EnergyCo

Central-West Orana Renewable Energy Zone Transmission project

Scoping Report

September 2022

www.energyco.nsw.gov.au

EnergyCo

Central-West Orana Renewable Energy Zone Transmission project

Scoping Report

September 2022

www.energyco.nsw.gov.au

NSW GOVERNMENT

Acknowledgement of Country

The Energy Corporation of NSW acknowledges that it stands on Aboriginal land. We acknowledge the Traditional Custodians of the land and we show our respect for Elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

Published by Energy Corporation of NSW

energyco.nsw.gov.au

Central-West Orana Renewable Energy Zone Transmission project First published: September 2022

ISBN/ISSN: ISBN 978-1-922899-66-8

Department reference number: EHG2022/0477

Contents

Contents (continued)

Contents (continued)

Contents (continued)

Contents (continued)

List of tables

List of figures

List of appendices

Executive summary

Project overview and need

New South Wales (NSW) is currently undergoing an energy sector transformation that will change how we generate and use energy. The National Energy Market (NEM) (managed by the Australian Energy Market Operator (AEMO)) is transitioning from a system dominated by a small number of large coal-fired generators located close to metropolitan centres to one of diverse renewable and distributed energy generation and storage located where the resource and environmental constraints permit.

The NSW Government is leading the development of Renewable Energy Zones (REZs) across NSW to deliver renewable energy generation and storage, supported by transmission infrastructure. A REZ groups new renewable energy power generation into locations where it can be efficiently stored and transmitted across NSW, requiring the coordination of power generation, power storage and transmission infrastructure. By doing so, REZs capitalise on economies of scale to deliver clean, affordable and reliable electricity for homes, businesses and industry in NSW.

Five REZs have been announced in NSW. This scoping report is in respect of the Central-West Orana Transmission project which would facilitate the development of renewable energy projects in the Central-West Orana REZ (refer to Figure ES-1) and which has an intended network capacity of at least three gigawatts. As the existing transmission network is not capable of transferring this amount of new electricity generation in the Central-West Orana REZ, new transmission infrastructure is needed to connect the new electricity generation and storage projects in the REZ to the NEM.

Energy Corporation of NSW (EnergyCo), a NSW Government statutory authority, has been appointed under the *Electricity Infrastructure Investment Act 2020* (NSW) as the Infrastructure Planner responsible for delivering the Central-West Orana REZ. EnergyCo is responsible for coordinating REZ transmission, generation, firming and storage projects to deliver efficient, timely and coordinated investment.

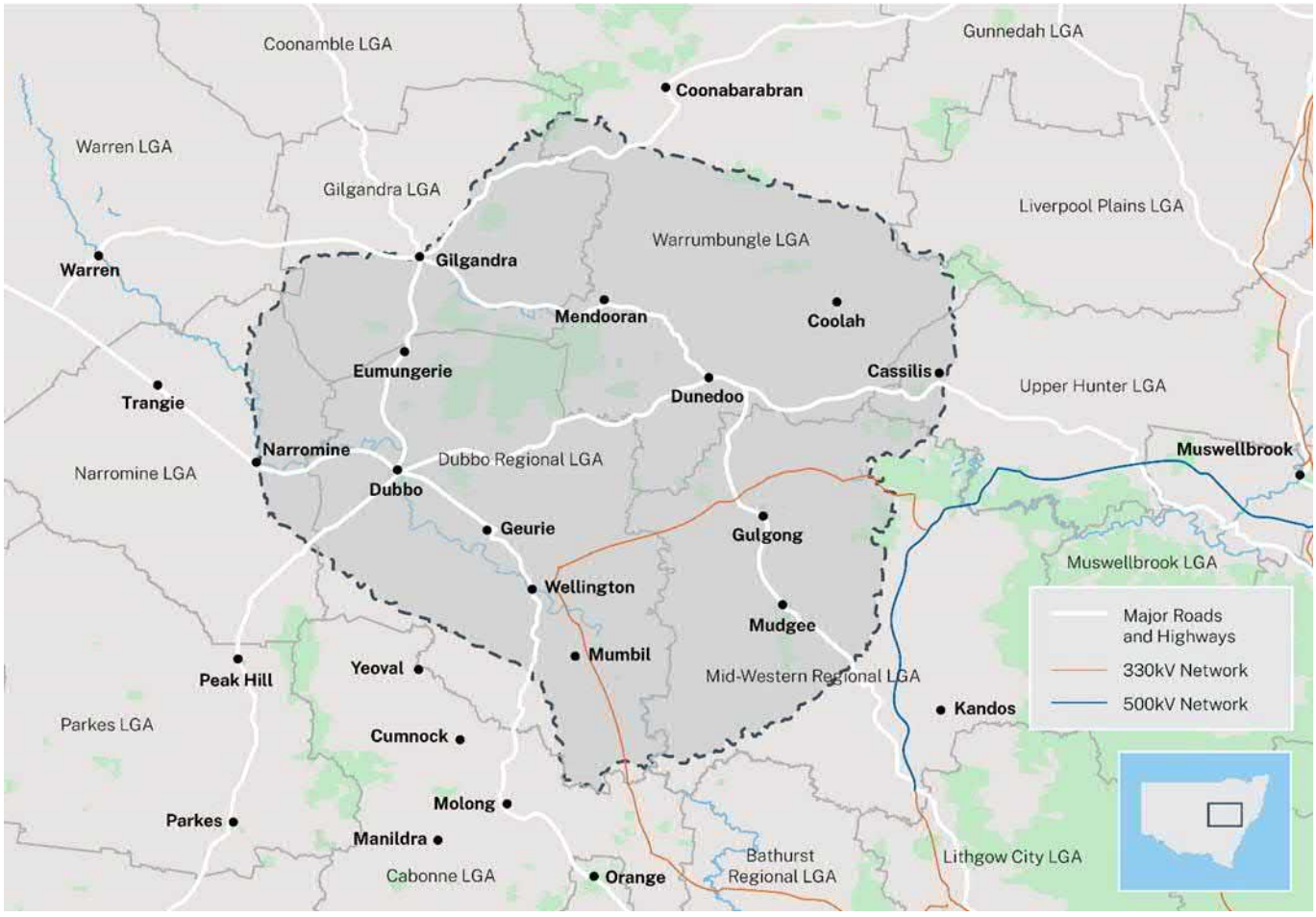


Figure ES-1 Central-West Orana REZ geographical area (Source: EnergyCo)

