government, industry and the community. Specifically, the Act establishes *a general biosecurity duty*:

> *General Biosecurity Duty: 'Any person who deals with biosecurity matter or a carrier and who knows, or ought reasonably to know, the biosecurity risk posed or likely to be posed by the biosecurity matter, carrier or dealing has a biosecurity duty to ensure that, so far as is reasonably practicable, the biosecurity risk is prevented, eliminated or minimised.'*

The NSW Department of Primary Industries (DPI) holds the primary responsibility for management of biosecurity under the Act, ensuring the legislative and policy settings support best practice management of biosecurity risks. In addition, DPI works with other jurisdictions to prevent, prepare for, respond to and recover from biosecurity incursions and incidents. DPI works with a range of partners in the management of biosecurity. Significant partners include; Local Land Services (LLS)[3], local government, and industry groups (DPI 2013).

Regional biosecurity strategies developed by DPI and LLS covering the proposal impact site include the following:

- *NSW Invasive Species Plan 2018-2021* (DPI 2018);
- *Regional Strategic Weed Management Plans 2017-2022* for each of the Murray LLS, Riverina LLS and Western LLS (Murray LLS 2017, Riverina LLS 2017, Western LLS 2017); and
- *Regional Strategic Pest Animal Management Plans 2018-2023* for each of the Murray LLS, Riverina LLS and Western LLS (Murray LLS 2018, Riverina LLS 2018, Western LLS 2018).

[1] legislation.nsw.gov.au/#/view/act/2015/24

[2] legislation.gov.au/Series/C2015A00061

[3] lls.nsw.gov.au/ The proposal traverses parts of the Murray LLS, Riverina LLS and Western LLS.

The above strategies are considered in Sections 5.1.3, 6.2 and 8 of this report.

2.1.2 Soil Conservation Act 1938

The *Soil Conservation Act 1938* makes provisions for the conservation of soil resources and farm water resources, and for the mitigation of erosion.

The Act enables the Soil Conservation Commissioner to issue notices to owners or occupiers aimed at preventing soil erosion or land degradation. The notices may require the owners or occupiers to refrain actions such as the clearing of land, or may require the adoption of measures to prevent erosion.

It also enables areas to be designated as 'areas of erosion hazard'. Landholders in these areas are urged to reach agreements for the completion of prescribed soil conservation measures. Failure to enter into an agreement can result in a notice being issued, similar to above.

2.1.3 SEPP (Primary Production and Rural Development) 2019

The *State Environmental Planning Policy (Primary Production and Rural Development) 2019* (Rural SEPP) include the following relevant aims of the policy:

(a) to facilitate the orderly economic use and development of lands for primary production,

(b) to reduce land use conflict and sterilisation of rural land by balancing primary production, residential development and the protection of native vegetation, biodiversity and water resources,

(c) to identify State significant agricultural land for the purpose of ensuring the ongoing viability of agriculture on that land, having regard to social, economic and environmental considerations,

(e) to encourage sustainable agriculture, including sustainable aquaculture.

Part 2 deals with State significant agricultural land within which clause 10 states that *'the objects of this Part are as follows—*

(a) to identify State significant agricultural land and to provide for the carrying out of development on that land,

(b) to provide for the protection of agricultural land—

(i) that is of State or regional agricultural significance, and

(ii) that may be subject to demand for uses that are not compatible with agriculture, and

(iii) if the protection will result in a public benefit.'

Clause 11 states that land is State significant agricultural land if it is listed in Schedule 1 of the Rural SEPP. However, Schedule 1 does not list any State significant agricultural land at present.

2.2 Guidelines

The SEARs refers to lists of policies and guidelines that may be relevant to the assessment of the proposal at:

- planningportal.nsw.gov.au/major-projects/assessment/policies-and-guidelines; and
- environment.gov.au/epbc/publications#assessments:

Documents of relevance at these locations are:

- *Far West Regional Plan 2036* (DPE 2017a)
- *Riverina Murray Regional Plan 2036* (DPE 2017b)
- *State Environmental Planning Policy (Rural Lands) 2008* (repealed with effect from 28 February 2019 by *State Environmental Planning Policy (Primary Production and Rural Development) 2019*).
- *The Land and Soil Capability Scheme* (OEH 2012)
- *Agricultural Land Use Mapping Resources in NSW* (Squires 2017).
- *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* (OEH 2013)

Some guidelines provided specific guidance in relation to the assessment of agricultural impacts (for example, use of the weed and pest animal management plans in the biosecurity assessment). Where appropriate, these guidelines have been referenced in the relevant sections.

3 Methodology

The methodology for this agricultural impact assessment has been designed to meet the requirements of the SEARs (Section 1.4.1).

3.1 Agricultural impact assessment

3.1.1 Landowner consultation and site inspections

Landowner consultations and property inspections occurred on 26, 27 and 28 July 2021. The consultation was undertaken by Peter Tremain of Tremain Ivey Advisory who was accompanied by Dominic Spurrett and David Stokes of Jones Lang LaSalle (proposal land management liaison team).

Consultation was undertaken with the owners of six properties affected by the proposal. The properties were chosen to cover a range of geographical locations, proposal impacts, and types of agricultural enterprises within the agricultural study area.

Two properties were large rangeland sheep grazing properties in the Moulamein – Keri Keri district. One of these properties also had some irrigated cropping land. Both were located where the transmission line would be constructed adjacent to an existing high voltage transmission line.

A further two properties were located near Lockhart. One of the properties was a mixed livestock and dryland cropping property, while the other undertook dryland cropping only based on a controlled traffic (tramline) system. One would be affected by the proposal where it would be constructed alongside an existing high voltage transmission line, but the other would be a 'greenfield' site within a new proposed transmission line easement.

The remaining two properties were located in The Rock – Milbrulong district. One was a large mixed livestock and dryland cropping property, while the other was a smaller mixed livestock and dryland cropping property with an emphasis on sheep grazing.

Consultations took the form of general discussions on the nature of the agricultural enterprises conducted on each property and specific discussions on perceived impacts of the proposal with one or more landowners of each property. The consultations also involved an inspection of the affected parts of the landowners' properties.

Some other properties were viewed to some extent from adjacent public roadways and adjacent private property. Further information on properties not inspected such as vegetation cover, type and locations of horticultural crops, extent of cleared areas and type of cropping was gained through examination of satellite imagery and public GIS datasets. This information, when combined with information gained from inspections of neighbouring properties and consultations with neighbouring landowners, was adequate to prepare this report.

3.1.2 Stakeholder consultation

Discussions were undertaken by telephone with weeds officers employed by Western LLS (Wentworth), Murray LLS, Riverina LLS, Wagga Wagga City Council, Hay Shire Council, Murrumbidgee Council, Federation Council and Wentworth Shire Council to obtain their opinions on the main biosecurity risks associated with the proposal and the type of mitigation measures that should be implemented.

3.1.3 Agricultural impact assessment

The description of the existing environment was primarily a desktop study based on data from various sources referenced in Chapter 4. However, this information was also evaluated with reference to the information gathered during the property inspections and landowner consultations described above. The assessment of the existing environment concentrated on:

- geographical factors (such as climate, topography and soils) that have the greatest influence on agriculture in the study area; and
- measures (such as land and soil capability, land use and value of production) which best appraise the nature and productivity of agricultural enterprises in the study area.

The assessment of the impacts on agriculture was based on information from the existing environment assessment, consultations with landowners and other stakeholders, property inspections and professional knowledge.

Mitigation measures are defined as actions, processes or structures which minimise or eliminate the impacts of the proposal. The assessment of mitigation and management measures was based on information from the existing environment and impact assessments, consultations with landowners and other stakeholders, property inspections, professional knowledge, and various information sources as referenced in Chapter 8.

3.2 Biosecurity

Relevant information on biosecurity issues for the proposal site were identified from the following sources:

1. landowner consultations (Section 3.1.1);
2. observations during the property inspections (Section 3.1.1);
3. consultation with various Local Land Services and local government weeds officers (Section 3.1.2);
4. reference to the *NSW Biosecurity Act 2015*;
5. reference to the relevant Regional Strategic Weed Management Plans; and
6. review of various other documents set out Section 5.1.3.

The methodology for the biosecurity assessment was similar to the agricultural impact assessment set out in preceding sections, as follows. The description of existing biosecurity issues was primarily a desktop study, but information gathered during property inspections and landowner consultations was also considered. The assessment of the existing biosecurity issues concentrated on those which were identified as the main risks associated with the proposal.

The assessment of the potential biosecurity risks was based on information from the existing environment assessments of this report, consultations with landowners and other stakeholders, property inspections, pest, disease and weed distribution data, professional knowledge, and various legislation and surveys referenced in Section 5.1.3. Further discussion, such as with respect to noxious weeds is also presented in the *Biodiversity Development Assessment Report* (WSP, 2021) for the proposal.

The assessment of mitigation and management measures was based on information from the existing environment and impact assessments of this report, consultations with landowners and other stakeholders, property inspections, professional knowledge, and Transgrid documents referenced in Section 10.

4 Existing environment

4.1 General description

4.1.1 Location

The agricultural study area is located across nine different local government areas (LGAs), namely Wentworth, Balranald, Murray River, Edward River, Hay, Murrumbidgee, Federation, Lockhart Shire, and Wagga Wagga ('the impacted LGAs'). Each of these LGAs would have at least 25 kilometres of transmission line passing through it.

4.1.2 Topography

The agricultural study area mainly traverses a landscape of relatively flat dune fields and sand plains between Buronga and Balranald. Further to the east there is a wide expanse of the alluvial Riverine Plains extending through most of the rest of the agricultural study area. The easternmost area around Wagga Wagga is characterised by undulating land of low relief.

The proposal ranges from an elevation of approximately 50 metres above Australian Height Datum (mAHD) near the Buronga substation to 120 mAHD around Urana. It reaches a maximum elevation of approximately 370 mAHD around Rowan south of Wagga Wagga before dropping to 230 mAHD at the Wagga Wagga substation.

4.1.3 Climate

Climate, especially rainfall and temperature, have a large impact on the productivity of dryland agricultural properties such as those found throughout the agricultural study area. Rainfall and temperatures vary considerably over the agricultural study area. Consequently, four Bureau of Meteorology (BoM) recording stations have been chosen to illustrate the range of climatic conditions, as follows:

076031 Mildura Airport	75 years of data	Elevation: 50 m
049002 Balranald (RSL)	142 years of data	Elevation: 61 m
074110 Urana Post Office	150 years of data	Elevation: 125 m
072150 Wagga Wagga AMO	80 years of data	Elevation: 212 m

Table 4.1
Summary of rainfall records

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean													
Mildura	22.2	21.2	19.2	19.3	24.8	21.9	24.5	25.4	26.5	28.7	25.6	25.0	285.4
Balranald	22.4	24.7	22.0	23.9	30.9	29.3	26.2	29.5	29.0	30.3	28.5	26.0	323.1
Urana	32.0	33.7	35.1	32.5	40.9	45.0	38.8	39.6	38.0	40.9	33.3	32.6	441.3
Wagga Wagga	40.1	40.2	45.9	39.9	50.4	50.8	53.7	51.0	49.0	55.8	46.7	46.1	571.4
10th percentile													
Mildura	0.8	0.2	0.1	0.6	4.3	5.5	4.3	5.6	4.2	3.1	3.1	1.6	165.9
Balranald	0.0	0.0	0.4	1.3	4.1	7.6	6.4	7.7	6.4	3.6	2.0	1.4	201.0
Urana	2.1	0.0	1.3	3.3	7.4	12.2	11.7	7.7	10.5	7.7	4.2	1.7	277.8
Wagga Wagga	7.0	4.1	1.8	7.8	8.1	19.0	22.0	10.1	16.9	14.4	12.0	4.8	401.8

The average rainfall generally increases from west to east; from 285 millimetres per annum at Mildura to 571 millimetres at Wagga Wagga (refer to Table 4.1). There is a seasonal dominance of approximately 15 to 20 per cent in late autumn to late spring, compared with summer and early autumn which is the driest period, on average. This dominance generally increases slightly from west to east.

The rainfall has moderately low to moderate variability according to BoM (2021). Records indicate that one in 10 years has rainfall of approximately 60 to 70 per cent of the long-term mean. Variability is much greater in summer and early autumn than at other times of the year, and declines from west to east.

Maximum temperature records for the selected stations are set out in Table 4.2. The mean maximum monthly temperature reaches a high of approximately 32°C to 33°C in January and a low of approximately 13°C to 16°C in July. Summer maximum temperatures are relatively similar across the western part of the agricultural study area (Mildura, Balranald and Urana) with only Wagga Wagga being significantly cooler by approximately one degree. There is a more distinct gradation to cooler winter maximum temperatures from west to east.

The average number of days per annum over 35°C is approximately 60 per cent higher in Mildura and Balranald than in Wagga Wagga.

Minimum temperature records are set out in Table 4.3. The mean minimum temperatures fall to lows of approximately 3 to 4°C in July, but are between 16°C and 17°C in January and February. The average number of days per annum with a minimum temperature under 2°C, which is generally regarded as the approximate temperature at which a frost will occur, is only 19.6 days in Mildura, increasing to over 50 days in Wagga Wagga.

Mean daily evaporation averages 6.0 millimetres at Mildura, with a peak of 10.7 millimetres in January. Mean daily evaporation is 15 per cent lower in Wagga Wagga on an annual basis, but the percentage difference is much higher in winter than summer (Table 4.3).

Due to high temperatures, high evaporation and low rainfall, the growing season in the western part of the agricultural study area is variable, but typically short in duration. Growing seasons are generally longer and more reliable in the east.

Table 4.2
Summary of maximum temperatures

Statistic Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean maximum temperature (°C)													
Mildura	32.5	31.8	28.5	23.7	19.1	16.0	15.5	17.3	20.6	24.2	27.7	30.4	23.9
Balranald	33.1	32.6	29.2	24.1	19.4	16.1	15.7	17.6	21.0	24.6	28.2	31.0	24.4
Urana	32.9	32.4	29.2	23.6	18.7	14.8	14.2	16.0	19.8	23.5	27.7	31.1	23.7
Wagga Wagga	31.9	30.9	27.7	22.6	17.4	13.9	12.8	14.5	17.7	21.7	26.0	29.6	22.2
Mean number of days >= 35°C													
Mildura	10.3	8.4	3.3	0.2	0.0	0.0	0.0	0.0	0.1	0.9	3.5	6.8	33.5
Balranald	9.3	8.0	3.6	0.2	0.0	0.0	0.0	0.0	0.1	0.8	3.0	6.1	31.1
Urana	9.8	6.2	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	6.9	27.3
Wagga Wagga	8.2	4.9	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.7	4.4	20.6

Table 4.3
Summary of minimum temperatures and evaporation

Statistic Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean minimum temperature (°C)													
Mildura	16.8	16.5	13.9	10.2	7.4	5.2	4.3	5.2	7.4	9.9	12.6	15.0	10.4
Balranald	16.6	16.4	13.7	9.6	6.8	4.4	3.5	4.7	7.1	9.9	12.7	14.9	10
Urana	16.3	16.3	14.0	9.4	6.1	3.6	3.2	4.1	6.3	8.8	11.8	14.6	9.5
Wagga Wagga	16.4	16.5	13.5	9.2	5.9	3.7	2.8	3.5	5.1	7.8	11.0	14.0	9.1
Mean number of days <= 2°C													
Mildura	0.0	0.0	0.0	0.1	1.6	5.4	6.9	4.5	1.0	0.1	0.0	0.0	19.6
Balranald	0.0	0.0	0.0	0.1	2.0	6.1	7.8	5.7	2.1	0.1	0.0	0.0	23.9
Urana	0.0	0.0	0.0	0.3	3.5	9.7	10.4	5.7	3.1	0.5	0.0	0.0	33.2
Wagga Wagga	0.0	0.0	0.0	0.9	5.6	10.4	13.5	11.0	6.8	2.0	0.2	0.0	50.4
Mean daily evaporation (mm)													
Mildura	10.7	9.8	7.4	4.6	2.7	1.8	2.0	3.0	4.6	6.6	8.6	10.1	6.0
Wagga Wagga	10.1	9.0	6.8	4.0	2.1	1.3	1.2	1.9	3.0	5.0	7.2	9.4	5.1

4.1.4 Climate change

The effect of climate change on the agricultural study area is somewhat uncertain, but is likely to be multi-faceted and include several impacts.

CSIRO (2016b) climate projections for the Murray Basin cluster of National Resource Management (NRM) regions[1] indicate that, in the near future (2030) natural variability is projected to predominate over trends due to greenhouse gas emissions. Late in the century (2090) cool season (April to October) rainfall is projected to decline under both an intermediate and high emission scenario. In the warm season (November to March), little change, increased rainfall and decreased rainfall are variously projected by different models. The magnitude of projected changes for late in the century (2090) span approximately -40 to +5 per cent in winter and -15 to +25 per cent in summer for a high emissions case.

Heavy rainfall intensity is projected to increase, with high confidence. Time spent in drought is projected, with medium confidence, to increase over the course of the century.

There is very high confidence in continued substantial increases in projected mean, maximum and minimum temperatures. For 2030, the annually averaged warming across all emission scenarios is projected to be around 0.6 to 1.3°C above the climate of 1986-2005. By 2090, the projected range of warming is 2.7 to 4.5°C for a high emission scenario and 1.3 to 2.4°C under an intermediate scenario.

More hot days and warm spells are projected with very high confidence. Fewer frosts are projected with high confidence and could halve by late in the century. Increased temperature is likely to result in higher evapotranspiration, shorter growing seasons, and a greater potential

[1] The Murray Basin cluster of NRM regions includes Murray LLS, Riverina LLS and the southern part of the Western LLS, and encompasses the entire agricultural study area.

for heat and moisture stress on crops, pasture and animals. The risk of extreme heatwaves, flooding, higher fire frequencies and a longer fire season is also anticipated.

The average crop and pasture growth is likely to be reduced in spring and summer by higher temperatures, and constrained by lower soil moisture levels. Conversely, plant growth rates may benefit from higher CO_2 levels and warmer average temperatures during autumn and winter. Frost damage risk may decline.

4.1.5 Soils

Most soils in the agricultural study area from Buronga to the Balranald area have low to moderately low inherent fertility (OEH 2017) and low plant available water holding capacity. Moderate inherent fertility soils dominate between the Balranald and Urana areas, while most soils between Urana and Wagga Wagga are either moderate or moderately low fertility. A map of inherent soil fertility across the agricultural study area has been included as Attachment 1.

The dominant soils in the western part of the agricultural study area from Buronga to the Balranald area are calcarosols and rudosols according to Australian Soil Classification (CSIRO 2016a). Calcarosols have moderately low inherent fertility and are formed on calcareous aeolian sediments of variable texture. They generally have a small, gradual increase in clay content with depth. The soil profile is alkaline throughout, while sodicity and salt levels are often high in the deeper subsoils (Agriculture Victoria 2021). Rudosols have low inherent fertility and a sandy, weakly developed profile.

The agricultural study area between the Balranald and Urana areas is dominated by vertosols. They are of moderate inherent fertility and have a clay texture throughout the profile. Vertosols display strong cracking when dry, and shrink and swell considerably during wetting and drying phases (Agriculture Victoria 2021).

The main soils found between the Urana area and the Wagga Wagga substation are kurosols, chromosols, vertosols, sodosols and kandosols. Kurosols are moderately fertile with a distinct texture contrast between the topsoil (A horizons) and a strongly acid subsoil (B horizons) with higher clay content. Sodosols are similar but have sodic B horizons which are not strongly acidic. Chromosols are also moderately fertile with a distinct texture contrast between the A horizons and the B horizons, but the latter is neither strongly acidic nor sodic.

4.1.6 Surface water

Surface water for agriculture is mainly supplied by the major water courses (such as the Murrumbidgee River, Box Creek, Yanco Creek and Colombo Creek), lesser watercourses; earthen farm dams, and irrigation canals. Water is used for stock and domestic use, and for some irrigation on and around the agricultural study area.

Earthen farm dams capture and store local runoff and are mainly used for livestock purposes. Surface water is reticulated on many grazing properties using a system of pumps, pipes, tanks and livestock troughs.

4.1.7 Groundwater

Groundwater between Buronga and the Balranald area is found in the Western Porous Rock Groundwater Resource. Quality ranges from fresh water in shallow lenses associated with the Murray River supplying domestic users, through to highly saline water. Most of the groundwater in the water table aquifer is highly saline (DPIE 2019b). It is generally used for livestock and domestic purposes, but not for irrigation. Most bores are located close to the Murray River between Buronga and Euston.

Groundwater between the Balranald and Urana areas is contained in the Lower Murrumbidgee Shallow Alluvium and the Lower Murrumbidgee Deep Alluvium. The shallow alluvium is approximately 40 metres deep with salinity ranging from fresh (585 µS/cm) to saline (32,800 µS/cm) with a mean of 8,314 µS/cm. The Lower Murrumbidgee Deep Alluvium has lower salinity, ranging from 364 to 8,930 µS/cm (brackish) with a mean of about 1,300 µS/cm, and less variability (DPIE 2019c). The lowest salinity is located east of Hay (Green, et al 2011). The Deep Alluvium is extensively used for irrigation in addition to livestock and domestic purposes. Bores are found along most of the agricultural study area within the Murrumbidgee Alluvium, but are concentrated in the section around Dinawan and the Newell Highway.

Groundwater between the Urana area and the Wagga Wagga substation is part of the Lachlan Fold Belt fractured rock groundwater resource. Water quality within the Lachlan Fold Belt varies significantly based on rock type, fracture density, aquifer depth, and climate. Water is generally used for livestock and domestic purposes, but generally not for irrigation (DPIE 2019a). Salinity is generally marginal to moderate at 500 to 3,000 mg total dissolved solids per litre (Green, et al 2011). Most bores are concentrated around Urana and The Rock - Wagga Wagga.

4.1.8 Biosecurity issues

In contrast to much of NSW, most western parts of the agricultural study area (typically to the west of Hay/Coleambally) have the potential to effectively manage biosecurity risks due to its separation from major populations and intensive agricultural industries, and the semi-arid climate which is challenging for exotic animals and plants to survive (DPE 2017a). However, in more intensive agricultural areas in the east, substantial biosecurity risks exist.

Weeds

The density of some species of native shrubs and trees (e.g. hop bush, turpentine bush and punty bush) has increased in some parts of the Western LLS region, thought to have largely resulted from high grazing pressure and changed fire regimes. However, most western parts of the agricultural study area are fortunate to have relatively few examples of widespread introduced species of weeds, due in part to its relatively intact native vegetation and low rainfall (Western LLS 2017).

Weeds recorded by authorised officers during property inspections under the *Biosecurity Act 2015* (DPI 2021a) in the vicinity of agricultural study area between Buronga and the Balranald area include horehound (*Marrubium vulgare*), burr ragweed (*Ambrosia confertiflora*), prickly pears *(Opuntia* and *Cylindropuntia* species), prairie ground cherry (*Physalis hederifolia*), khaki weed (*Alternanthera pungens),* blue heliotrope *(Heliotropium amplexicaule),* Noogoora burr *(Xanthium occidentale), Arundinaria* (reed) species, Cabomba (*Cabomba caroliniana*), silverleaf nightshade (*Solanum elaeagnifolium*), Coolatai grass (*Hyparrhenia hirta*), Paterson's curse (*Echium plantagineum*), star thistle (*Centaurea calcitrapa),* blackberry *(Rubus fruticosus),* giant Parramatta grass (*Sporobolus fertilis)* and African boxthorn (*Lycium ferocissimum*).

Horehound, khaki weed, Paterson's curse, silverleaf nightshade, African boxthorn, spiny burrgrass (*Cenchrus spinifex and Cenchrus longispinus*), galvanised burr (*Sclerolaena birchii*), Bathurst burr (*Xanthium spinosum*), St. John's wort (*Hypericum perforatum*), asparagus fern (*Asparagus virgatus*), mesquite (*Prosopis* species), willows (*Salix* species), sagittaria (*Sagittaria platyphylla*) were recorded between the Balranald and Urana areas. African boxthorn, silverleaf nightshade and khaki weed were widely reported along many roadsides around the agricultural study area (DPI 2021a).

Horehound, blackberry, prickly pears *(Opuntia* and *Cylindropuntia* species), silverleaf nightshade, Coolatai grass, African boxthorn, Bathurst burr, St. John's wort, willows, lippia (*Phyla canescens),* privet *(Ligustrum lucidum),* asparagus weeds *(Asparagus* species), athel pine (*Tamarix aphylla),* Cape broom *(Genista monspessulana),* sweet briar (*Rosa rubiginosa),* St. Barnaby's thistle *(Centaurea solstitialis),* wild radish (*Raphanus raphanistrum),* tree-of-heaven (*Ailanthus altissima),* green cestrum *(Cestrum parqui,* African olive *(Olea europaea* subspecies *cuspidate)* and black locust (*Robinia pseudoacacia)* were recorded between the Urana area and the Wagga Wagga substation (DPI 2021a).

The respective regional strategic weed management plans (Murray LLS 2017, Riverina LLS 2017 and Western LLS 2017) identifies regional priority weeds, some of which are, or may be, present in the vicinity of the agricultural study area (DPI 2021a, DPI 2021b), as follows:

- African boxthorn
- Boxing glove/coral cactus (*Cylindropuntia fulgida*)
- Bridal creeper
- Burr ragweed
- Cabomba
- Cane needlegrass (*Nassella hyaline*)
- Cape broom
- Clockweed (*Oenothera curtiflora*)
- Coolatai grass
- Fireweed (Senecio madagascariensis)
- Giant reed (*Arundo donax*)
- Gorse (*Ulex europaeus*)
- Green cestrum
- Hardhead thistle (*Rhaponticum repens*)
- Honey locust (*Gleditsia triacanthos*)
- Mesquite
- Mother of millions (Bryophyllum spp.)
- Perennial ground cherry (*Physalis longifolia*)
- Prairie ground cherry
- Prickly pears
- Rope pear *(Cylindropuntia imbricata)*
- Sagittaria
- Scotch broom (*Cytisus scoparius*)
- Silver-leaf nightshade
- Spiny burr grass (*Cenchrus* spp.)
- Water hyacinth (Eichhornia crassipes)
- Willow rhus (*Searsia lancea*).

The only state priority weed which may be present in the part of the agricultural study area which is in the Western LLS is bitou bush (*Chrysanthemoides monilifera* ssp. *rotundata*). However, state priority weeds which may occur in the Riverina or Murray LLS regions include:

- boneseed (Chrysanthemoides monilifera ssp. monilifera)
- tropical soda apple (*Solanum viarum*)
- water hyacinth
- African boxthorn
- asparagus weeds
- athel pine
- blackberry
- cabomba
- Hymenachne (*Hymenachne amplexicaulus*)
- lantana (*Lantana camara*)
- prickly pears
- cane cactus (*Austrocylindropuntia cylindrica*)
- silver-leaf nightshade
- willows.

Other important weeds in the Western, Murray and Riverina LLS regions are listed in the respective regional strategic weed management plans. The description of these weeds vary between LLS but they are described in Murray LLS (2017) as species that are widespread in parts of the region and are of high community concern or priority to manage because of their extent and impact. These weeds are a direct threat to agricultural production and the environment and control should be undertaken to contain locally. These weeds are listed in Attachment 4.

Other weeds in the vicinity of the agricultural study area include khaki weed, Noogoora burr and Bathurst burr. Khaki weed is often found in irrigation and high traffic areas such as roadways. The burrs can also be a significant problem in irrigation fields and are an important wool contaminant.

Khaki weed, devil's claw (*Ibicella lutea)*, spiny burr grass, African boxthorn, galvanised burr, Paterson's curse, green cestrum, St John's wort, caltrops (*Tribulus terrestris)*, herbicide resistant ryegrass (*Lolium rigidum*), needle grasses and horehound were mentioned by landowners and/or weeds officers during consultations as problematic weeds present in the district with the potential to become more widespread.

Pest animals

Foxes, feral pigs, wild rabbits and kangaroos are the most important vertebrate pests to agriculture across the Western, Murray and Riverina LLS regions. Unmanaged rangeland goats are relatively important in the Western LLS region, but less common and important elsewhere. Other vertebrate pests such as wild dogs and deer are present, but generally not in sufficient numbers to cause significant damage. Several other pest animals (feral camels, feral donkeys and wild horses) are considered to be emerging issues in agriculture, but none are presently found in close proximity to the agricultural study area (Murray LLS 2018, Riverina LLS 2018 and Western LLS 2018). Plague locusts and mice can also cause problems in favourable seasons. Some species (such as goats and pigs) pose significant biosecurity, economic and social threats to the Western region as they can harbour and transmit both endemic and exotic diseases.

Biosecurity zones

A biosecurity zone may be used for the long-term management of an ongoing key biosecurity risk or impact. It is a specific geographic area where certain actions must be taken and the zone area can be the whole State, a defined part of the State, a group of neighbouring properties or an individual property.

Horticultural enterprises are particularly susceptible to plant diseases and pests. The part of the agricultural study area from Buronga to approximately 40 kilometres east of Euston is adjacent to the Greater Sunraysia Pest Free Area. Additionally, of relevance to the proposal, the following biosecurity zones have been established under the Biosecurity Regulation 2017:

- All of the agricultural study area is within the Grapevine Phylloxera Exclusion Zone
- The Rice Biosecurity Zone also covers the agricultural study area from approximately Euston to near Lake Cullivel (comprising the Balranald, Edward River, Federation Hay, Murray River and Murrumbidgee LGAs), a distance of around 375 kilometres of the proposal alignment
- The entire state of NSW is a Potato Biosecurity Zone.

Other

The occurrence of sheep footrot in the vicinity of the agricultural study area has been low in recent years. DPI (2016) reported no flocks were quarantined for footrot in either March 2014 or December 2015 across the Western LLS region, out of a total of 861 flocks. In the Murray and Riverina LLS regions there were a total of 15 flocks in quarantine at December 2015, a decrease of three flocks on March 2014. The total number of flocks across the Murray and Riverina LLS regions was 4,831. Therefore, the infection rate was around 0.3 per cent.

Footrot is a contagious bacterial disease of sheep and goats, caused by the organism *Dichelobacter nodosus (D. nodosus)* in association with several other bacteria. The bacterium *D. nodosus* may persist for many years in the feet of infected sheep and may pass from infected sheep into the soil. Footrot is introduced into a clean flock by the inclusion of infected sheep in the flock, or by exposure to contaminated land under favourable conditions.

Little recent data is available on the prevalence of ovine Johnes disease (OJD) in NSW. However, the western part of the agricultural study area was in a 'low prevalence area' in 2011 with an estimated infected flock proportion of less than 0.8 per cent (DPI 2011). The agricultural study area from the Urana area to the Wagga Wagga substation was in a high prevalence area with more than 12.5 per cent of flocks estimated to be infected. No known OJD infections were reported during landowner consultations. OJD is an incurable infectious disease caused by the bacterium *Mycobacterium paratuberculosis*.

No specific data is available on sheep lice infestations near the agricultural study area.

The landowners consulted confirmed that OJD has not been a significant problem as it has been well managed in the past. There have been problems with footrot in recent years, but these cases are relatively rare. Although the prevalence of the major livestock diseases has been low in the past, stock movements associated with the recent drought and subsequent restocking may increase their incidence.

4.1.9 Land tenure

Nearly all of the agricultural study area from Buronga to the Balranald-Kyalite area is held under Western Lands Leases, granted under the *Crown Land Management Act 2016* (formerly the *Western Lands Act 1901)*, with only a small area under freehold. East of the Balranald-Kyalite area most of the agricultural land is freehold.

4.1.10 Farm size

ABS statistics (ABS 2017a) indicate an average agricultural establishment size of approximately 8,100 hectares for the Wentworth LGA, although this includes smaller horticultural and cropping holdings, especially near the Murray River. Average size is much larger at approximately 16,200 hectares for the Wentworth-Balranald statistical area which is representative of the parts of the agricultural study area in rangeland areas. The average agricultural establishment size (ABS 2017a) is lower in the Hay LGA at approximately 11,200 hectares (Table 4.6, page 27) and declines in LGAs further east such including Murray River (approximately 2,400 hectares), Edward River (2,000 hectares), Federation (1,500 hectares), Lockhart (860 hectares) and Wagga Wagga (840 hectares).

4.2 Land use

A map of land use across the construction impact area and a 10 kilometre buffer has been included as Attachment 2. Relevant areas of land use across the construction impact area are summarised in Table 4.4.

Table 4.4
Summary of land use in the construction impact area

Land Use (DPIE 2020)	Area (ha)	Proportion (%)
Agricultural land uses		
2.1.0 Grazing native vegetation	3,237	64.3%
3.2.0 Grazing modified pastures	145	2.9%
3.3.0 Cropping	1,249	24.8%
4.3.0 Irrigated cropping	62	1.2%
4.4.0 Irrigated perennial horticulture	0	0.0%
Sub total - Agriculture	4,694	93.3%
1 Conservation and natural environments	192	3.8%
2.2.0 Production native forestry	32	0.6%
5.4.0 Residential and farm infrastructure	5	0.1%
5 Other intensive uses (mining, transport, etc.)	34	0.7%
6 Water (lakes, rivers, etc.)	75	1.5%
Total	**5,031**	**100.0%**

Note on Table 4.4:

Individual amounts are approximate and may not sum to the amount of the totals due to rounding.

The majority of the western part of the agricultural study area from Buronga to the vicinity of Urana is used for grazing native vegetation and is classified as such in DPIE (2020) mapping.

Grazing of goats, cattle and sheep (for wool and meat) is common through the agricultural study area. There are also significant areas of dryland cropping, especially between Buronga and the Balranald area, and between the Mabins Well area (Four Corners Road) and the Urana district. Small areas of modified pastures, and irrigated horticulture or cropping are also found.

A significant part of the agricultural study area is located in Yanga State Conservation Area, south east of Balranald.

Cropping dominates the land use from the Urana area to the Wagga Wagga substation. However, in any particular year the 'cropping' area includes substantial land which is in a pasture phase of the cropping rotation. Small areas of grazing of both modified pastures and native vegetation were also identified.

4.3 Land and soil capability

There are a number of measures of land capability relevant to agriculture. This report concentrates on the Land and Soil Capability (LSC) assessment scheme (OEH 2012). However, other measures are also examined in the following sections.

4.3.1 Background

The LSC assessment scheme was published in 2012 by the former Office of Environment & Heritage (OEH 2012), representing a revision of an earlier scheme that was first published by the former Soil Conservation Service of NSW in 1986 (Emery 1986). The LSC system builds on the earlier scheme, but with more emphasis on a broader range of soil and landscape properties.

LSC is based on an assessment of the biophysical characteristics of the land, the extent to which this will limit a particular type of land use, and the current technology that is available for the management of the land. It indicates the broad agricultural land uses most physically suited to an area. That is, it determines the best match between the physical requirements of the use and the physical qualities of the land, and the potential hazards and limitations associated with specific uses over a site. The LSC system can provide guidance on the inputs and management requirements associated with different intensities of agricultural land use (Woodward 1988).

The LSC assessment is based on the premise that using land beyond its capability may have serious consequences for the land and soil resources of the State as well as broader environmental impacts on water, air and biodiversity (Woodward 1988).

The LSC assessment scheme comprises eight land capability classes (1 to 8) with values representing a decreasing capability of the land to sustain intensive agricultural land use. Class 1 represents land capable of sustaining most intensive land uses including those that are often associated with regular soil cultivation, whereas class 8 represents land that can only sustain very low intensity land uses.

The current LSC scheme was initially developed for the NSW property vegetation planning program under the former *Native Vegetation Act 2003* and further upgraded for the NSW Natural Resources Monitoring, Evaluation and Reporting program.

The LSC assessment scheme uses the biophysical features of the land and soil including landform position, slope gradient, drainage, climate, soil type and soil characteristics to derive detailed rating tables for a range of land and soil hazards. These hazards include water erosion, wind erosion, soil structure decline, soil acidification, salinity, waterlogging, shallow soils and mass movement. Each hazard is given a rating between 1 (best, highest capability land) and 8 (worst, lowest capability land). The final LSC class of the land is based on the most limiting hazard.

The LSC class gives an indication of the land management practices that can be applied to a parcel of land without causing degradation to the land and soil at the site and to the off-site environment. As land capability decreases, the management of hazards requires an increase in knowledge, expertise and investment. In lands with lower capability, the hazards cannot be managed effectively for some land uses.

The LSC assessment scheme is most suitable for broad-scale assessment of land capability, particularly for assessment of lower intensity, dryland agricultural land use. It is less applicable for high intensity land use, or for irrigation (Woodward 1988).

4.3.2 The construction impact area

A map of LSC across the construction impact area and a 10 kilometre buffer has been included as Attachment 3. The area of each LSC class in the construction impact area is summarised in Table 4.5.

Across the entire construction impact area, moderate and moderate–low capability land (class 4 and 5) are the dominant capability classes and together comprise 60 per cent of the land area. Higher and lower capability classes (3, 6 and 7) each make up between 12 per cent and 15 per cent of the construction impact area. However, there are large differences in the distribution of each land class, as summarised below.

The majority of construction impact area west of the Cobb Highway comprises classes 5 and 7 land. Smaller areas of moderate capability (class 4) land can be found, and there are significant areas class 6 land around Balranald.

East of the Cobb Highway to the Urana district, class 4 is the dominant land capability, associated with significant areas of class 6 land.

From the Urana district to the Wagga Wagga substation, higher capability land predominates (mostly class 3 and 4), with some small patches of class 5, 6 and 7 land.

Class 3 land is described as "*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".*

Class 4 land is described as *"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"*.

Class 5 land is described as *"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".*

Class 6 land is described as "*low capability land: Land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation"*.

Class 7 land is described as *"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".*

Table 4.5
Summary of land and soil capability

	Construction impact area	
LSC Class	Area (ha)	Proportion of total area
3 - High capability	747	14.9%
4 - Moderate capability	1,485	29.5%
5 - Moderate–low capability	1,518	30.2%
6 - Low capability	621	12.3%
7 - Very low capability	660	13.1%
Total	**5,031**	**100.0%**

The LSC mapping set out in Attachment 3 broadly concurs with observations made during the property inspections.