The project

EnergyCo is seeking approval for the construction and operation of new high voltage electricity transmission infrastructure that is required to connect energy generation and storage projects within the Central-West Orana REZ to the existing electricity network (the project). The project would comprise the following key features:

- a new switching station at Wollar, to connect the project to Transgrid's existing Wollar Substation and onto the NEM
- new twin double circuit 500 kV transmission lines and associated infrastructure to connect to the NEM and single and double circuit 330 kV single lines to connect energy generation and storage projects within the Central-West Orana REZ to the energy hubs
- energy hubs at Merotherie and Elong Elong, to connect energy generation and storage projects within the Central-West Orana REZ to the new 500 kV network infrastructure
- switching stations along the 330 kV network infrastructure to transfer the energy generated from the energy generation projects onto the 330 kV network infrastructure
- establishment and upgrade of access tracks and public roads, and other ancillary works such as laydown and staging areas, earthwork material sites with crushing and screening plants, concrete batching plants, brake/winch sites, site offices and workforce accommodation camps
- utility adjustments required for construction of the new network infrastructure.

The project includes a southern extension of the transmission network between Elong Elong and Mumbil with a connection to the NSW transmission network. This section is under investigation and will be subject to a separate planning approval.

It is expected that construction of the project would commence in the second half of 2024 and take approximately three years to complete, with initial operations commencing as early as mid-2027.

Planning and assessment process

The project is Critical State significant infrastructure (CSSI) and is subject to approval by the NSW Minister for Planning under Division 5.2, Part 5 of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act).

A referral under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) has been submitted to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) at the same time as this report. If the project is determined to be a controlled action, the approval of the Australian Minister for the Environment will be required in addition to the State CSSI approval.

Purpose of this document

EnergyCo has prepared this scoping report to support a CSSI application under section 5.15 of the EP&A Act. It provides a description of the project and presents the environmental matters that will require further assessment as part of an EIS for the project, including the proposed approach to assessing each of these matters. It also describes the community engagement that will be carried out during the preparation of the EIS. The report is intended to assist in the formulation of the environmental assessment requirements (SEARs) that will be issued by the Secretary of the NSW Department of Planning and Environment (DPE) under section 5.16 of the EP&A Act.

In accordance with the bilateral agreement reached between the NSW and Australian Governments, an EIS under the EP&A Act for CSSI can also be used for an assessment under the EPBC Act for a controlled action, where directed by the Australian Minister for the Environment.

Key environmental issues

The key environmental issues identified for the project, which will be assessed in detail during the preparation of the EIS, are:

- land use and property
- agriculture
- landscape character and visual amenity
- biodiversity
- Aboriginal cultural heritage
- non-Aboriginal heritage
- social
- economic
- noise and vibration
- hazard and risk
- traffic and transport
- waste management and resource use
- cumulative impacts.

Other issues to be assessed include:

- hydrology, flooding and water quality
- geology and groundwater
- soils and contamination
- air quality
- climate change and greenhouse gas.

Next steps

Following receipt of the SEARs, EnergyCo will prepare an EIS for the project. The EIS will be developed in accordance with the requirements of Division 5.2 of the EP&A Act, Division 5 of Part 8 of the Environmental Planning and Assessment Regulation 2021 (EP&A Regulation) and the DPE *State Significant Infrastructure Guidelines* (NSW Department of Planning, Industry and Environment (DPIE), 2021a) (the Guidelines) and will include:

- an analysis of feasible alternatives to the carrying out of the project
- a description of the project during construction and operation
- a description of the existing environment and an assessment of potential direct and indirect impacts on key and other potential environmental issues during construction and operation, including cumulative impacts with other projects
- measures that will be implemented to avoid, minimise and offset potential impacts
- consideration of issues raised by stakeholders and the community during preparation of the EIS.

The EIS will be publicly exhibited by DPE, in accordance with the provisions of Division 5.2 of the EP&A Act. During the public exhibition of the EIS, the community, stakeholder, organisations and government agencies will have the opportunity to provide feedback via a formal submission. The EIS is expected to be exhibited in mid-2023.

1 Introduction

This chapter provides an overview and background to the Central-West Orana Renewable Energy Zone Transmission project (the project) and describes the purpose and structure of this Scoping Report.

1.1 Renewable Energy Zones (REZs)

New South Wales (NSW) is currently undergoing an energy sector transformation that will change how we generate and use energy. The National Energy Market (NEM) (managed by the Australian Energy Market Operator (AEMO)) is transitioning from a system dominated by a small number of large coal-fired generators located close to metropolitan centres, to one of diverse renewable and distributed energy generation and storage located where the resource and environmental constraints permit.

Renewable Energy Zones (REZs) are modern day power stations which combine renewable energy generation and energy storage systems, connected to transmission infrastructure via energy hubs, as shown in Figure 1-1. REZs will play a vital role in delivering clean, affordable and reliable electricity for homes, businesses and industry in NSW to help replace the State's existing power stations as they come to their scheduled end of operational life.