4.4 Other measures of land capability

4.4.1 Agricultural land classification

The Agricultural Land Classification (ALC) system is similar to the LSC assessment scheme. The current ALC system (Hulme, et al 2002) was developed by the former NSW Agriculture (now DPI).

Under the ALC system land is classified by evaluating biophysical, social and economic factors that may constrain the use of land for agriculture. In general terms, the fewer the constraints on the land, the greater its value for agriculture. Each type of agricultural enterprise has a particular set of constraints affecting production.

The ALC system is not considered in detail in this assessment due to its similarity to the LSC assessment scheme, and its limitations. Squires (2017) states that the ALC system has limitations with *"poor quality control of product, limited availability and suitability for digital conversion (available as paper maps only in some areas), does not identify specific industry needs and excludes non-soil based agricultural needs".*

4.4.2 Biophysical strategic agricultural land

Biophysical strategic agricultural land (BSAL) is land with high quality soil and water resources capable of sustaining high levels of productivity. The protocol for determining BSAL is set out in OEH (2013). BSAL have the best quality intrinsic 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 (DPE 2013). Mapping of BSAL was undertaken by the then NSW Department of Planning and Infrastructure. This mapping indicates that there is some BSAL along the Murrumbidgee flood plain near Wagga Wagga, but none of this is in close vicinity of the agricultural study area.

4.5 Agricultural productivity

4.5.1 Employment

Agriculture is the largest industry (by number of persons employed) in most of the nine impacted LGAs which are covered by the agricultural study area. In 2016, employment in 'agriculture, forestry and fishing' was generally between approximately 17 per cent and 30 per cent of employed persons in the impacted LGAs. The rate was lower in Wagga Wagga (four per cent) due to the large urban population, while it reached 36 per cent in the Murrumbidgee LGA (ABS 2021).

Total employment in 'agriculture, forestry and fishing' is estimated at approximately 5,800 persons across the nine LGAs. This is approximately 11 per cent of all employed persons, or 21 per cent if the Wagga Wagga LGA is excluded. In 2020, there were 3,085 'agriculture, forestry and fishing' businesses in the nine impacted LGAs (ABS 2021). This is approximately 26 per cent of all businesses, or 37 per cent of all business if Wagga Wagga LGA is excluded.

4.5.2 Agricultural land use

The total area of agricultural holdings across the nine impacted LGAs in 2015-16 (ABS 2017a)[1] was as follows:

Table 4.6
Total area of agricultural holdings 2015-16

Area	Area of Holdings (ha)	Number of Holdings (ha)	Average Area (ha)
Wentworth	2,345,737	288	8,145
Balranald	1,938,184	120	16,152
Hay	994,949	89	11,179
Murray River	895,536	374	2,394
Edward River	652,641	334	1,954
Murrumbidgee	574,091	364	1,577
Federation	527,692	342	1,543
Lockhart	231,527	269	861
Wagga Wagga	382,956	456	840
Total	8,543,313	2,636	3,241

[1] Detail agricultural statistics are only produced by the ABS to an LGA level every five years. The most recent LGA data is from 2010-11 and 2015-16.

The same ABS statistics shows the following broad land use on agricultural holdings across the nine LGAs.

Table 4.7
Land use on farms 2015-16

Land use	Area (ha)
Wheat for grain	538,634
Other broadacre crops	466,771
Hay and Silage	153,804
Grapes	10,357
Other horticulture	7,503
Other land - Mostly grazing	7,366,244
Total area of holdings	8,543,313

Statistics that detail the use of 'other' land not used for cropping or horticulture are not available for 2015-16. However, most of the 'other land is expected to be native vegetation or improved pastures used for grazing. There would also be land used for environmental purposes, infrastructure or intensive agriculture (such as poultry and feedlots), unused, or having minimal use land. Overall, 'other' land comprises 86 per cent of the total area of holdings, but this percentage varies from over 95 per cent of the large western LGAs (Balranald, Hay and Wentworth) to around 50 per cent of the three most easterly LGAs (Federation, Lockhart and Wagga Wagga).

4.5.3 Livestock carried

Table 4.8 sets out total livestock numbers across the nine impacted LGAs in 2016. Poultry and bees which are usually associated with intensive production are excluded. 'Stock units' are calculated as one unit for sheep, lambs, goats and 'other', and 10 units each for meat cattle and dairy cattle. Pigs are disregarded for this calculation.

Table 4.8
Total livestock numbers

All impacted LGAs

Livestock type	Number
Sheep and lambs	3,708,561
Meat cattle	273,114
Dairy cattle	54,348
Pigs	258,579
Goats & other livestock	13,557
Total - Stock Units	6,996,732
per hectare[1]	0.95

Source: ABS 2017a

[1] Excluding cropping and horticultural areas (Table 4.7).

The average stocking rate of 0.95 stock units per hectare in 2016 (Table 4.8) is relatively low. However, this is strongly influence by the large western LGAs of Balranald, Hay and Wentworth. Stocking rates are much higher in the eastern LGAs such as Federation (3.10 sock units per hectare), Lockhart (5.57 sock units per hectare) and Wagga Wagga (5.62 sock units per hectare). The average stocking rate across all of NSW in 2016 was 1.63 stock units per grazing hectare (ABS 2017a).

4.5.4 Value of agricultural production

The total gross value of agricultural production across the nine impacted LGAs in 2015-16 (ABS 2017b) is shown in Table 4.9 at $1.78 billion. Wheat was the most valuable agricultural commodity produced in 2015-16, followed by other broadacre crops. The disposal of cattle and calves (mostly for meat), 'other' horticultural crops (including citrus, stone fruits, avocadoes, almonds and other nuts), wool, grapes, pigs and the disposal of sheep and lambs were the next largest values, all in excess of $100 million. Horticulture is relatively more important in the western LGAs of Wentworth and Balranald, while cropping contributed more than 65 per cent of the total value of production in the eastern LGAs of Lockhart and Wagga Wagga, and more than 50 per cent in the Hay, Murrumbidgee and Federation LGAs.

The total gross value of agricultural production in 2015-16 was equivalent to $208 per hectare over the total area of agricultural holdings (8,543,313 hectares, refer to Table 4.6). However, there is a large difference the average total gross value of agricultural production in the western LGAs of Wentworth, Balranald and Hay (average of $71 per hectare), in Murray River and Edward River ($233 per hectare) and in the remaining LGAs ($610 per hectare). There is also a large difference between the average value of broadacre cropping production ($733 per hectare), irrigated horticulture production (approximately $15,200 per hectare) and grazing production ($89 per hectare). The value of agricultural production is greatly influenced by seasonal and market conditions and can fluctuate widely from year to year.

Table 4.9
Total gross value of agricultural production

All impacted LGAs

Broadacre Crops	
Wheat	$350,326,164
Other	$435,524,557
Hay	$63,305,316
Total - Broadacre Crops	$849,156,037
Horticulture	
Grapes	$122,133,288
Other horticulture	$149,277,109
Total - Horticultural crops	$271,410,397
Livestock Products	
Wool	$135,113,500
Sheep and lambs	$106,702,682
Cattle and calves	$167,758,975
Milk	$98,442,859
Pigs	$112,463,952
Poultry & eggs	$38,546,189
Goats & other livestock	$348,785
Total - Livestock Products	$659,376,943
Total – Agriculture	$1,779,943,377

5 Assessment of construction impacts

5.1 Loss of land use

5.1.1 Area directly affected

The construction impact area would include permanent works such as transmission line tower bases, permanent access tracks, the new Dinawan substation, and the expansion area for the Wagga Wagga substation. The construction impact area would also include temporary access tracks, and other temporary ancillary works required to facilitate the construction of the proposal (such as laydown and staging areas, concrete batching plants, brake/winch sites, site offices and accommodation camps).

The impact area of the proposal would be relatively small in the context of the agricultural study area and the regional agricultural industry. For example, the transmission line easement would be around 4,288 hectares and the extent of all construction compound sites (Balranald, Cobb Highway, Dinawan and Lockhart and Wagga Wagga) would be approximately 385 hectares (including accommodation camps and laydown areas).

An additional area for temporary works would be required for tracks and other ancillary construction activities. The total construction impact area would be around 5,031 hectares (in addition to some areas of existing access tracks to be used across to access the existing road network to the main proposal easement). This is equivalent to approximately 0.06 percent of the total area of agricultural holdings in the nine impacted LGAs.

The remainder of the agricultural study area would not be directly affected by on-ground works. However, it would be affected by other impacts which may extend over a much greater area than calculated above. These other impacts are discussed below in Sections 5.1.3 and 5.3.

Areas not required for operational purposes (some roads, tracks and other ancillary works) would be rehabilitated and returned to its former land use after construction has been completed. Agricultural production would only be lost on this area during construction and for a limited time afterwards.

The direct impact of the proposal on agricultural production would be relatively low during both the construction phase and the operating phase and would have minor effect on agricultural productivity.

5.1.2 Agricultural holdings

The expected transmission line easement (80 metres wide, approximately 4,288 hectares) would cover a small fraction (0.05 percent)[1] of the total area of agricultural holdings in the nine impacted LGAs. Therefore, the impacts of the proposal on existing agricultural enterprises would be minimal. In addition, the proposal would not cause significant fragmentation or alienation of agricultural land or result in significant disruption to agricultural operations.

[1] Based on total agricultural holdings of 8,543,313 hectares (Table 4.6)

5.1.3 Land impacts – summary

The major impact of the proposal on soil and land capability would be through the removal of areas from agricultural production to accommodate new electrical infrastructure such as towers. The areas to be removed as a result of the proposal would be small, as discussed below.

The agricultural productivity of the main enterprises found on the agricultural study area varies greatly from low value rangeland grazing in the west to high value cropping and grazing in the east, with smaller areas of very high value irrigated cropping and horticulture.

The impact on agricultural land use in the agricultural study area would be limited by the relatively small area permanently and directly affected, the continuation of some agricultural enterprises over most of the agricultural study area, and the planned mitigation measures (Chapter 8).

5.2 Biosecurity

The following sub sections address the potential biosecurity impacts of the construction stage of the proposal.

5.2.1 General biosecurity risks

There are risks that animal diseases, plant diseases, feral pests and (especially) weeds could be introduced or spread during the construction phase of the proposal. A biosecurity breach of this nature is likely to increase costs and decrease income of agricultural properties in the vicinity of the proposal. Depending on the biosecurity matter, impacts on both costs and income could be short term to longer term (more than five years).

Increased costs could include expenses associated with monitoring pests, weeds or diseases and implementing control measures; while reduced income could include reduced livestock, crop or pasture production, plus lower produce quality.

Potential carriers of weed seeds, plant material and diseases include vehicles (especially tyres), machinery and personnel (clothing and footwear). These can transport biosecurity matter over relatively long distances.

Biosecurity matter could also be spread by soil and water movements associated with construction works. These latter movements generally occur over relatively short distances. Short distance movement of biosecurity matter is a greater concern in the more intensive, closely settled areas in the eastern parts of the agricultural study area. The extensive nature of agriculture in the western parts means that the potential of significant biosecurity impacts by movement over short distances is relatively low.

The biosecurity risks would generally be highest during the construction phase due to earthworks, and the frequency of vehicle and personnel movements.

5.2.2 Weed biosecurity risks

Weeds which present a significant biosecurity risk of the proposal are those:

- which may be spread readily by activities associated with the proposal;
- that are adapted to the environmental conditions of the region; and
- that would have a substantial economic impact if they were to spread.

Weeds that are present in the region and present a potential biosecurity threat are listed in Section 4.1.8.

Weeds such as some cactuses, spiny burrgrass, khaki weed, Noogoora burr and Bathurst burr are readily spread by vehicle, machinery and human activity. Some also have a potential high impact on the income and costs of agricultural enterprises. For example, silver-leaf nightshade is difficult to control in pastures and irrigation areas, while the spiny burrgrass grass presents a challenge in pastures and crops. Noogoora burr and Bathurst burr are important wool contaminants.

There are numerous other weeds which could potentially have a significant impact on the agricultural enterprises, however the risk is moderated by:

- most weeds not being readily spread by activities associated with the proposal; and
- limited adaptability of some weeds to the environmental conditions of the region, especially in the drier climate found in western parts of the agricultural study area.

The risk of weed spread associated with the proposal would be high, and the maximum potential impact would occur during the construction phase due to earthworks, the frequency of vehicle and personnel movements, and increased weed growth due to disturbance of ground cover and soil. The Wentworth Shire Council biosecurity officer advised that weeds had been introduced into the shire during previous construction projects. However, few other similar instances were reported during consultations.

Mitigation measures to limit and manage the weed biosecurity risk are provided Section 8.

5.2.3 Livestock pests and diseases biosecurity risks

Sheep lice, ovine Johne's disease (OJD) and ovine footrot are the highest livestock pest and disease risks associated with the proposal. They are all diseases of sheep, are present in the region, and can have significant productivity impacts on sheep enterprises.

Footrot is the most important risk despite its low current prevalence (Section 4.1.8), due to the relative ease of its spread and its high potential economic impact. Virulent footrot is a severe, debilitating disease causing significant economic loss from reduced wool growth, lower wool quality, poor ewe fertility, slow growth rates, losses from blowfly strike, and reduced value of sale sheep. In infected flocks, there are also significant costs associated with the control of the disease.

OJD is a wasting disease of sheep that can result in significant economic losses on infected farms due to sheep deaths, lost meat production, fewer lambs and less wool. Under the *Biosecurity Act 2015*, sheep footrot and OJD are notifiable diseases.

Sheep lice cause significant losses in sheep enterprises due to treatment costs, reduced wool growth and lower meat production.

The risks associated with these diseases are low due to the low probability of spread being caused by proposal activities and the low prevalence of disease in the area (Section 4.1.8). In the western parts of the agricultural study area, risks would be further reduced by the extensive nature of agriculture, the low density of livestock and unfavourable conditions for disease spread.

Other possible biosecurity risks include bovine Johne's disease (BJD) and internal parasites. However, the biosecurity risks associated with these diseases are very low within the agricultural study area.

5.2.4 Vertebrate pest biosecurity risks

The most significant vertebrate pests (whereby this is defined as an organism considered to be harmful to (in this case to current agricultural land) in the vicinity of the agricultural study area are likely to be pigs, foxes, rabbits and kangaroos. All these pests have economic impacts on agricultural enterprises arising from lamb predation, fence damage or consumption of pasture and crops. However, the impact of the proposal, if any, would be very low as it is unlikely to significantly change the number or movement patterns of vertebrate pests.

Other vertebrate pests such as wild dogs and unmanaged goats have potential economic impacts, but are less prevalent in the agricultural study area.

5.2.5 Plant disease and pest biosecurity risks

There are substantial biosecurity risks associated with plant diseases and pests in the horticultural industries on and around the agricultural study area. In particular, some of the western parts of the agricultural study area are located adjacent to the Greater Sunraysia Pest Free Area of NSW and Victoria. The main aim of this quarantine area is the prevention of the entry of Queensland fruit fly into NSW and Victoria. Most fruit and fruiting vegetables are banned from entering the Greater Sunraysia Pest Free Area.

In addition, there is a ban on taking grapevines, cuttings or budwood into the Phylloxera Exclusion Zone. This zone covers most of NSW including the agricultural study area. Soil that has been in contact with any grapevine material also cannot be brought into this zone.

The agricultural study area is also in the Potato Biosecurity Zone which covers all of NSW, and this bans the movement of plants belonging to the family Solanaceae and associated matter into the zone.

The NSW Rice Pest and Disease Exclusion Zone covers part of the agricultural study area. This zone bans the entry of rice plants or grain such as paddy rice or brown rice.

There are also avocado orchards near the agricultural study area which are susceptible to phytophthora root rot. The closest orchards are approximately 6 to 10 kilometres from the agricultural study area (University of New England 2021). Phytophthora root rot could be spread to and within the agricultural study area by soil attached to footwear or vehicle tyres, and by water movements. Snails are a significant pest of citrus trees and may be introduced to new areas by vehicle and personnel movements.

Consequently, there are substantial biosecurity risks to horticultural enterprises if activities associated with the proposal were to result in inappropriate plant material or soil being brought into the agricultural study area. Biosecurity risks would be highest during the construction phase due to the larger number of personnel and vehicle movements to, and within, the agricultural study area.

Plant diseases or pests are not a substantial issue for most grazing enterprises in the region, especially extensive rangeland enterprises. While there are several important crop diseases in the region, it is unlikely that any activity associated with the proposal would result in spread of crop or pasture diseases or pests. Therefore, no significant biosecurity risk to crop or grazing enterprises is expected.

5.3 Other potential impacts

5.3.1 Restricted movement

It is unlikely that the construction of the proposal would substantially restrict movements of landholders, workers, their livestock or equipment within the agricultural study area. It is possible that some movement would be affected temporarily due to restricted access to construction areas. However, these restrictions would be of a short duration, be undertaken in consultation with relevant landowners and in a limited location, and therefore unlikely to markedly affect movements for agricultural purposes.

Such restrictions are more likely to occur in cropping and horticultural areas than rangeland grazing areas due to the higher intensity land use and greater movement restrictions imposed by cropped areas.

5.3.2 Impacts on cropping and horticultural operations

The construction of a transmission tower or other facilities on cropping or horticultural land would have the potential to disrupt, to some extent, normal husbandry operations on land surrounding the structure or facility. Critical times include sowing (approximately April to June) and harvesting periods (typically October to December). Delays to these activities can result in significant income losses due to sub-optimal sowing times and weather damage. Some direct damage to crops may also occur due to vehicle and plant movement and the construction of towers, tracks and ancillary works.

Usual cultivation, crop establishment and spraying travel patterns would also need to be adjusted to avoid towers and other proposal structures during the construction process, and care would need to be taken to avoid collisions when using wide farming equipment. The impacts of the proposal structures such as electricity transmission towers and lines on controlled traffic farming (CTF), steering guidance, weed control and cropping under powerlines would commence during the construction phase and continue into the operational phase. These impacts are discussed further in Section 6.3.2.

The impact on cropping and horticultural operations in the agricultural study area during the construction phase would be relatively minor due to the small areas directly affected, the relatively short duration of construction, and the ability to continue cropping across most of the transmission line easement and the agricultural study area during construction.

5.3.3 Impacts on irrigation activities

In addition to the cropping impacts outlined above, irrigated cropping or horticulture enterprises may be subject to other impacts during the construction phase. Construction activities and erection of new tower structures may require some irrigation infrastructure to be modified or moved, in agreement with the landowner, where they impact on the operation of irrigation blocks areas. These impacts would commence during the construction phase and continue into the operational phase and are discussed in Section 6.3.3.

5.3.4 Impacts on aerial agriculture operations

Significant impacts on aerial agriculture operations (such as aerial spreading of fertilisers and aerial spraying) and drones could arise from the construction of transmission lines in cropping or horticultural areas. These impacts would commence during the construction phase and continue into the operational phase and are discussed in Section 6.3.4.