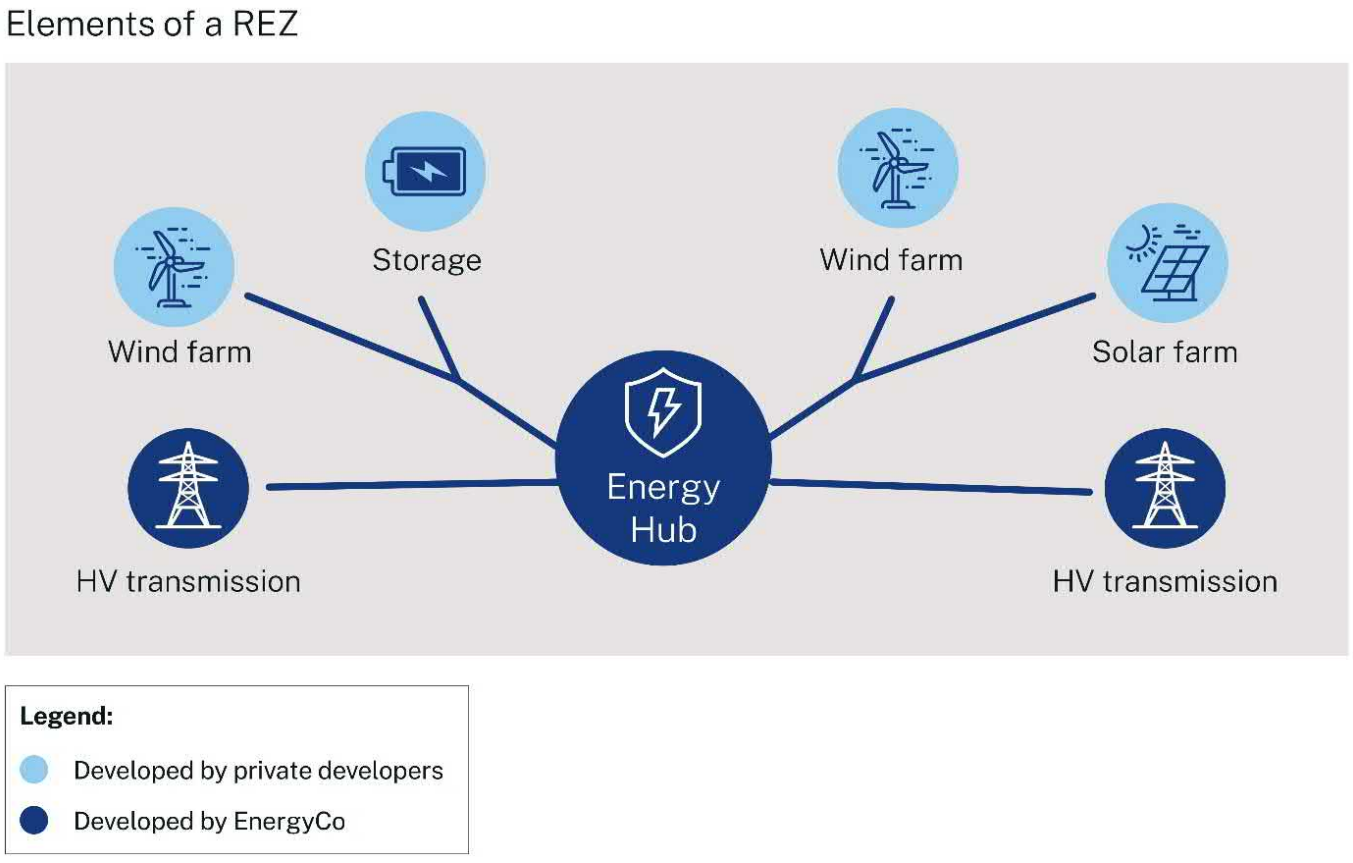


Figure 1-1 Elements of a REZ

Various government strategies, plans and policies such as AEMO's Integrated Systems Plan (ISP) (AEMO, 2022), the NSW Transmission Infrastructure Strategy (DPE, 2018a) and NSW Electricity Infrastructure Roadmap (DPE, 2020), identify the important role for REZs to provide an effective and economical way to integrate new generation, storage and transmission development. The NSW Electricity Infrastructure Roadmap also identifies five regions prioritised for the development of REZs: the Central-West Orana, South-West, New England, Hunter-Central Coast and Illawarra regions of NSW.

The relationship between the project and relevant government strategies is described further in Chapter 2.

1.2 Central-West Orana REZ

The Central-West Orana REZ was formally declared on 5 November 2021 under the *Electricity Infrastructure Investment Act 2020*. The declaration sets out the intended network capacity, geographical area and infrastructure required for the REZ. Under the declaration, EnergyCo is appointed as the Infrastructure Planner and is responsible for coordination of the development of generation and network infrastructure.

The REZ is approximately 20,000 square kilometres in size and centred by Dubbo and Dunedoo, on the land of the Wiradjuri, Wailwan and Kamilaroi peoples (refer to Figure 1-2). The Central-West Orana region has a strong mix of energy resources and significant investor interest, with more than 27 gigawatts of projects identified in response to a registration of interest (ROI) process in June 2020. The number of responses to the ROI reflects the strong level of interest in the REZ and helps ensure only the most competitive projects will be able to access the new transmission infrastructure through the Consumer Trustee's competitive tender processes.