5.3.5 Impacts on livestock enterprises

The main potential impact on livestock enterprises would be disturbance of sheep and cattle caused by noise and vehicle movements. Although livestock habituate to disturbances, the noise and movement of construction vehicles and other construction activities may have an impact on livestock in specific circumstances, especially during calving and lambing periods. Livestock can be panicked, particularly if they are new to the area near the proposal (such as occurs with relocated, agisted or newly purchased animals) or if they are not accustomed to human contact.

The impacts of noise on livestock would be diminished by the low density of livestock in the western parts of the agricultural study area, but construction activities would have greater and closer contact with livestock in more intensive eastern parts. Conversely, the reduced human contact experienced by some western livestock may make them more susceptible to disturbance. Although there is a potential for some disturbance, the effect on productivity is expected to be relatively small.

Considerable disruption could occur to livestock enterprises if stock water pipelines or fences were damaged and not promptly repaired during construction, or if gates were left open.

Overhead transmission lines also have the potential to impact on the operation of electric fencing and stock yards. This impact is discussed under the operation phase in Section 6.3.5.

5.3.6 Fire risk

Fires could be started by human activities, equipment and vehicles during the construction phase.

Fires have the potential to cause significant damage to livestock, agricultural infrastructure (such as dwellings, stock yards, sheds and fences), pasture, shade and shelter trees, and agricultural equipment.

Conversely, clearing along the transmission line easement provides a potential firebreak and increases access for firefighting activities in some areas.

Fire risk has been discussed in greater detail in a separate technical report for this EIS on bushfire risk management (Technical paper 12).

5.3.7 Travelling stock reserves and livestock routes

The grazing industry uses a network of Crown reserves called travelling stock reserves (TSRs) for moving or grazing stock on foot around NSW. Some of these reserves are linear, providing a route for livestock to move from place to place. Other reserves are blocks of varying sizes providing a place for livestock to be temporarily grazed or held (e.g. for overnight yarding). In addition to the TSRs, livestock can also be moved along public roads subject to a permit from the LLS.

The agricultural study area intersects with several TSRs from the Balranald area to the Wagga Wagga substation. Most of these are linear reserves associated with major roads (LLS 2021), including:

- Balranald-Kyalite Road,
- Moulamein-Balranald Road,
- Hay Road (Maude Road),
- Cobb Highway,
- Carrathool Road, and
- McLennons Bore Road.

The agricultural study area also intersects with, or is adjacent to, TSR blocks (LLS 2021) at:

- Four Corners (Carrathool Road – 325 hectares),
- Fernbank (Fernbank Road - 139 hectares),
- Thurrowa (Newell Highway - 266 hectares),
- Bundure (Colombo Road - 255 hectares),
- Coonong (Coonong Road - 135 hectares),
- The Gums (Federation Way (Urana-Morundah Road) - 146 hectares),
- Cullivel (Boree Creek Road – 22 hectares), and
- Brookong (Urana-Lockhart Road - 409 hectares).

Maude Road, Cobb Highway, Carrathool Road, Urana-Lockhart Road, Lockhart-The Rock Road, Olympic Highway and Holbrook Road, which all intersect with the agricultural study area, have been identified by the NSW Government as 'livestock highways'. The NSW Department of Industry (2017) defined livestock highways as a key network of livestock routes connecting key agricultural regions within NSW, and with Queensland and Victoria.

It is possible that some movement of livestock along travelling stock reserves or public roads would be affected temporarily by restricted access to construction areas. However, these restrictions would be of a short duration and the proposal is not expected to significantly prevent or hinder livestock movements.

6 Assessment of operational impacts

6.1 Loss of land use

The main impact of the proposal on soil and land capability would be the removal of areas from agricultural production. The areas required by the proposal, however, would be small, as discussed below.

The general comments on the loss of land use during construction included in Section 5.1 are also relevant to the loss of land use during the operational phase.

Some of the operational impact area (such as bases of the transmission line structures) would be not be permanently removed from agricultural production. For example, grazing may continue around and under the transmission line and structures. However, in cropping areas, the structure and a safe buffer around the structure would result in some areas being permanently unable to be cropped in the future.

Other parts of the operational impact area, such as hardstand areas and permanent tracks could affect soil characteristics to the point that these locations would no longer be productive cropping or pasture areas. This would affect cropping and horticultural land use to a greater degree than the transmission line structures, but these locations would comprise only a small percentage of the agricultural study area (Section 4.2).

The potential impact of the proposal on irrigated horticultural land is relatively high due to its high productivity (Section 4.5.4). However, it is not expected that any irrigated horticultural land would be taken out of production by the proposal.

The direct impact of the proposal on agricultural production would be minimal during the operation phase, due to the small areas affected and the low productivity of parts of the agricultural study area. The permanent disturbance area of the tower footprints amounts to 419 hectares, or 0.005 per cent of the total area of agricultural holdings in the nine impacted LGAs. A safe buffer around structures would add an additional affected area.

The exact location of proposal structures would influence the amount of land permanently affected. If structures are located close to other objects, the land between the two objects could become inaccessible to cropping equipment. For example, a tower located 10 metres from a fence may prevent cultivation, seeding, spraying and/or harvesting in that gap if cropping equipment is wider than 10 metres.

The width of cropping equipment varies from property to property, but sprayers can exceed 40 metres in width. However, some sprayers have the capacity to fold and operate at narrower widths.

6.2 Biosecurity

6.2.1 Weeds

The biosecurity risks and potential impacts outlined in Section 5.2.2, in relation to the construction phase are also applicable to the operational phase. The major difference is that activity would be less intense and frequent in the operational phase, and therefore the risk of weed spread would be much lower.

6.2.2 Livestock pests and diseases

As discussed in Section 5.2.3, the biosecurity risks associated with livestock pest and diseases from activities associated with the proposal would be low. The risks in the operational phase would be lower than for the construction phase due to lesser vehicle, machinery and personnel activity.

6.2.3 Vertebrate pests

As for the construction phase (Section 5.2.4), the impact of the proposal on vertebrate pests during operation, if any, would be very low.

6.2.4 Plant diseases and pests

As discussed in Section 5.2.5, the biosecurity risks associated with plant pest and diseases from activities associated with the proposal are significant for horticultural industries but low for other agricultural enterprises. Lower personnel activity would lead to lesser risks in the operational phase than for the construction phase.

6.3 Other potential impacts

6.3.1 Restricted movement

It is unlikely that the operation of the proposal would significantly restrict the movements of landholders, workers, livestock or equipment.

6.3.2 Impacts on cropping and horticultural on-ground operations

The presence of transmission line structure or other facilities on cropping land would disrupt, to some extent, normal on-ground crop husbandry operations across land surrounding the structure or facility. Usual cultivation, crop establishment and spraying travel patterns must be adjusted to avoid the structure or facility, and care needs to be taken to avoid collisions when using wide farming equipment. However, the overall impact of the proposal on crop production would be minor due to the small areas directly affected, and the ability to continue cropping across most of the transmission line easement and the agricultural study area during the operation phase.

Structures such as electricity transmission towers are particularly problematic for controlled traffic farming (CTF). CTF is a farming system built on permanent wheel tracks where the crop zone and traffic lanes are permanently separated. In areas where CTF is not currently used, the proposal may have an impact if the system was implemented in the future. The permanent wheel tracks would need to be adjusted to avoid any proposal structures. In some instances, where straight parallel tracks are currently used, the adjusted tracks would not be straight or parallel in parts, leading to inefficiencies in cropping operations.

Many landholders in the agricultural study area, including those employing CTF, use global positioning system (GPS) guidance for their cropping equipment. This guidance uses GPS receivers in the equipment, and sometimes in a fixed base station. Concerns have been expressed that the proposal's transmission lines would have the potential to interfere with the GPS reception by base stations and cropping equipment, or with signals sent by base stations to equipment.

The extent to which interference may occur is dealt with in more detail in a separate technical report of this EIS on electromagnetic fields (Technical paper 13). However, should interference with GPS guidance occur, this would cause a substantial impact on cropping operations.

Effective weed control within cropping areas would also be impacted by the inability to apply herbicides to the area under or around structures such as transmission towers with normal spray operations. These areas may need separate applications of herbicides and extra attention to prevent a build-up of weeds and their spread onto adjacent cropping areas.

Powerlines above cropping areas can be hazardous due to the considerable height of agricultural plant and equipment such as harvesters and grain augurs. The height above ground of transmission lines would be sufficient to enable the allowable approach distance of six metres (WorkCover 2006) to be maintained for cropping machinery. Large grain harvesters are generally the tallest farm machinery, with an operating height of around four metres and a total height with auger extended while unloading grain of approximately five metres.

Transgrid's guidelines indicate that machinery cannot extend more than 4.3 metres above ground level within transmission line easements (Transgrid 2021a). Consequently, areas within the transmission easement would not be suitable for grain loading and unloading activities.

6.3.3 Impacts on irrigation activities

In addition to the cropping impacts outlined in Section 6.3.2, irrigated cropping or horticulture enterprises may be subject to other impacts.

The use of hand-move irrigation pipes in irrigation areas around overhead powerlines can be an additional hazard due to their considerable length. It is unlikely that hand-move irrigation pipes are used much in the agricultural study area due to the extensive nature of typical irrigation enterprises.

Transmission structures and other associated facilities would have the potential to interfere with moving irrigation equipment, particularly mechanised centre pivot or linear move systems. However, there does not appear to be any centre pivot or linear move systems within the immediate vicinity of the proposal.

6.3.4 Impacts on aerial agriculture operations

Significant impacts on aerial agriculture operations (such as aerial spreading of fertilisers and aerial spraying) and drones could potentially arise from the presence of transmission lines in cropping or horticultural areas.

The efficiency and effectiveness of aerial agriculture operations can decline as application procedures must be amended to compensate for the presence of proposal structures. Transmission lines and towers are a potential hazard for low level aviation activities and these must be considered in planning a safe aerial application program. The direction of flight, release heights and run lengths may have to be adjusted to maintain safe operations. This can lead to parts of cropping paddocks near proposal structures being less effectively sprayed due to increased release heights, or some areas may not be able to be sprayed safely at all.

Efficiency of the aerial agricultural operations may decrease and become more time consuming.

Aerial agriculture is extensively used in the mixed dryland farming areas east of the Urana area, and on irrigated cropping lands. Aerial agriculture is less common in the western part of the agricultural study area. Despite this, the use of drones for mustering and monitoring in rangeland areas is increasing.

The location of the transmission line in the proximity of existing airstrips employed for aerial agriculture may restrict the use of these airstrips in some cases. Nearby powerlines can compromise safety during take-off and landing. In these cases, use of the airstrips may not be possible in certain conditions, or the airstrip may need to be relocated.

The use of drones for monitoring crops (including horticulture) is also increasing. Proximal sensing using drones is competitive with remote sensing by satellites for crop monitoring purposes. Crop sensing by drones is cheaper, more targeted, more timely, less affected by cloud cover, and provides higher quality images, which would probably result in increased future use.

Transmission lines and structures would restrict drone flight and sensing in areas around these structures. Drones are subject to electric and-magnetic interference from transmission lines, and it is recommended that they are not flown within approximately 30 metres of a power line (Drone U Flight School 2021). Unmanned aerial vehicles (such as drones) cannot be flown within 60 metres of any transmission line structure, guy wire or conductor (Transgrid 2021a).

6.3.5 Impacts on livestock enterprises

The main potential impact on livestock enterprises would be noise and movement disturbance of sheep and cattle, as discussed in Section 5.3.5. These impacts would lessen during the operation phase due to a lower intensity of personnel and vehicle movements, as maintenance activities would be less frequent than construction activities. The potential for damage to fences and other livestock infrastructure, and gates being left open, are also lower.

Overhead transmission lines also impact on the operation of electric fencing. Electric fencing must be located at least 30 metres from transmission structures or supporting guy wires, and have a height of no greater than 2.5 metres (Transgrid 2021a).

Australian Standard AS/NZS 3014:2003 states that electric fence crossings with overhead power lines must be avoided wherever possible. When a crossing cannot be avoided, it must be made underneath the transmission line and near as possible right angles to it. In addition, all electric fence connecting leads and wires are installed near an overhead power line above 33,000 volts must have a clearance of at least eight metres.

These requirements would potentially restrict the siting of electric fences, but is unlikely to have major impact on the operation of grazing enterprises.

All metallic fences (electric and non-electric) in the vicinity of transmission lines have specific construction requirements involving earthing and isolation panels (Transgrid 2021b), adding some extra construction costs.

Any livestock yards or buildings situated under the transmission lines would need to be relocated.

6.3.6 Fire risk

Fires could be started by human activities, equipment and vehicles during the operational phase. This risk should be lower than during construction, but are dependent on seasonal and weather conditions.

Fires could also arise from the operation of transmission lines and substations. Mechanical failure of a transmission line (for example, a dropped conductor), or failure of a transmission line to operate correctly under fault conditions (for example, faulty earthing at times of lightning strike), can initiate fire under specific conditions (Transgrid 2013). Other fire risks may involve high heat, wind impacts and contact with vegetation.

Fire risk has been discussed in greater detail in a separate technical report for this EIS on bushfire risk management (Technical paper 12).

7 Assessment of cumulative impacts

Cumulative impact assessment means the consideration of other nearby development projects along with the proposal. Projects with the potential for cumulative impacts with the proposal were identified through a review of publicly available information and environmental impact assessments from the following databases:

- NSW Major Projects website (NSW Government, searched October 2021)
- Relevant council websites (searched October 2021)
- Australian Government – Department of Environment and Energy, EPBC Public notices list (Australian Government, searched October 2021).

A number of proposed developments have been identified and these include:

- EnergyConnect – Western Section
- Buronga Solar Farm
- Buronga Landfill Expansion
- Buronga – Gol Gol residential expansion
- Inland Rail – Albury to Illabo
- Uranquinty Solar Farm
- Gregadoo Solar Farm.

7.1 EnergyConnect (NSW – Western Section)

The NSW – Western Section of EnergyConnect would comprise around 135 kilometres of new 330kV double circuit transmission line and associated infrastructure between the SA/NSW border and the existing Buronga substation, upgrade of the Buronga substation and upgrade of the existing 22 kilometre 220kV single circuit transmission line between the Buronga substation and the NSW/Victoria border at Monak. Transgrid has previously sought separate environmental planning approvals for EnergyConnect (NSW – Western Section).

The EnergyConnect (NSW – Western Section) was approved in September 2021. Construction of the proposal is scheduled to commence in early-2022 (enabling phase). The construction of the transmission lines would take approximately 18 months while the Buronga substation upgrade and expansion would be delivered in two components and be operational by late-2023.

The magnitude of the impacts of this project on agriculture is limited by:

- the relatively low productivity of agriculture in the area,
- the small amount of land removed from agriculture,
- the continuation of agriculture activity despite the construction and operation of the project; and
- the low biosecurity risks in the region.

There would be little impact of the project on agricultural productivity at a regional scale, and it is distant from most of this proposal. Therefore, the cumulative impacts would be small.

7.2 Buronga Solar Farm

The Buronga Solar Farm development includes a 400 MW solar farm with energy storage and associated infrastructure located adjacent to the proposal Buronga substation. The EIS for the project is currently being prepared. The project would also involve the construction of a 220kV or 330kV transmission line for connection to the existing Buronga substation. The construction schedule for the proposal is identified as being about approximately 18 to 24 months from site establishment to completion (noting commencement subject to approval from DPIE).

The preliminary environmental assessment for the Buronga Energy Station (Renew Estate, 2018) indicates the proposal site is approximately 1,200 hectares of which approximately 50 per cent has been cleared for cropping and grazing of volunteer pastures with the remainder being used for grazing of native pastures. The majority of the proposal site is LSC class 5 land of moderate–low capability, with a small portion of class 7 land of very low capability.

During operation, groundcover vegetation would be maintained under the arrays and is intended to be managed by sheep grazing where possible. Therefore, some grazing production would continue during the operational phase, but cropping would cease. The solar farm would be decommissioned and rehabilitated at the end of the project, making the site available for agriculture once again.

The preliminary environmental assessment concludes that the temporary (approximately 30 years) reduction of agricultural production at the proposal site is unlikely to have any significant impact on the agricultural productivity of the region.

The impact of the project on agricultural productivity at a regional scale would be minor. Therefore, the cumulative impacts would be small.

7.3 Buronga Landfill Expansion

The proposal includes the expansion to the existing Buronga landfill to allow for an increase in the total quantity of waste that can be accommodated from 30,000 tonnes to 100,000 tonnes of general waste per annum. The proposal would consist of the construction of multiple additional landfill cells over the next 30 years comprising a volume of approximately 4.8 million cubic metres over an area of approximately 395,000 square metres (including the current active landfill cell).

The area impacted by the project is relatively small, and it is understood from the preliminary scoping report (Tonkin 2020) that the project land is not currently used for agriculture. Therefore, no impact on regional agricultural production would be expected.

7.4 Buronga – Gol Gol residential expansion

Wentworth Shire Council is proposing new subdivisions to provide approximately 500 new large residential housing allotments in the Buronga – Gol Gol growth area, approximately 10 kilometres to the west of the proposal.

Maps which form part of the Wentworth LEP 2011 indicate that the total urban release area is approximately 240 hectares. Most of this area is currently used for irrigated horticulture. Consequently, the potential impact on regional agricultural production is significant if all this area was released for residential expansion, due the high value of irrigated horticulture production. However, the impact of the current proposal on irrigated horticulture would be very small and therefore the cumulative impacts would be minor.

7.5 Inland rail – Albury to Illabo

ARTC is proposing to upgrade the Albury to Illabo section, along the 185 kilometres of existing operational narrow-gauge railway from the Victorian/New South Wales border to Illabo in regional NSW. The Proposal would provide clearance of the existing 'Main South' corridor to operate 1,800 metres long, 6.5 metres high, double stacked trains and includes the provision of dual track in areas for train passing. The project is made up of discrete sections of proposed upgrade, including upgrades within the existing rail corridor at Uranquinty, The Rock and within the centre of Wagga Wagga.

Subject to planning approval, construction is planned to commence in mid-2023 and complete by late 2024. Operations to commence in 2025.

The proposal agricultural impacts during construction and operational phases are expected to be minimal due to the project-specific disturbance area being contained generally to the existing rail corridor, and therefore cumulative impacts are not expected.

7.6 Uranquinty Solar Farm

Origin Energy is proposing to develop a commercial scale solar photovoltaic site and associated battery storage at Uranquinty. The proposal would have a capacity of up to 200 megawatts (MW) of renewable energy production for the local electricity supply. The site is located north-west of Uranquinty village along Uranquinty Cross Road, around 15 kilometres south-west of Wagga Wagga. Given current timing for the proposed solar farm, there is the potential for the proposal and the solar farm construction periods to overlap

The scoping report (GHD 2021) indicates that the Uranquinty Solar Farm site has an area of approximately 450 hectares and is currently used for agricultural purposes, with the primary use being cropping. The Uranquinty Solar Farm has the potential to result in the reduction of land used for agricultural purposes due to the establishment of the solar farm and the associated infrastructure. The proponent would consider whether it is feasible to allow stock to graze within the site during operation as part of ongoing design development.