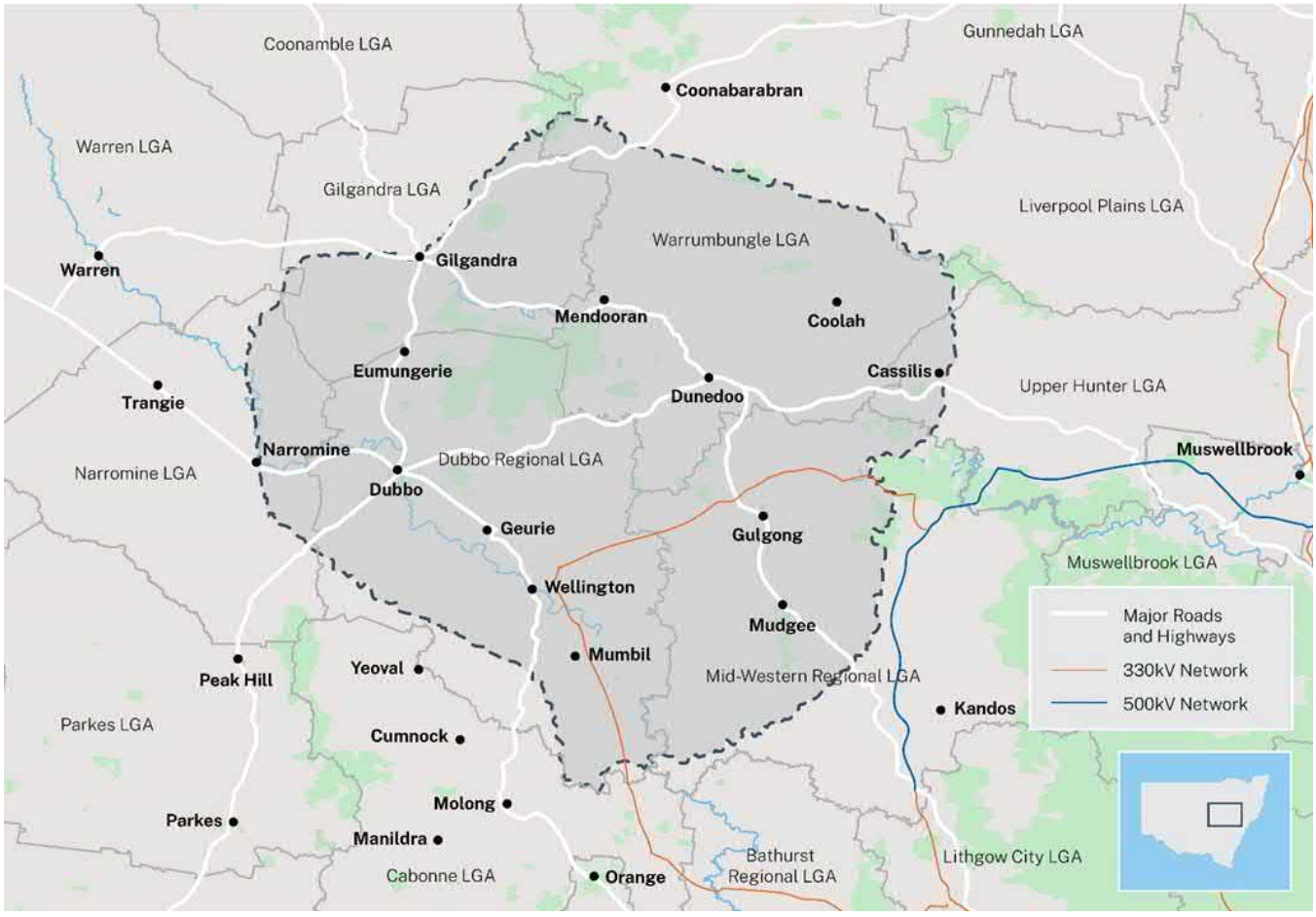


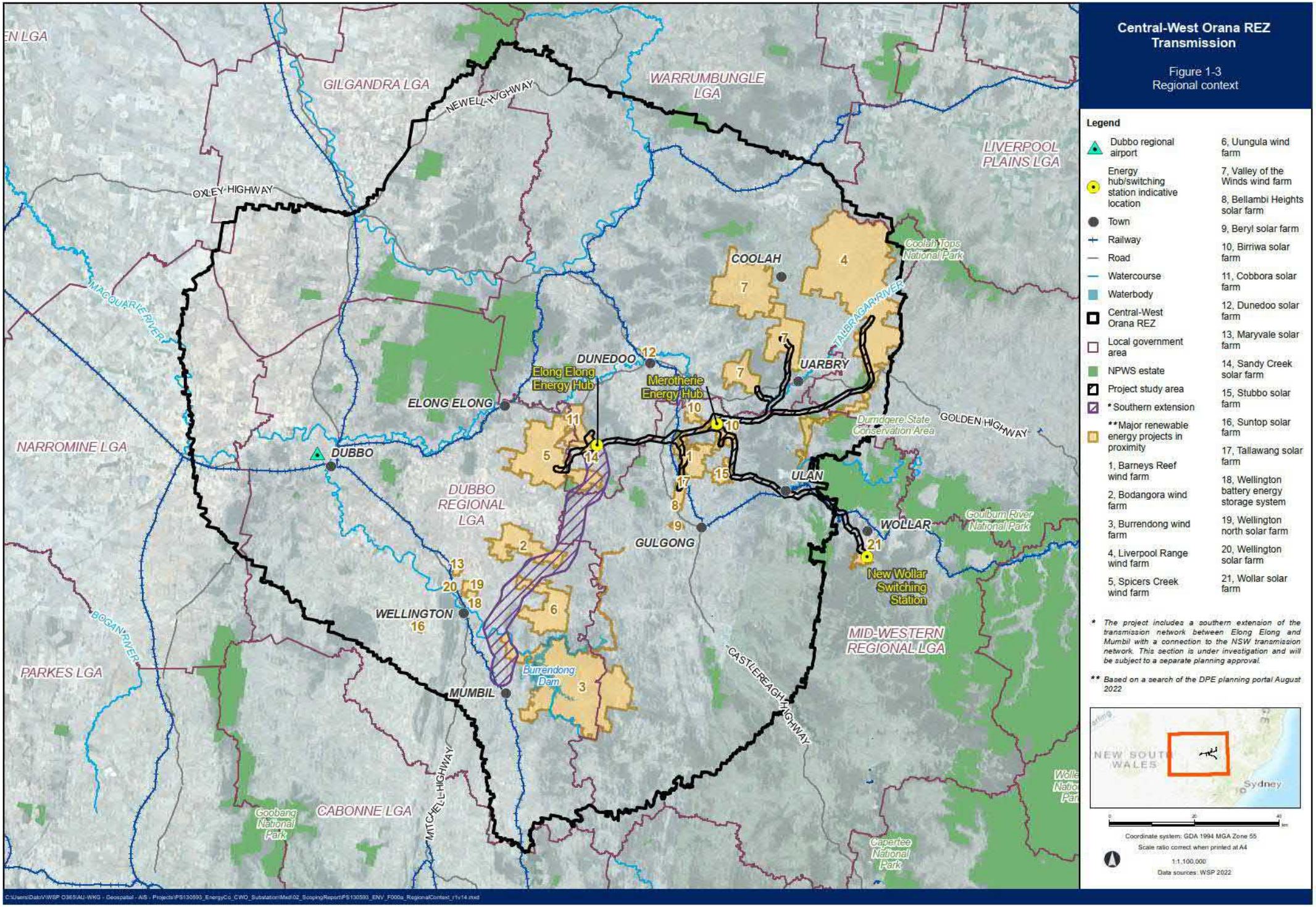
Figure 1-2 Central-West Orana REZ geographical area (Source: EnergyCo)

As Australia's first REZ, it will play a pivotal role in underpinning NSW's transition to a clean, affordable and more reliable energy sector. The NSW Government has committed to delivering at least three gigawatts of initial power transfer capacity from the Central-West Orana REZ, enough to maintain energy security as coal fired generation retires and keep downward pressure on electricity prices for NSW energy consumers.

1.3 Project overview

As the existing 330 kilovolt (kV) and 132 kV transmission network is not capable of transferring at least three gigawatts of new electricity generation in the Central-West Orana REZ, development of new electricity generation and storage projects will require new transmission infrastructure in the region.

EnergyCo is proposing the construction and operation of new high voltage (HV) electricity transmission infrastructure and new energy hubs and switching stations required to connect new energy generation and storage projects within the Central-West Orana REZ to the existing electricity network (refer to Figure 1-3). The project would enable at least three gigawatts of new network capacity to be unlocked by the mid-2020s and enable renewable energy generators within the Central-West Orana REZ who are successful in their bids to access the new transmission infrastructure to export electricity to the rest of the network. Importantly, the development of renewable energy generation projects in the Central-West Orana REZ are the sole responsibility of private generators and subject to separate planning and environmental approvals.


Central-West Orana REZ Transmission
Figure 1-3
Regional context
Legend
Dubbo regional airport
Energy hub/switching station indicative location
Town
Railway
Road
Watercourse
Waterbody
Central-West Orana REZ
Local government area
NPWS estate
Project study area
* Southern extension
** Major renewable energy projects in proximity
1, Barneys Reef wind farm
2, Bodangora wind farm
3, Burrendong wind farm
4, Liverpool Range wind farm
5, Spicers Creek wind farm
6, Uungula wind farm
7, Valley of the Winds wind farm
8, Bellambi Heights solar farm
9, Beryl solar farm
10, Birriwa solar farm
11, Cobbora solar farm
12, Dunedoo solar farm
13, Maryvale solar farm
14, Sandy Creek solar farm
15, Stubbo solar farm
16, Suntop solar farm
17, Tallawang solar farm
18, Wellington battery energy storage system
19, Wellington north solar farm
20, Wellington solar farm
21, Wollar solar farm
* The project includes a southern extension of the transmission network between Elong Elong and Mumbil with a connection to the NSW transmission network. This section is under investigation and will be subject to a separate planning approval.
** Based on a search of the DPE planning portal August 2022
NEW SOUTH WALES
Sydney
Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:1,100,000
Data sources: WSP 2022
GILGANDRA LGA
WARRUMBUNGLE LGA
LIVERPOOL PLAINS LGA
NARROMINE LGA
DUBBO REGIONAL LGA
MID-WESTERN REGIONAL LGA
PARKES LGA
CABONNE LGA
NEWELL HIGHWAY
OXLEY HIGHWAY
GOLDEN HIGHWAY
CASTLEREAGH HIGHWAY
MITCHELL HIGHWAY
MACQUARIE RIVER
BOGAN RIVER
TALBRAGAR RIVER
COOLAH
DUNEDOO
ELONG ELONG
DUBBO
UARBRY
ULAN
WOLLAR
GULGONG
WELLINGTON
MUMBIL
Elong Elong Energy Hub
Merotherie Energy Hub
New Wollar Switching Station
Burrendong Dam
Coolah Tops National Park
Dunggere State Conservation Area
Goulburn River National Park
Goobang National Park
Capertee National Park

An overview of the project is shown in Figure 1-4 and would comprise the following key features:

- a new switching station at Wollar, to connect the project to Transgrid's existing Wollar Substation and onto the NEM
- new twin double circuit 500 kV transmission lines and associated infrastructure to connect to the NEM and single and double circuit 330 kV single lines to connect energy generation and storage projects within the Central-West Orana REZ to the energy hubs
- energy hubs at Merotherie and Elong Elong, to connect energy generation and storage projects within the Central-West Orana REZ to the new 500 kV network infrastructure
- switching stations along the 330 kV network infrastructure to transfer the energy generated from the energy generation projects onto the 330 kV network infrastructure
- establishment and upgrade of access tracks and public roads, and other ancillary works such as laydown and staging areas, earthwork material sites with crushing and screening plants, concrete batching plants, brake/winch sites, site offices and workforce accommodation camps
- utility adjustments required for construction of the new network infrastructure.

It is expected that construction of the project would commence in the second half of 2024 and take approximately three years to complete with initial operations commencing as early as mid-2027.

The project has been developed to avoid impacts on important environmental, land use and social values, as described in Chapter 2. This approach will continue throughout further design development and will be detailed in the EIS.

The project includes a southern extension of the transmission network between Elong Elong and Mumbil with a connection to the NSW transmission network. This section is under investigation and will be subject to a separate planning approval.

Central-West Orana REZ Transmission

Figure 1-4
The project

Legend

- Energy hub/switching station indicative location
- Existing substation
- Town
- Road
- Railway
- Watercourse
- Waterbody
- Local government area
- NPWS estate
- Project study area
- *Southern extension

**The project includes a southern extension of the transmission network between Elong Elong and Mumbil with a connection to the NSW transmission network. This section is under investigation and will be subject to a separate planning approval.*

Coordinate system: GCS GDA 1994
Scale ratio correct when printed at A4
1:600,000
Data sources: WSP 2022

C:\Users\DaboY\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\02_ScopingReport\PS130593_ENV_F000b_TheProject_r1v11.mxd

1.4 Related development

A range of proposed renewable energy generation and storage projects located in the Central-West Orana REZ would connect to the project, subject to the outcomes of the Consumer Trustee's competitive tender process for rights to access the new transmission infrastructure. Renewable energy generation and storage projects are subject to separate planning and approval processes. Further information is provided in Section 6.2.1 and shown in Figure 6-3.

1.5 The proponent

In November 2021, the NSW Government appointed the Energy Corporation of NSW (EnergyCo; ABN 13 495 767 706), as the Infrastructure Planner under the *Electricity Infrastructure Investment Act 2020*, responsible for delivering the Central-West Orana REZ. EnergyCo is a NSW Government statutory authority established under the *Energy and Utilities Administration Act 1987* (NSW).