The Uranquinty Solar Farm would reduce agricultural production, but the relatively small size means that the impact would be small on a regional scale. The loss of agricultural production could be reduced by grazing of the site during the operational phase.

7.7 Gregadoo Solar Farm

The Gregadoo Solar Farm would be located about 13 km south-east of Wagga Wagga. The project is proposed to comprise construction, operation and decommissioning of a maximum 47 MW solar farm and associated infrastructure. Construction is expected to commence mid-2021.

The environmental impact statement for the Gregadoo Solar Farm site (NGH Environmental 2018) indicates that the project land would continue to be grazed with sheep during operation and, upon decommissioning, would be returned to its previous agricultural capacity. The solar farm occupies around 96 hectares of a 150 hectare property.

The Gregadoo Solar Farm would have little impact on regional agricultural production due to its small size and the continued sheep grazing.

7.8 Summary

Cumulative impacts on agriculture in the region arising from the proposal and other projects would not be substantial.

The individual impact on regional agriculture of each project is expected to be relatively small. The total agricultural area affected by the projects is minor, relative to total extent of agriculture in the nine impacted LGAs through which the proposal passes. Most of the projects would allow at least some agricultural production to continue on the project land. Consequently, the cumulative impact of the proposal and the other identified projects is expected to be low.

The potential impact on regional irrigated horticulture production of the Buronga – Gol Gol residential expansion is significant through its potential effect on irrigated horticultural production. However, the impact of the proposal on irrigated horticulture production is relatively small and therefore, the contribution of the proposal to the potential cumulative impacts on irrigated horticulture would be minor.

8 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential agricultural impacts are listed in Table 8.1.

Table 8.1
Mitigation measures – agriculture

Reference	Mitigation measure	Timing	Applicable location(s)
LP1	Access tracks (temporary and permanent) would be confirmed in consultation with landholders to minimise impacts on agricultural activities to the greatest extent possible. Where permanent tracks are required, a single access track would be designed to serve both temporary and permanent purposes, where possible.	Pre-construction and construction	All locations
LP2	Transmission line structures (and associated permanent structures or construction compounds) would be located where possible to avoid or minimise impacts, or as agreed with the affected landholder, on: • cropping and irrigated horticultural land • areas used for set up and pack up of agricultural equipment, entry points and turning areas • drainage catchments for farm dams • locations of high biosecurity risk.	Pre-construction	All locations
LP3	To minimise disruption to agricultural activities: • landholders would be consulted regarding any required adjustments to property infrastructure (fences, access tracks, etc) and the proposed timing and location of construction works, especially where some restriction on vehicular or stock movements would be necessary. Appropriate arrangements would be negotiated with the affected parties and put in place prior to any such disruption • property infrastructure (such as gates) would be managed in accordance with landholder requirements, (provided access is not limited or restricted) • any damage to property infrastructure caused by construction would be repaired promptly	Pre-construction and construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
	• use of existing roads, tracks and other existing disturbed areas would be prioritised • where access is required across open spaces, care would be exercised to ensure that minimum damage is caused to the surface by confining vehicular or plant movement, as far as possible, to one route.		
LP4	Consultation would be undertaken with relevant landowners who utilise aerial farming operations to identify appropriate mitigation arrangements (where feasible) such as the installation of aerial warning markers on the transmission lines.	Pre-construction and construction	Transmission line
LP5	Disturbed areas would be stabilised and appropriately rehabilitated (i.e. back to pre-impacted conditions) as soon as feasible and reasonable following the completion of construction at each location. This would be carried out in consultation with the relevant landowner.	Construction	All locations
LP6	Procedures would be implemented so that potential impacts or conflicts between livestock and construction activities are appropriately managed. Procedures would be developed in consultation with affected landholders and would include management of: • noise intensive activities during sensitive periods within the livestock production cycle (such as lambing and calving) • vehicle movements and other activities within the vicinity of livestock • movement of stock away from potential stressors created by construction activities.	Construction	Transmission line

Reference	Mitigation measure	Timing	Applicable location(s)
LP7	Biosecurity controls would be implemented during construction to minimise the risk of off-site transport or spread of disease, pests or weeds. Controls would include (but not limited to): • inspections and cleaning of vehicles, machinery, and personnel equipment prior to movement on and off construction work areas or between properties • minimising movements across adjoining farmland including trip numbers and locations • additional measures where localised areas of high biosecurity risks have been identified. The specific controls applicable to a property would be identified in consultation with the affected landholder. The effectiveness of these controls would be monitored in a manner and time interval consistent with the level of risk on each property.	Construction	All locations
LP8	Where present, weeds would be managed in consultation with the relevant landholder. Consultation would also occur with the relevant authority (LLS, the relevant local council) or NSW Department of Primary Industries) in relation to notifiable weeds.	Construction	All locations
LP9	In the event of new infestations of notifiable weeds as a result of construction activities, the relevant control authority would be notified as per *Biosecurity Act 2015* and Biosecurity Regulation 2017.	Construction	All locations
LP10	Fencing and access arrangements, such as locked gates, would be determined in consultation with landholders. Management of access on private landowner properties required to access infrastructure for maintenance, including opening and closing of gates, would be done in accordance with landholder requirements. Any damage caused by maintenance activities would be repaired promptly.	Operation	Transmission line

Reference	Mitigation measure	Timing	Applicable location(s)
LP11	If landholders indicate adverse effects on agricultural precision farming GPS signals due to operation of the project within 12 months from commencement of operation, the claims would be investigated. Any disruption due to operation of the proposal would be addressed in consultation with the affected landholder. Where it is identified there is a disruption, Transgrid would investigate and implement mitigation measures (such as signal boosting equipment) in consultation with the affected operator.	Operation	Transmission line
LP12	Biosecurity controls, confirmed in consultation with the affected landholders, would be implemented during operation to minimise the risk of off-site transport or spread of disease, pests or weeds during maintenance activities.	Operation	All locations
LP13	Where present within the operational transmission line easement and associated areas for permanent infrastructure, weeds would be managed in accordance with the *Biosecurity Act 2015*.	Operation	All locations

9 Conclusion

There are several potential impacts of the proposal on the agricultural industry. However, the magnitude of these impacts is constrained by the following factors:

- the low impact of the proposal in terms of the relatively small amount of land removed from agriculture,
- the general continuation of agriculture activity across the transmission line easement and the agricultural study area during construction and operation;
- relatively low biosecurity risks; and
- effective mitigation measures would be implemented to reduce the impacts of the proposal on the agricultural industry.

The impact of the proposal on agricultural productivity at a regional scale would be minimal due to the above factors.

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Attachment 1 – Inherent soil fertility maps

Agriculture - Attachment 1

Inherent Soil Fertility in the Study Area

Sheet 1 of 5

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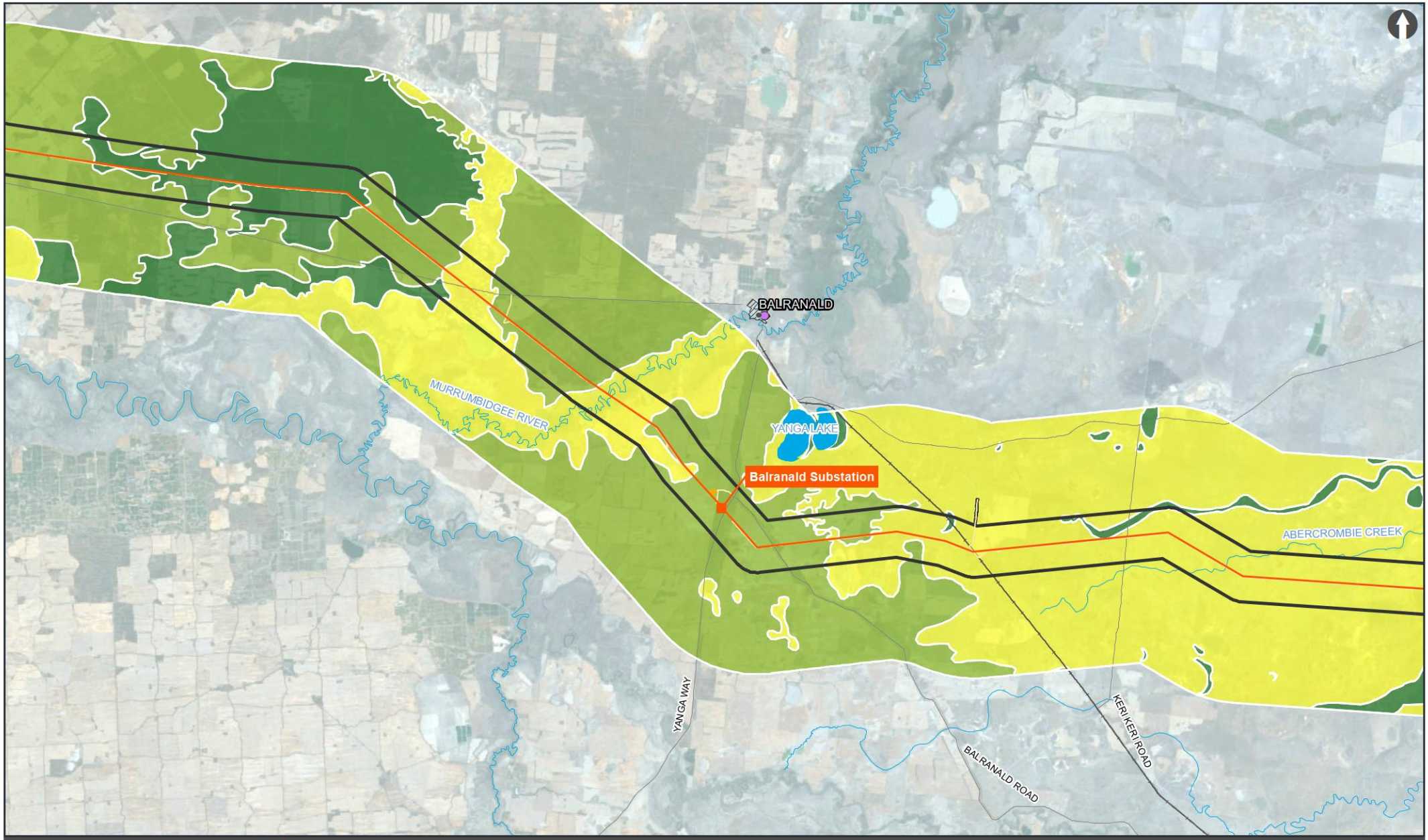
Source: NSWSS, ESRI, Transgrid, WSP



Project Components
- Water Fill Point
- Access Tracks
- Proposed Alignment
- Main Construction Compounds and Accommodation Sites
- Existing Substation
- Existing Railway
- Agricultural Study Area
- Built Up Areas
- Waterbody

Inherent Soil Fertility
- 1 - Low
- 2 - Moderately low
- 3 - Moderate

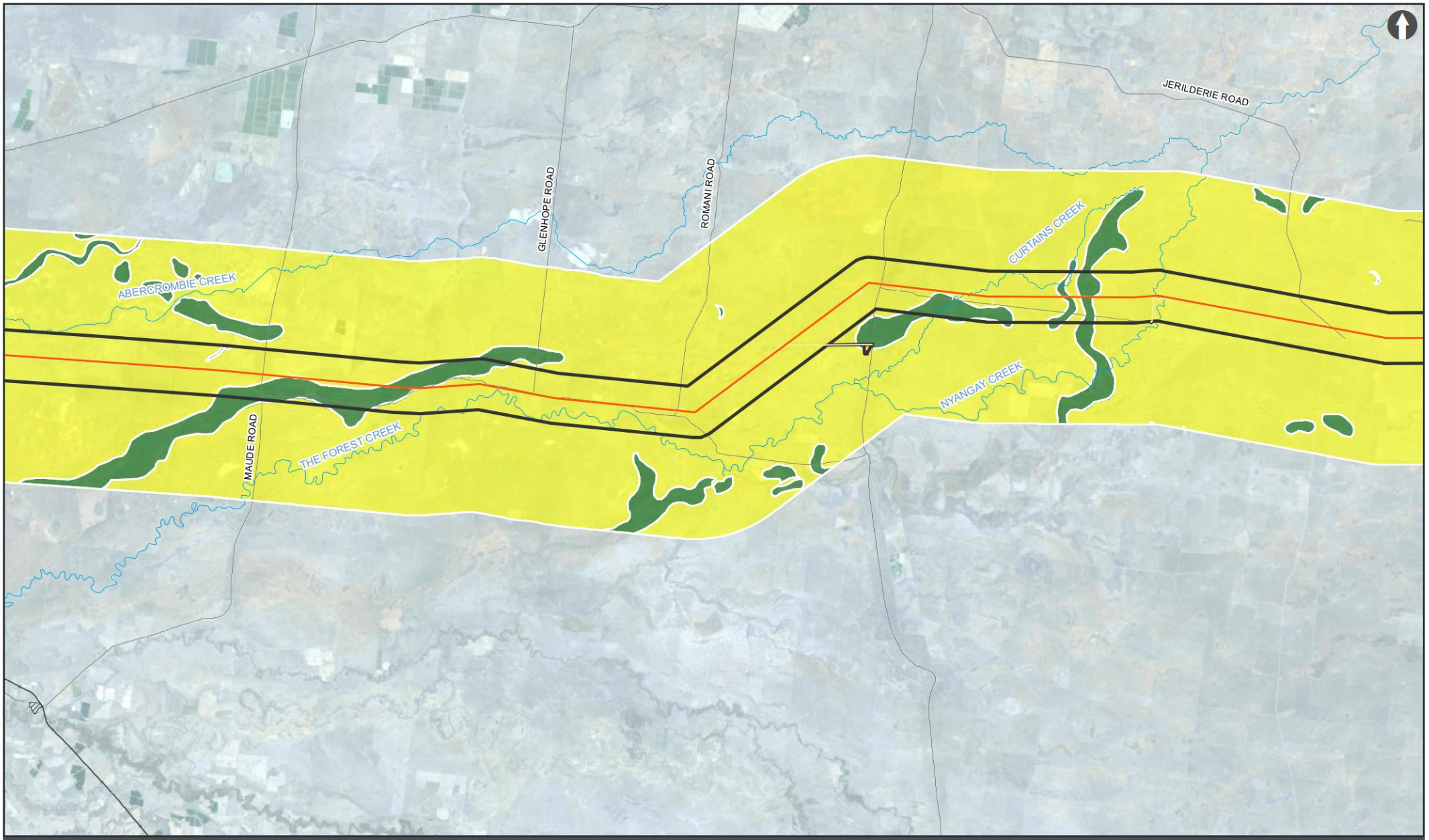
Agriculture - Attachment 1

Inherent Soil Fertility in the Study Area

Sheet 2 of 5

C:\Users\autw500241\WSP O365\EnergyConnect - General\5_Shared\54_Production\Maps\003_PEC_East\02_Specialist\Reports\06_Agriculture\PS117658_AGRI_F0001_InherentSoilFertility_r1v4.mxd

Source: NSWSS, ESRI, Transgrid, WSP



Project Components
- Water Fill Point
- Access Tracks
- Proposed Alignment
- Main Construction Compounds and Accommodation Sites

- Existing Substation
- Existing Railway
- Agricultural Study Area
- Built Up Areas

Inherent Soil Fertility
- 1 - Low
- 3 - Moderate

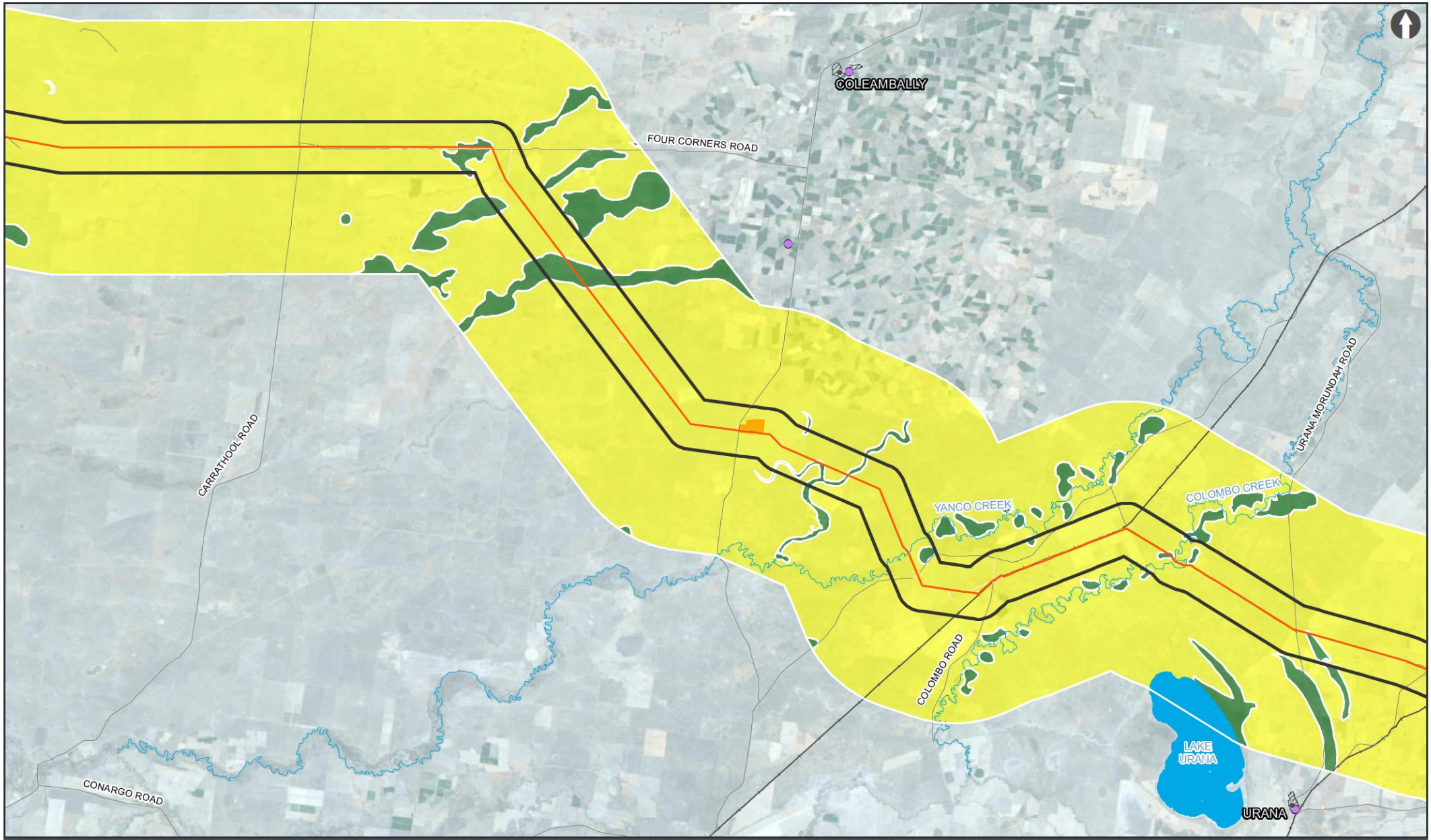
Agriculture - Attachment 1

Inherent Soil Fertility in the Study Area

Sheet 3 of 5

C:\Users\autw500241\WSP O365\EnergyConnect - General\5_Shared\54_Production\Maps\003_PEC_East\02_Specialist\Reports\06_Agriculture\PS117658_AGRI_F0001_InherentSoilFertility_r1v4.mxd