As the Infrastructure Planner, EnergyCo is the proponent of the project.

EnergyCo's postal address is GPO Box 5469, Sydney NSW 2001. EnergyCo will coordinate transmission, generation, firming and storage projects for the Central-West Orana REZ to deliver efficient, timely and coordinated investment.

EnergyCo has a number of key functions. Some of those functions will be exercised on behalf of EnergyCo by contractors and a Network Operator appointed by EnergyCo. EnergyCo's functions in respect of the project include:

- working with developers of proposed wind, solar and storage projects to understand their needs and plan for efficient solutions that encourage investment in grid-scale renewable projects and minimise cumulative impacts on the community
- leading community and stakeholder engagement
- developing the Reference Scope for the project in consultation with program partners and renewable energy generators
- acquiring land and easements required for the REZ transmission project
- leading the environmental planning approval process
- contributing to strategic planning for each REZ
- appointing a Network Operator to design, build, finance, operate and maintain the REZ transmission project.

Transgrid will continue to operate and maintain the existing NSW HV transmission network to connect to the Central-West Orana REZ, including upgrading the existing Wollar Substation which is the subject of a separate approval proposal.

1.6 Purpose and structure of this report

The Central-West Orana REZ Transmission project was declared to be Critical State significant infrastructure (CSSI) under section 5.13 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) by the Minister on 23 November 2020 (see declaration contained in State Environmental Planning Policy (Planning Systems) 2021 (Planning Systems SEPP), Schedule 5, clause 23, gazetted 16 December 2020). The project is CSSI as its scope falls within the declaration set out in the Planning Systems SEPP.

The purpose of this Scoping Report is to describe the project and present the preliminary assessment of the potential environmental issues that would be assessed as part of an EIS for the project. It has been prepared having regard to the DPE *State Significant Infrastructure Guidelines* (DPIE, 2021a) (the Guidelines).

This report is intended to provide sufficient information to allow for the preparation of Secretary's Environmental Assessment Requirements (SEARs). The EIS will be prepared in accordance with the requirements of the SEARs, clause 192 of the Environmental Planning and Assessment Regulation 2021 (EP&A Regulation) and the Guidelines (refer to Chapter 4 of this report for more information relating to the statutory context of the project).

The information and recommendations in this Scoping Report will be used to further inform the ongoing design process for the project with an aim to avoid or minimise environmental, economic and social impacts where practicable.

The structure and content of this report is as follows:

- Chapter 1 – Introduction: Outlines the background and need for the project, and purpose of this report.
- Chapter 2 – Strategic context and alternatives: Provides an overview of the strategic and regulatory context and the anticipated benefits of the project. An overview of the options assessment that led to the preferred option is also presented.
- Chapter 3 – Project description: Provides an outline of the key features of the project.
- Chapter 4 – Statutory context: Provides an overview of the relevant statutory approvals framework for the project, including applicable legislation and planning policies.
- Chapter 5 – Stakeholder and community engagement: Provides an overview of the stakeholder engagement and consultation activities that have been undertaken to date with regards to the project. An overview of the proposed future consultation activities is also provided.
- Chapter 6 – Proposed environmental assessment: Provides a preliminary description of the existing environment and an initial consideration of the potential direct and indirect impacts that may result from this project.
- Chapter 7 – Conclusion: Outlines the key conclusions of this report.
- Chapter 8 – References: Identifies the key reports and documents used to generate this report.
- The appendices to this report are:
  - Appendix A – Scoping summary table
  - Appendix B – Preliminary environmental risk assessment
  - Appendix C – Preliminary biodiversity assessment
  - Appendix D – Preliminary heritage assessment
  - Appendix E – Preliminary social impact assessment.

1.7 Report terminology

The following terms are used throughout this Scoping Report:

- Renewable Energy Zone (REZ): A geographic area with high-quality variable renewable energy resources (such as wind and solar), suitable topography and land use designations for development, and demonstrated interest from project developers.
- Central-West Orana REZ: A geographic area of approximately 20,000 square kilometres centred by Dubbo and Dunedoo and extending west to Narromine and east beyond Mudgee and to Wellington in the south and Gilgandra in the north, that will combine renewable energy generation, storage and HV transmission infrastructure to deliver energy to electricity consumers.
- Consumer Trustee: AEMO services, as the NSW Consumer Trustee, runs competitive tenders for Long-Term Energy Services Agreements and Renewable Energy Zones Access Rights to support investment, construction and operation of renewable energy generation and long duration storage infrastructure in NSW.
- The project: New HV electricity transmission infrastructure, consisting of new 500 kV and 330 kV transmission lines and related infrastructure, that would allow renewable energy generators and storage projects in the Central-West Orana REZ to connect to the existing transmission network.
- Energy hub: An energy hub is a substation where energy exported from renewable energy generators or storage is aggregated, transformed to 500 kV (where required) and exported to the transmission network.
- Project study area: Extends north to south from Cassilis to Wollar and east to west from Cassilis to Goolma (refer to Figure 1-3). The study area is generally a one kilometre wide corridor in which the proposed transmission line would be located (further details regarding the project development and feasible alternatives are described in Section 2.6 of this report). A refined study area for the transmission line will be identified in the EIS. Additional locations that may be required for specific uses (such as access tracks, construction compounds and workforce accommodation camps) outside the study area will also be identified in the EIS.
- Single circuit transmission lines: A set of three conductors carried by a single tower set.
- Double circuit transmission lines: A set of six conductors carried by a single tower set.
- Twin transmission lines: A pair of single or double circuit transmission lines running parallel.
- Substation: A facility used to increase or decrease voltages between incoming and outgoing lines (e.g. 330 kV to 500 kV).
- Switching station: A facility used to connect two or more distinct transmission lines of the same designated voltage.
- Transmission line easement: an area surrounding and including the transmission lines which is a legal ‘right of way’ and allows for ongoing access and maintenance of the lines. Landowners can typically continue to use most of the land within transmission line easements, subject to some restrictions for safety and operational reasons.