Source: NSWSS, ESRI, Transgrid, WSP



Project Components

- Water Fill Point
- Access Tracks
- Proposed Alignment
- Main Construction Compounds and Accommodation Sites
- Existing Substation
- Existing Railway
- Agricultural Study Area
- Built Up Areas
- Waterbody

Inherent Soil Fertility

- 1 - Low
- 3 - Moderate

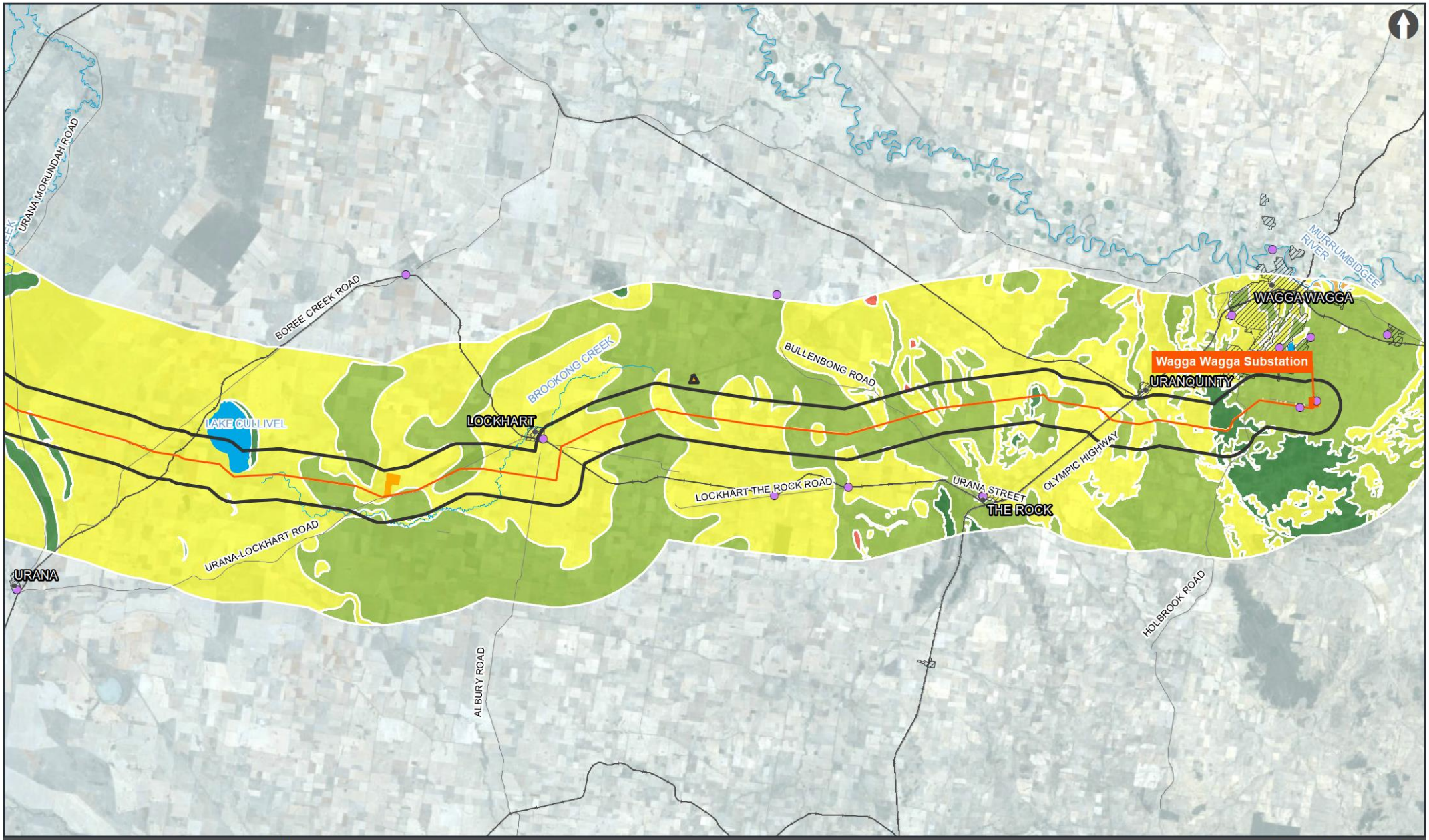
Agriculture - Attachment 1

Inherent Soil Fertility in the Study Area

Sheet 4 of 5

C:\Users\autw500241\WSP O365\EnergyConnect - General\5_Shared\54_Production\Maps\003_PEC_East\02_SpecialistReports\06_Agriculture\PS117858_AGRI_F0001_InherentSoilFertility_r1v4.mxd

Source: NSWSS, ESRI, Transgrid, WSP



Project Components
- Water Fill Point
- Access Tracks
- Proposed Alignment
- Main Construction Compounds and Accommodation Sites
- Existing Substation
- Existing Railway
- Agricultural Study Area
- Built Up Areas
- Waterbody

Inherent Soil Fertility
- 1 - Low
- 2 - Moderately low
- 3 - Moderate
- 4 - Moderately high
- 5 - High
- 99 - Water

Agriculture - Attachment 1

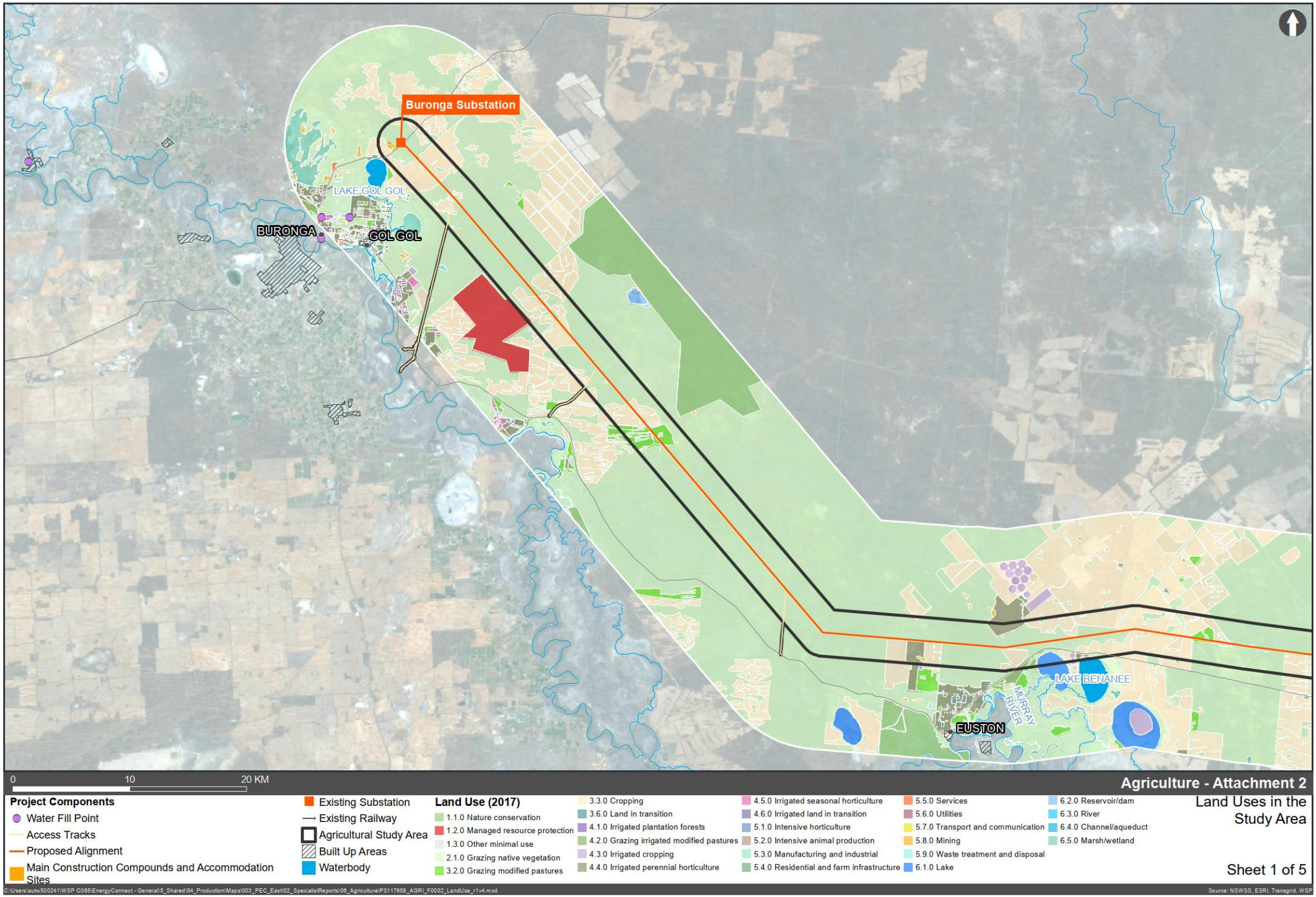
Inherent Soil Fertility in the Study Area

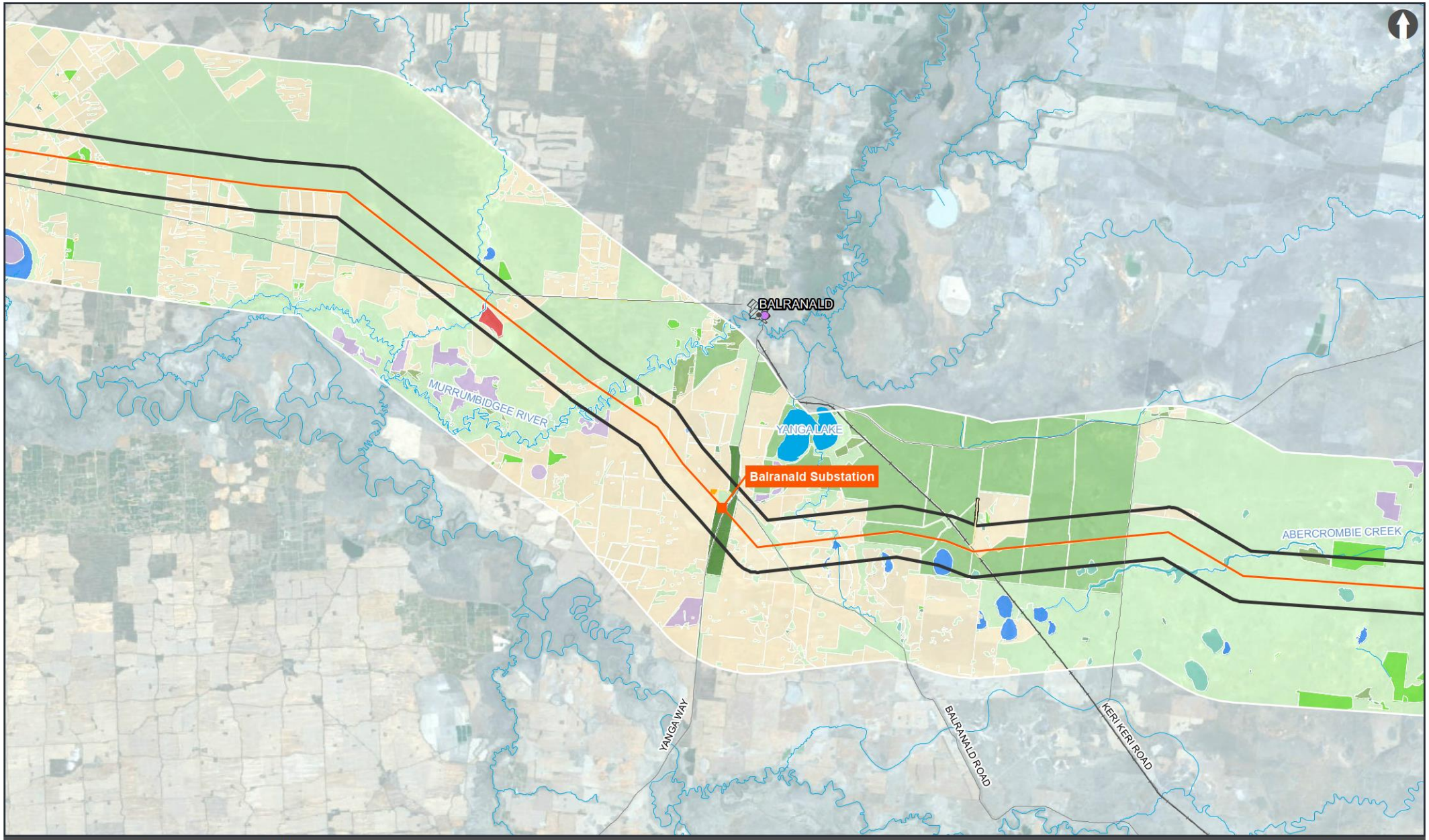
Sheet 5 of 5

C:\Users\autw500241\WSP O365\EnergyConnect - General\5_Shared\54_Production\Maps\003_PEC_East\02_SpecialistReports\06_Agriculture\PS117658_AGRI_F0001_InherentSoilFertility_r1v4.mxd

Source: NSWSS, ESRI, Transgrid, WSP

Attachment 2 – Land use maps


Buronga Substation
LAKE GOL GOL
BURONGA
GOL GOL
EUSTON
LAKE BENANEE
MURRAY RIVER
0
10
20 KM
Agriculture - Attachment 2
Project Components
Water Fill Point
Access Tracks
Proposed Alignment
Main Construction Compounds and Accommodation Sites
Existing Substation
Existing Railway
Agricultural Study Area
Built Up Areas
Waterbody
Land Use (2017)
1.1.0 Nature conservation
1.2.0 Managed resource protection
1.3.0 Other minimal use
2.1.0 Grazing native vegetation
3.2.0 Grazing modified pastures
3.3.0 Cropping
3.6.0 Land in transition
4.1.0 Irrigated plantation forests
4.2.0 Grazing irrigated modified pastures
4.3.0 Irrigated cropping
4.4.0 Irrigated perennial horticulture
4.5.0 Irrigated seasonal horticulture
4.6.0 Irrigated land in transition
5.1.0 Intensive horticulture
5.2.0 Intensive animal production
5.3.0 Manufacturing and industrial
5.4.0 Residential and farm infrastructure
5.5.0 Services
5.6.0 Utilities
5.7.0 Transport and communication
5.8.0 Mining
5.9.0 Waste treatment and disposal
6.1.0 Lake
6.2.0 Reservoir/dam
6.3.0 River
6.4.0 Channel/aqueduct
6.5.0 Marsh/wetland
Land Uses in the Study Area
Sheet 1 of 5
C:\Users\autw500241\WSP O365\EnergyConnect - General\5_Shared\54_Production\Maps\003_PEC_East\02_SpecialistReports\06_Agriculture\PS117658_AGRI_F0002_LandUse_r1v4.mxd
Source: NSWSS, ESRI, Transgrid, WSP



Agriculture - Attachment 2

Project Components
- Water Fill Point
- Access Tracks
- Proposed Alignment
- Main Construction Compounds and Accommodation Sites
- Existing Substation
- Existing Railway
- Agricultural Study Area
- Built Up Areas
- Waterbody

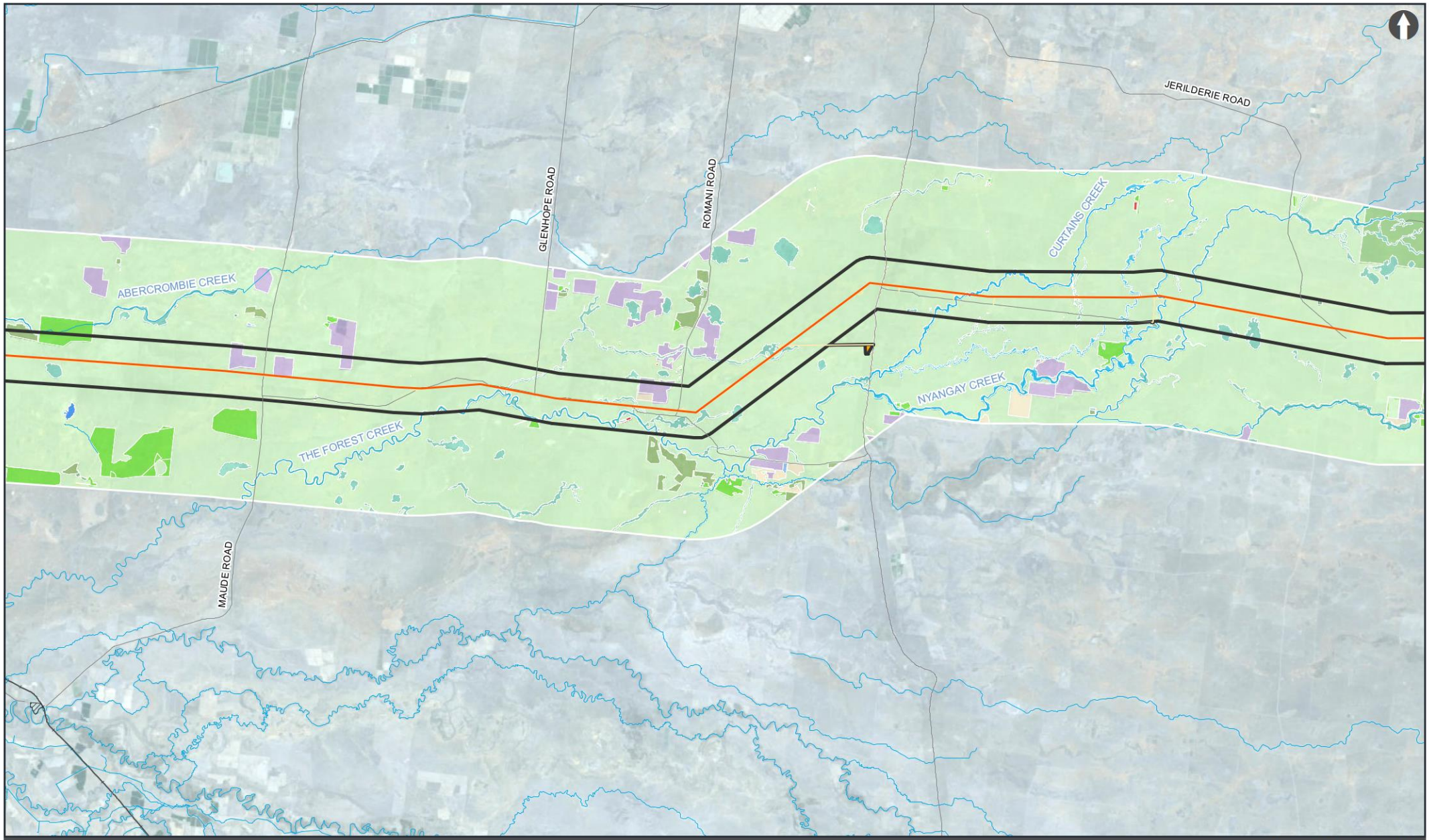
Land Use (2017)
- 1.1.0 Nature conservation
- 1.2.0 Managed resource protection
- 2.1.0 Grazing native vegetation
- 2.2.0 Production native forestry
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 4.2.0 Grazing irrigated modified pastures
- 4.3.0 Irrigated cropping
- 4.4.0 Irrigated perennial horticulture
- 5.2.0 Intensive animal production
- 5.4.0 Residential and farm infrastructure
- 5.6.0 Utilities
- 5.7.0 Transport and communication
- 5.8.0 Mining
- 6.1.0 Lake
- 6.2.0 Reservoir/dam
- 6.3.0 River
- 6.5.0 Marsh/wetland