1.8 Limitations

The information presented in this Scoping Report has been based on preliminary desktop biodiversity and cultural heritage studies (provided in Appendices C and D), with limited field verification along some sections of the project. The remaining assessments have been prepared based on preliminary desktop review and assessment of published data including relevant databases, reports and other available literature. More detailed investigations of potential environmental issues, including field inspections, are proposed be undertaken during the preparation of the EIS for the project.

2 Strategic context and alternatives

This chapter describes the need for the project, including the relevant Australian and NSW Government policies that support the project. It describes the project objectives and the alternative options considered to address the objectives.

2.1 Project need

2.1.1 Overview

The Australian Government is committed to coordinated global action to reduce greenhouse gas emissions in line with the Paris Agreement and has set targets to reduce emissions by 43 per cent below 2005 levels by 2030 and to net zero by 2050. Independently, the NSW Government has set a goal to achieve net-zero emissions by 2050 (DPIE, 2020a). Achieving these goals requires transformative low emissions technologies to be deployed at scale across all sectors of the economy.

Electricity generation is currently Australia's largest source of greenhouse gas emissions, accounting for 33 per cent of Australia's total annual emissions in 2020 (Climate Change Authority, 2020). The NEM connects the southern and eastern states and territories in Australia and delivers around 80 per cent of Australia's electricity consumption. As such, to meet Australia's emission reduction targets, the NEM needs to significantly transition from traditional energy sources to lower emission alternatives including renewable energy (Australian Department of Industry, Science, Energy and Resources (DISER), 2020).

With the rise in renewable energy generation, coal-fired generation is facing increasing market, financial and operating pressures. Coal-fired generation is withdrawing faster than anticipated (AEMO, 2022), due to large coal-fired power plants, such as the Eraring and Bayswater power stations, closing ahead of originally anticipated retirement dates (Eraring power station to close by 2025 and Bayswater power station to close by 2033). As such, the NEM needs to identify and connect to new low emission energy generation sources prior to the retirement of coal-fired power to continue to have enough energy to meet future demand, while meeting Australia's carbon emissions policy commitments.

Modelling indicates that 14 gigawatts (60 per cent of current coal capacity) may be withdrawn by 2030 and all coal generation could withdraw by 2040 (AEMO, 2022), as competitive and operational pressures intensify with cleaner and lower-cost renewable energy generation and gas and coal price volatility in the first half of 2022.

The closure of large coal-fired power stations has the potential to put pressure on the future supply of energy, particularly when considering that electricity consumption in NSW is forecast to increase in the future (AEMO, 2019; AEMO, 2022). This highlights the urgent need to develop and connect new renewable energy to the NEM, noting that more renewables are required to replace conventional generators because of their lower capacity factors due to the intermittency of the electricity that they produce (Australian Energy Council, 2017).

The 2022 ISP (AEMO, 2020) estimates that over 125 gigawatts of new grid-scale renewables are needed by 2050, in addition to the current 16 gigawatts capacity, as most of Australia's coal-fired generation will likely retire by 2040. As such, the NEM needs to identify and connect to new low emission energy generation sources to continue to have enough energy to meet future demand, while meeting Australia's carbon emissions policy commitments (DISER, 2020).

2.1.2 Need for additional transmission network capacity

The NEM incorporates around 40,000 kilometres of transmission lines and cables across Queensland, NSW, Australian Capital Territory, Victoria, South Australia (SA) and Tasmania. The NEM involves wholesale electricity generation, which is transported via HV transmission lines from generators to large industrial energy users and to distribution networks in each region, which deliver energy to homes and businesses.

The existing transmission network was established to transport electricity primarily from generators in fossil-fuel rich areas to load centres, such as residential or industrial areas. As the supply mix evolves, transmission networks need to be reconfigured to connect regions with high-quality renewable energy resources to load centres, and incorporate dispatchable capacity, including energy storage, to firm intermittent supplies.

Current interest in new energy generation projects in the NEM exceeds the existing transmission network capacity in several locations, meaning that not all projects would be able to connect to the network. The existing network is estimated to have a connection capacity of 16 gigawatts in areas with favourable renewable resources, which is significantly less than the 125 gigawatts (or more) of new grid-scale renewables required by 2050 (AEMO, 2022). The transmission grid therefore needs targeted augmentation, including strategically placed large-scale interconnectors and transmission line extensions, to balance resources and unlock REZs in new regions.

The NSW Transmission Infrastructure Strategy (DPE, 2018a), which is discussed in more detail in Section 2.2, states that connection of these REZs will 'leverage massive private sector investment opportunities, boosting regional economies and building the state's resilience by ensuring there are enough new energy projects coming online to replace the retiring traditional power stations expected over the next two decades'. However, it is noted that investors in new energy projects typically will not invest unless they are sure there will be enough transmission capacity to distribute and sell their energy (DPE, 2018b).

As discussed in Chapter 1 of this report, the existing transmission network is not capable of transferring the scale of new electricity generation identified for the Central-West Orana REZ. Development of new electricity generation and storage projects in the Central-West Orana REZ will require new HV transmission infrastructure in the region.

2.2 Strategic context

The Australian and NSW governments have put in place a number of plans and policies to support the energy market transition. An overview of how the project would be consistent with the aims and objectives of these strategic planning and policy documents is included in Table 2-1 and Table 2-2.