Land Uses in the Study Area

Sheet 2 of 5

C:\Users\autw500241\WSP O365\EnergyConnect - General\5_Shared\54_Production\Maps\003_PEC_East\02_SpecialistReports\06_Agriculture\PS117658_AGRI_F0002_LandUse_r1v4.mxd

Source: NSWSS, ESRI, Transgrid, WSP



Agriculture - Attachment 2

Land Uses in the Study Area

Access Tracks
Proposed
Main Construction Compounds and Accommodation Sites
Existing Substation
Existing Railway
Agricultural Study Area
Built Up Areas
Waterbody

Land Use (2017)

- 1.1.0 Nature conservation
- 1.2.0 Managed resource protection
- 1.3.0 Other minimal use
- 2.1.0 Grazing native vegetation
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 4.2.0 Grazing irrigated modified pastures
- 4.3.0 Irrigated cropping
- 5.2.0 Intensive animal production
- 5.4.0 Residential and farm infrastructure
- 5.6.0 Utilities
- 5.7.0 Transport and communication
- 5.8.0 Mining
- 6.1.0 Lake
- 6.2.0 Reservoir/dam
- 6.3.0 River
- 6.4.0 Channel/aqueduct
- 6.5.0 Marsh/wetland

Sheet 3 of 5

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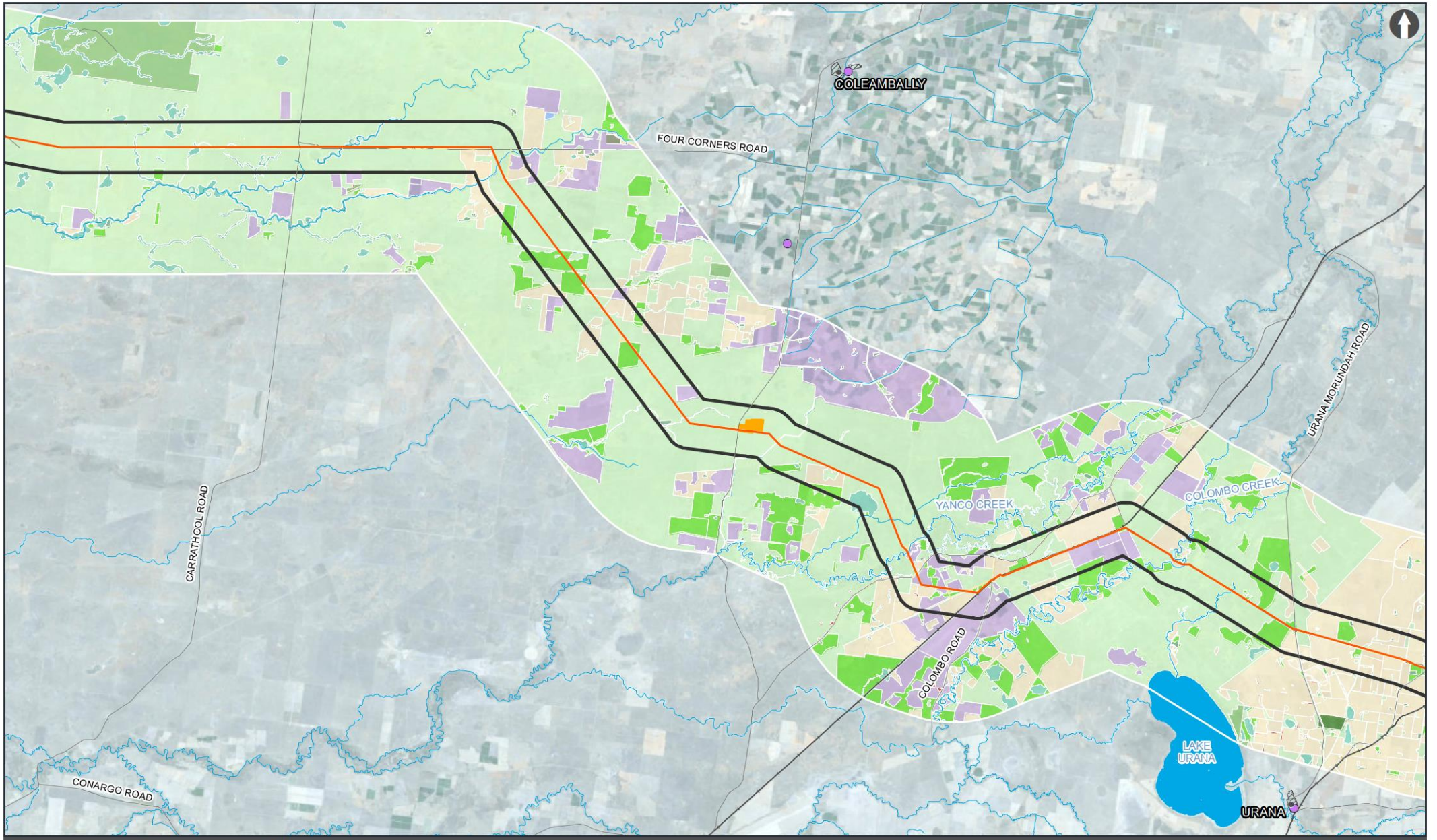
Source: NSWSS, ESRI, Transgrid, WSP



Agriculture - Attachment 2

Land Uses in the Study Area

Sheet 4 of 5

Project Components

- Water Fill Point
- Access Tracks
- Proposed Alignment
- Main Construction Compounds and Accommodation Sites
- Existing Substation
- Existing Railway
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- Built Up Areas
- Waterbody

Land Use (2017)

- 1.1.0 Nature conservation
- 1.2.0 Managed resource protection
- 2.1.0 Grazing native vegetation
- 2.2.0 Production native forestry
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- 3.3.0 Cropping
- 4.1.0 Irrigated plantation forests
- 4.2.0 Grazing irrigated modified pastures
- 4.3.0 Irrigated cropping
- 4.4.0 Irrigated perennial horticulture
- 5.2.0 Intensive animal production
- 5.4.0 Residential and farm infrastructure
- 5.7.0 Transport and communication
- 5.8.0 Mining
- 5.9.0 Waste treatment and disposal
- 6.1.0 Lake
- 6.2.0 Reservoir/dam
- 6.3.0 River
- 6.4.0 Channel/aqueduct
- 6.5.0 Marsh/wetland

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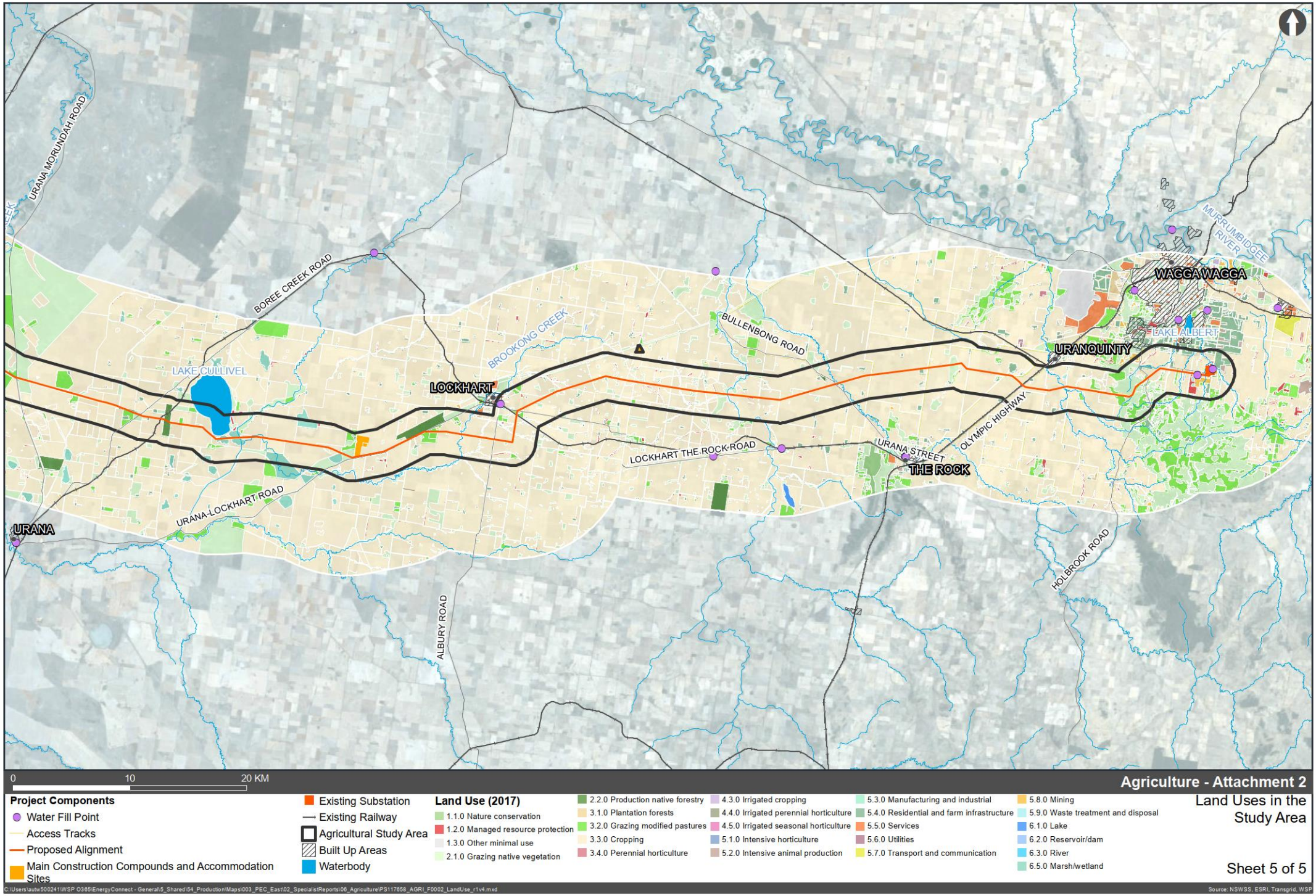
Source: NSWSS, ESRI, Transgrid, WSP


URANA MORUNDAH ROAD
BOREE CREEK ROAD
BROOKONG CREEK
BULLENBONG ROAD
LAKE CULLIVEL
LOCKHART
LOCKHART THE ROCK ROAD
URANA STREET
OLYMPIC HIGHWAY
THE ROCK
URANA-LOCKHART ROAD
URANA
ALBURY ROAD
HOLBROOK ROAD
MURRUMBIDGEE RIVER
WAGGA WAGGA
LAKE ALBERT
URANQUINTY
0
10
20 KM
Agriculture - Attachment 2
Project Components
Water Fill Point
Access Tracks
Proposed Alignment
Main Construction Compounds and Accommodation Sites
Existing Substation
Existing Railway
Agricultural Study Area
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Waterbody
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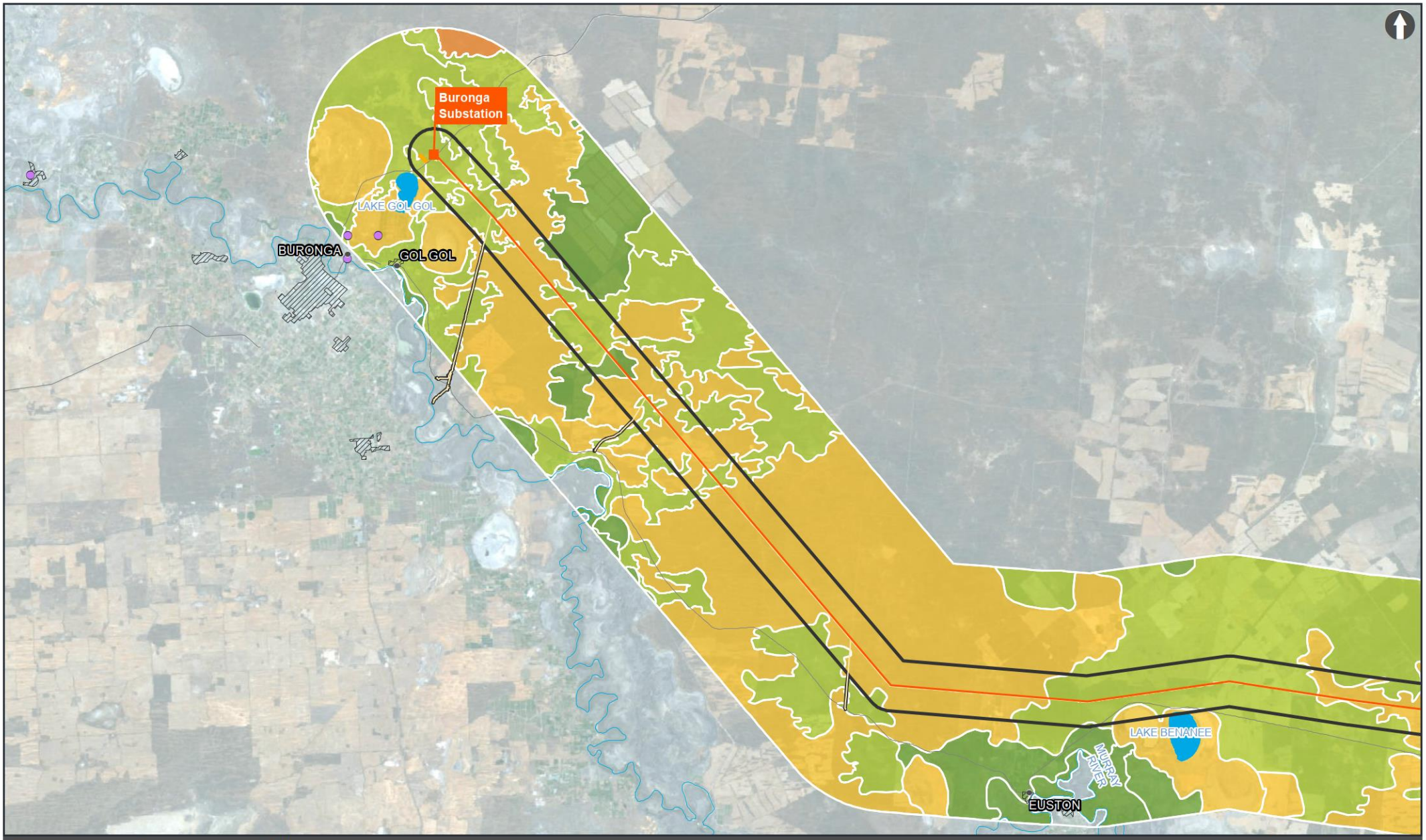
3.1.0 Plantation forests
3.2.0 Grazing modified pastures
3.3.0 Cropping
3.4.0 Perennial horticulture
4.3.0 Irrigated cropping
4.4.0 Irrigated perennial horticulture
4.5.0 Irrigated seasonal horticulture
5.1.0 Intensive horticulture
5.2.0 Intensive animal production
5.3.0 Manufacturing and industrial
5.4.0 Residential and farm infrastructure
5.5.0 Services
5.6.0 Utilities
5.7.0 Transport and communication
5.8.0 Mining
5.9.0 Waste treatment and disposal
6.1.0 Lake
6.2.0 Reservoir/dam
6.3.0 River
6.5.0 Marsh/wetland
Land Uses in the Study Area
Sheet 5 of 5
C:\Users\autw500241\WSP O365\EnergyConnect - General\5_Shared\54_Production\Maps\003_PEC_East\02_Specialist\Reports\06_Agriculture\PS117858_AGRI_F0002_LandUse_r1v4.mxd
Source: NSWSS, ESRI, Transgrid, WSP

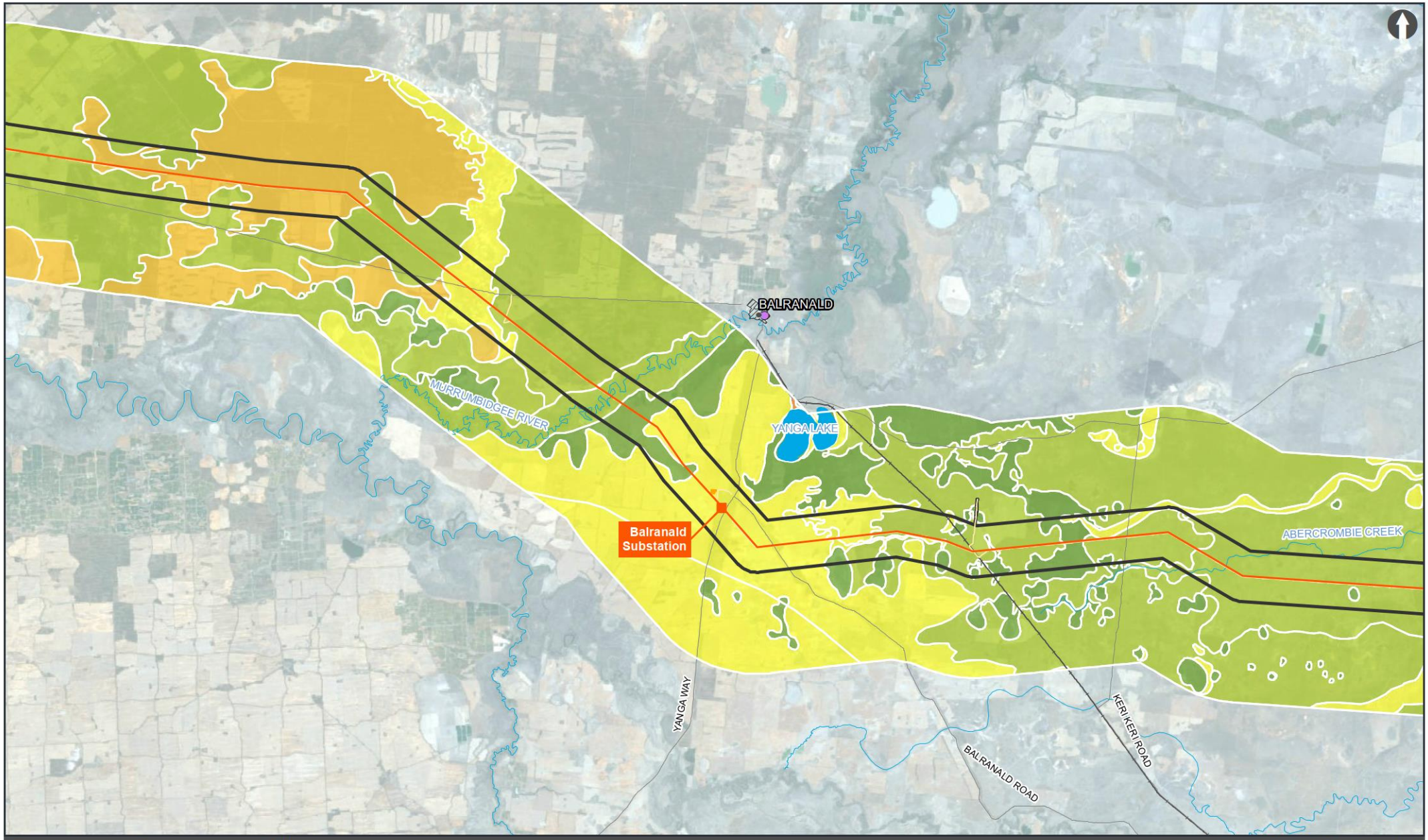
Attachment 3 – Land and soil capability maps



Agriculture - Attachment 3

Land and Soil Capability in the Study Area

Sheet 1 of 5



Project Components
- Water Fill Point
- Access Tracks
- Proposed Alignment
- Main Construction Compounds and Accommodation
- Existing Substation
- Existing Railway
- Agricultural Study Area
- Built Up Areas
- Waterbody

Land and Soil Capability within 10km of Proposed
- 4 - Moderate to Severe Limitations
- 5 - Severe Limitations
- 6 - Very Severe Limitations
- 7 - Extremely Severe Limitations
- 8 - Extreme Limitations

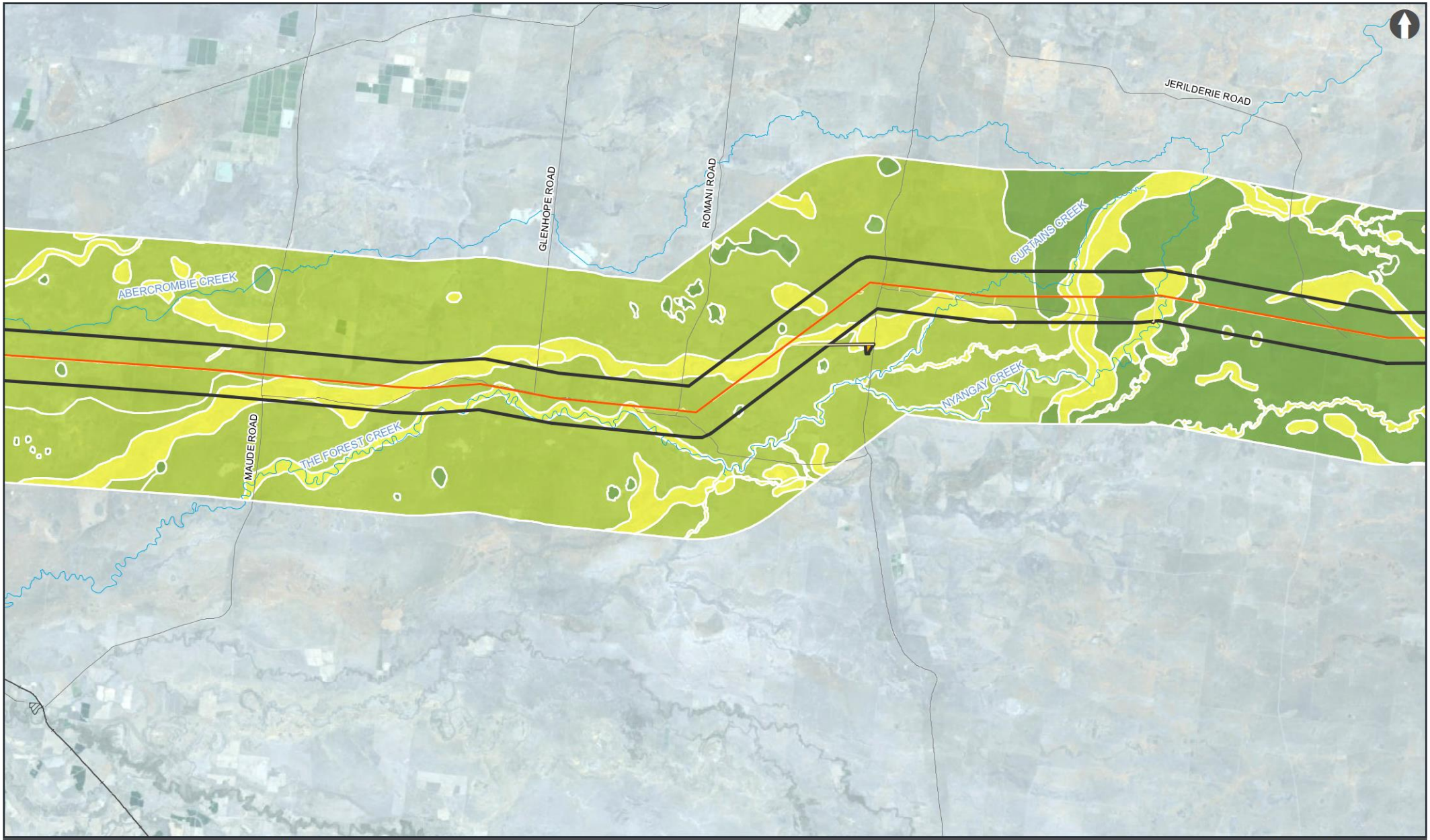
Agriculture - Attachment 3

Land and Soil Capability in the Study Area

Sheet 2 of 5

C:\Users\autw500241\WSP O365\EnergyConnect - General\5_Shared\54_Production\Maps\003_PEC_East\02_SpecialistReports\06_Agriculture\PS117658_AGRI_F0003_LandSoilCapability_r1v4.mxd

Source: NSWSS, ESRI, Transgrid, WSP



Agriculture - Attachment 3

Land and Soil Capability in the Study Area

Sheet 3 of 5

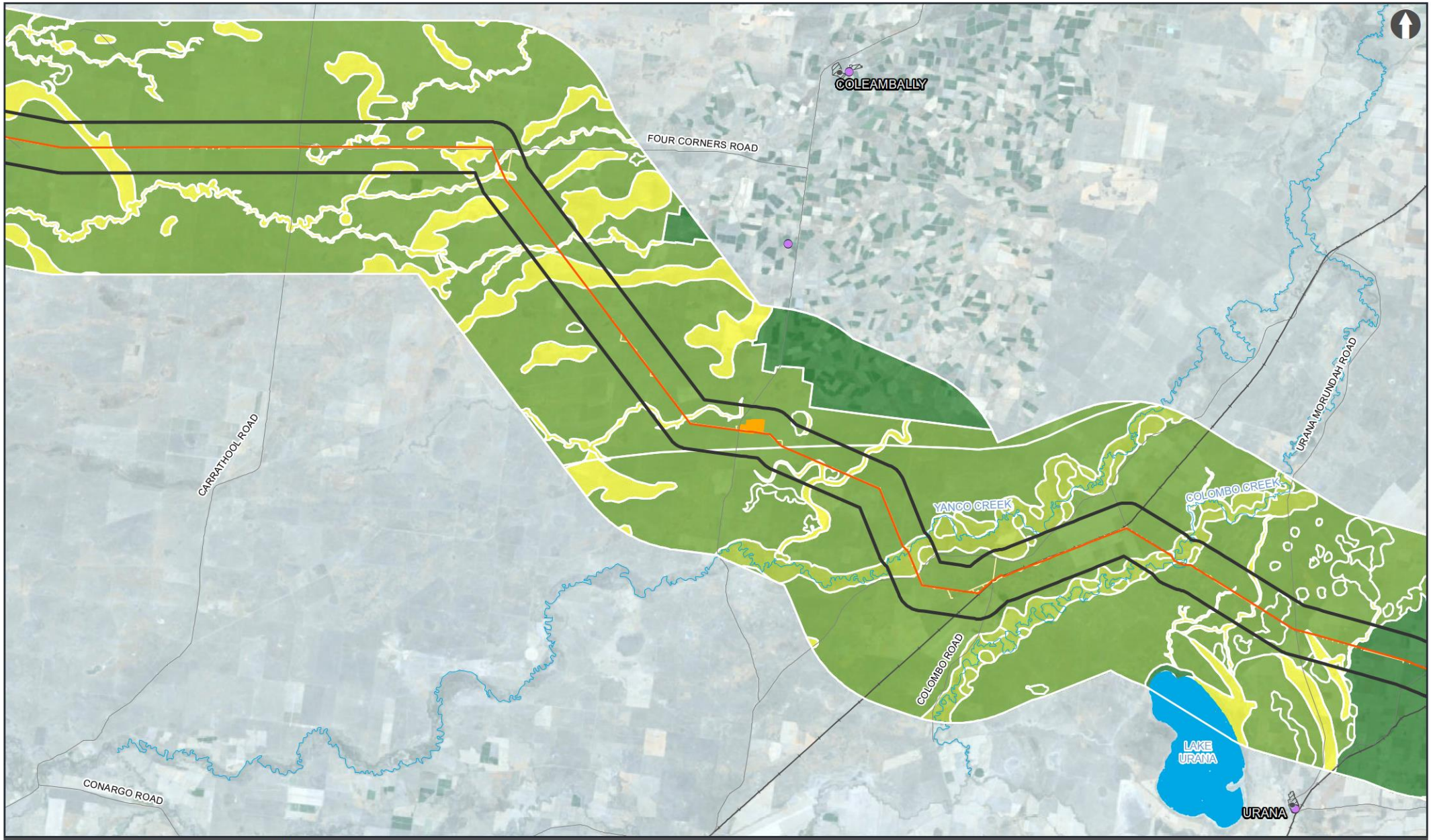
- Access Tracks
- Proposed Alignment
- Main Construction Compounds and Accommodation
- Existing Substation
- Existing Railway
- Agricultural Study Area
- Built Up Areas
- Waterbody

Land and Soil Capability within 10km of Proposed

- 4 - Moderate to Severe Limitations
- 5 - Severe Limitations
- 6 - Very Severe Limitations

C:\Users\autw500241\WSP O365\EnergyConnect - General\5_Shared\54_Production\Maps\003_PEC_East\02_SpecialistReports\06_Agriculture\PS117658_AGRI_F0003_LandSoilCapability_r1v4.mxd

Source: NSWSS, ESRI, Transgrid, WSP



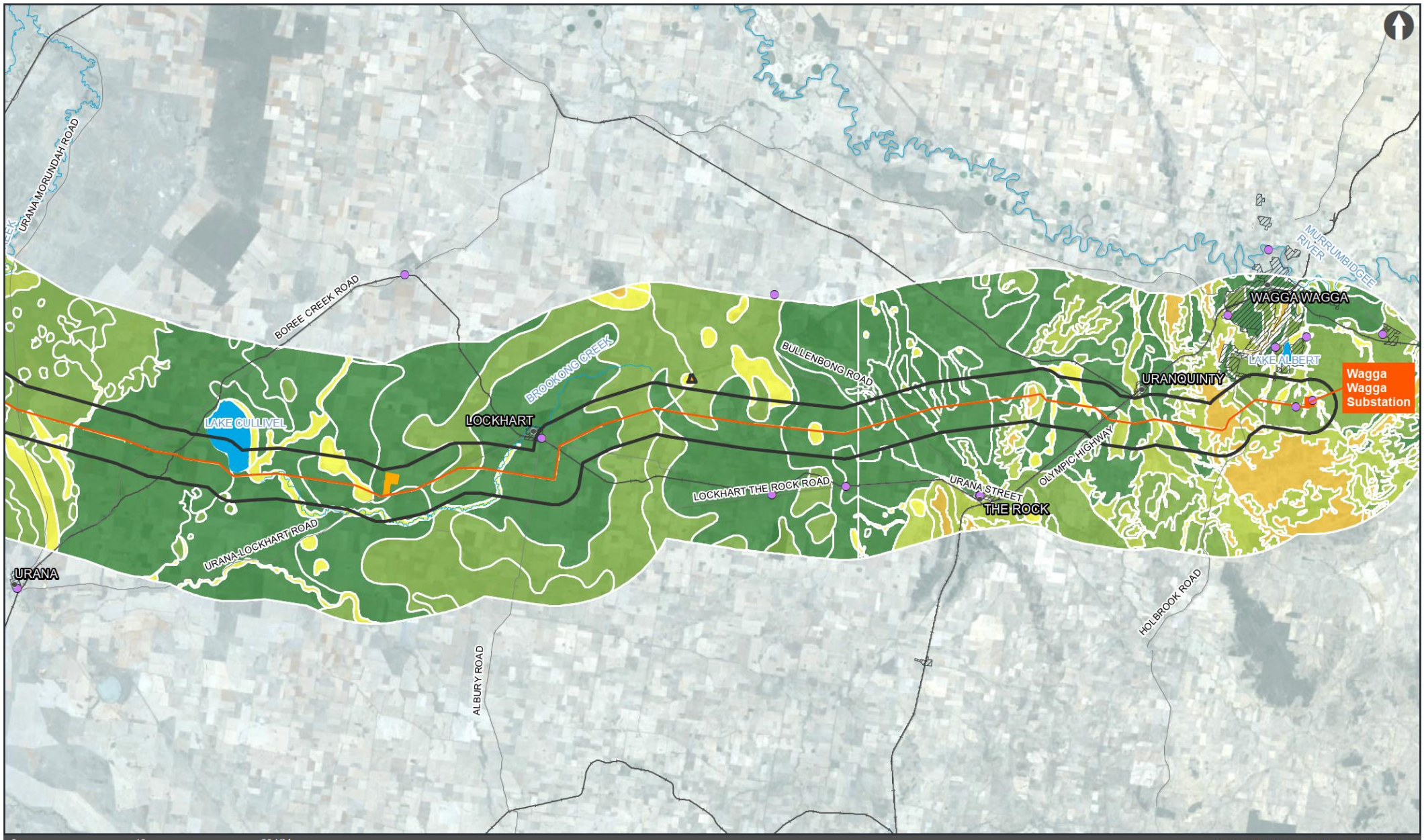
Agriculture - Attachment 3

Land and Soil Capability in the Study Area

Sheet 4 of 5

C:\Users\autw500241\WSP O365\EnergyConnect - General\5_Shared\54_Production\Maps\003_PEC_East\02_Specialist\Reports\06_Agriculture\PS117658_AGRI_F0003_LandSoilCapability_r1v4.mxd

Source: NSWSS, ESRI, Transgrid, WSP



Agriculture - Attachment 3

Land and Soil Capability in the Study Area

Sheet 5 of 5

Attachment 4

Other regional weeds

(2 pages)

Common name	*Scientific name*	LLS *Western*	LLS *Murray*	LLS *Riverina*
Box elder	*Acer negundo*		X	
Tree of heaven	*Ailanthus altissima*		X	X
Camel thorn	*Alhagi pseudalhagi*		X	
Khaki weed	*Alternanthera pungens*	X	X	X
Bridal creeper	*Asparagus asparagoides*		X	X
Onion weed	*Asphodelus fistulosus*	X		
Wild oat	*Avena spp.*	X		
Wild turnip	*Brassica tournefortii*	X		
Brome grass	*Bromus spp.*	X		
Ward's weed	*Carrichtera annua*	X		
Spiny burr grass	*Cenchrus incertus & C. longispinus*		X	X
Star thistle	*Centaurea calcitrapa*		X	X
St Barnaby's thistle	*Centaurea solstitialis*		X	
Green cestrum	*Cestrum parqui*			X
Windmill grass	*Chloris truncata*	X		
Flax-leaf fleabane	*Conyza bonariensis*	X		
Pampas grass	*Cortaderia spp.*		X	X
Golden dodder	*Cuscuta campestris*		X	X
Prickly pear	*Cylindropuntia spp.*		X	X
Lincoln weed	*Diplotaxis tenuifolia*	X		
Spiny emex	*Emex australis Steinh*		X	X
African lovegrass	*Eragrostis curvula complex*			X
Spanish heath	*Erica lusitanica*		X	X
Bear-skin fescue	*Festuca gautieri*		X	X
Galenia	*Galenia pubescens*		X	
Honey locust	*Gleditsia triacanthos*		X	X
Reed sweet-grass	*Glyceria maxima*		X	X
Harrisia cactus	*Harrisia martinii and H. tortuosa*		X	X
Blue heliotrope	*Heliotropium amplexicaule*		X	X
Common heliotrope	*Heliotropium europaem*	X		
Barley grass	*Hordeum spp.*	X		
St John's wort	*Hypericum perforatum*		X	X
Tangled hypericum	*Hypericum triquetrifolium*		X	X
Devil's claw	*Ibicella lutea or Proboscidea louisianica*			X
Himalaya honeysuckle	*Leycesteria formosa*		X	X
Privet (broad-leaf)	*Ligustrum lucidum*			X
Privet (narrow-leaf)	*Ligustrum sinense*			X
Winged sea lavender	*Limonium lobatum*	X		
Statice	*Limonium sinuatum*	X		
Annual ryegrass	*Lolium rigidum*	X		
Indian fig	*Opuntia ficus-indica*	X		
Long leaf willow primrose	*Ludwigia longifolia*		X	X

Common name	Scientific name	LLS		
		Western	*Murray*	*Riverina*
African boxthorn	*Lycium ferocissimum*		*X*	*X*
Horehound	*Marrubium vulgare*		*X*	*X*
Cape tulips	*Moraea flaccida and M. miniata*		*X*	*X*
Scotch - Illyrian thistles	*Onopordum spp.*		*X*	*X*
Indian fig	*Opuntia ficus-indica*			*X*
Prickly pears	*Opuntia spp.*		*X*	*X*
Red rice	*Oryza rufipogon*		*X*	
Reed canary grass	*Phalaris arundinacea*		*X*	*X*
Lippia	*Phyla canescens*			*X*
Wild radish	*Raphanus raphanistrum*	*X*		
Castor oil plant	*Ricinus communis*	*X*		
Sweet briar	*Rosa rubiginosa*		*X*	*X*
Blackberry	*Rubus fruticosus (agg.)*		*X*	*X*
Galvanised burr	*Sclerolaena birchii*		*X*	*X*
Bitter stonecrop	*Sedum acre*		*X*	*X*
Pepper tree	*Schinus molle*	*X*		
Indian hedge mustard	*Sisymbrium oriental*	*X*		
Silverleaf nightshade	*Solanum elaeagnifolium*		*X*	*X*
Blackberry nightshade	*Solanum nigrum*	*X*		
Buffalo burr	*Solanum rostratum*		*X*	*X*
Common wow thistle	*Sonchus oleraceus*	*X*		
Johnson grass	*Sorghum halepense*		*X*	*X*
Silk forage sorghum	*Sorghum spp. hybrid cv. ‘silk’*		*X*	*X*
Columbus grass	*Sorghum x almum*		*X*	*X*
Athel pine	*Tamarix aphylla*		*X*	*X*
Tamarix	*Tamarix ramosissima*		*X*	
Poison ivy	*Toxicodendron radicans*	*X*		
Rhus tree	*Toxicodendron succedaneum*	*X*	*X*	*X*
Cat-head	*Tribulus terrestris*	*X*		*X*
Silver grass	*Vulpia bromoides*	*X*		
Bathurst burr	*Xanthium spp.*		*X*	*X*