Table 2-1 Relevant Australian Government policy

Australian Government policy	Project alignment with policy
Australia's Nationally Determined Contribution Communication 2022 (DISER, 2022) The Australian Government's Nationally Determined Contribution under the Paris Agreement makes a commitment to an emissions reduction target of 43 per cent below 2005 levels by 2030, which is a 15 per cent increase on the previous target.	The project facilitates the longer-term transition to low-emission energy sources by connecting renewable energy generators to the NEM. The intended network capacity of the Central-West Orana REZ is at least three gigawatts, enough to power 1.4 million homes. The project is therefore considered to be consistent with the Australian Government's current emission reduction commitments under the Paris Agreement.
Australia's Long-Term Emissions Reduction Plan (DISER, 2020) The Long Term Emissions Reduction Plan is a whole-of-economy plan that aims to achieve net-zero emissions by 2050, based on coordinated actions across four areas: • driving down the cost of low emissions technologies • enabling deployment of low emission technologies at scale • helping regional industries and communities seize economic opportunities in new and traditional markets • work with other countries on the technologies needed to decarbonise the world's economy.	The project would construct new transmission network infrastructure in the Central-West Orana REZ to enable the connection of new utility-scale renewable energy projects to the existing transmission network in NSW and is therefore considered to be consistent with the priorities of the Long-Term Emissions Reduction Plan.
2022 Integrated Systems Plan (AEMO, 2022) The ISP is an actionable roadmap for eastern Australia's power system to optimise consumer benefits through a transition of the energy market. Development in the Central-West Orana REZ was identified in the 2020 ISP (AEMO, 2020) as a Phase 1 project in NSW, as it is development that would meet regional renewable energy targets and other policies, and/or where there is good access to existing network capacity with good system strength. The 2022 ISP identifies 10,000 kilometres of new transmission needed to connect new generation and storage opportunities and deliver renewable energy to consumers through the NEM. The project is identified as an anticipated project in the 2022 ISP.	The project is identified as a key component of the 2022 ISP and is therefore considered to be consistent with this plan.
2021 Infrastructure Investment Objectives Report (AEMO Services Limited, 2021) The 2021 Infrastructure Investment Objectives Report sets out the NSW Consumer Trustee's 20-year Development Pathway for the construction of electricity infrastructure in NSW to achieve the infrastructure investment objectives included in the *Electricity Infrastructure Investment Act 2020* in a practically feasible way. The Development Pathway seeks to support the entry of new generation and long-duration storage infrastructure as soon as practicable, having regard to supply chain constraints and opportunities, and independent of the timing of coal plant withdrawals. This approach ensures that sufficient energy is available in NSW in advance of any unexpectedly early coal plant withdrawal that may occur, and also allows for construction to be brought forward if such a withdrawal were to occur. The Development Pathway prioritises generation construction that aligns with the development of REZ network infrastructure for the Central-West Orana and New England REZs. The purpose of this is to maximise the utilisation of REZ network infrastructure as soon as it is available.	The project is consistent with the Development Pathway prescribed in the report as it would provide the network infrastructure to connect renewable energy generation projects from the Central-West Orana REZ, providing for the availability of at least three gigawatts of energy to the NEM.

Table 2-2 Relevant NSW Government policy

NSW Government policy	Project alignment with policy
NSW Transmission Infrastructure Strategy (DPE, 2018a) The NSW Transmission Infrastructure Strategy identifies the NSW Government's plan to unlock private sector investment through priority transmission infrastructure projects, which can deliver least-cost energy to customers through to 2040 and beyond. The Strategy aims to increase NSW's energy capacity by prioritising Energy Zones in the Central-West, South-West and New England regions of NSW, which will become a driving force to deliver affordable energy into the future.	The project would enable the connection of multiple renewable energy projects in the Central-West Orana REZ to the NEM, providing certainty to private sectors investors and cost savings to energy consumers. The project is consistent with the aims of the Strategy.
NSW Electricity Strategy (DPIE, 2019a) The NSW Electricity Strategy outlines a plan for a reliable, affordable and sustainable electricity system for NSW. It identifies the need to connect new generation projects to the existing transmission network to meet NSW's future energy needs, making it critical to efficiently develop transmission to these new generation projects.	The project would assist in delivering on this commitment and provide regional investment in lower-cost, new energy infrastructure to connect the Central-West Orana REZ to the NEM.
NSW Electricity Infrastructure Roadmap (DPE, 2020) The NSW Electricity Infrastructure Roadmap provides a coordinated framework for the delivery of new transmission, generation, long duration storage and firming infrastructure to support low carbon renewable energy and the replacement of coal fired power station capacity scheduled to close in the next two decades. The Roadmap notes the State has committed an initial 12 gigawatts of new transmission capacity and two gigawatts of storage capacity by 2030. Key to the transition of the energy sector are five REZs identified at the time, including the Central-West Orana REZ. The REZs will need to be supported by new transmission infrastructure to transfer the expected energy generation efficiently to the major load centres of the Sydney – Wollongong – Newcastle – Hunter Valley area.	The project is aligned with the NSW Electricity Infrastructure Roadmap as it would provide regional investment in lower-cost, new energy infrastructure to connect the Central-West Orana REZ to the NEM. The project would contribute to the Roadmap goal of 12 gigawatts of new transmission capacity by providing three gigawatts of transmission capacity in the CWO REZ.
State Infrastructure Strategy 2018-2038 (Infrastructure NSW, 2018) The State Infrastructure Strategy establishes the strategic directions, projects and initiatives to meet the infrastructure needs of a growing population and a growing economy. The strategic objective for the energy sector within the strategy is to 'encourage private sector investment to deliver secure, reliable, affordable, low emissions energy supply'.	The project is aligned with the strategic objective for the energy sector within the strategy as it would provide the increased transmission capacity that is required to encourage private sector investment in low-emission energy generation projects within the Central-West Orana REZ in NSW.
NSW Climate Change Policy Framework (Office of Environment and Heritage (OEH), 2016) The NSW Climate Change Policy Framework outlines NSW's long-term objectives to achieve net-zero emissions by 2050 and make NSW more resilient to a changing climate.	The project is aligned with this framework, as it would provide a key piece of strategic transmission infrastructure that would enable the transition to a lower emissions economy.

NSW Government policy	Project alignment with policy
Central West and Orana Regional Plan 2036 (DPE, 2017) and draft Central West and Orana Regional Plan 2041 (DPIE, 2021) The Central West and Orana Regional Plan 2036 sets the strategic land use planning framework for the region. The draft Central West and Orana Regional Plan 2041 (draft Regional Plan) (DPIE, 2021) builds on the current Regional Plan by recognising and responding to the regions' role in supporting NSW's transition to net zero carbon emissions by 2050 through a broad range of actions, including through enabling the establishment of the Central-West Orana REZ.	The project would enable NSW's transition to net-zero carbon emissions by encouraging private sector investment in new renewable energy. The project is consistent with the objectives of the draft Regional Plan, as it would stimulate the local and regional economies by facilitating new business and investment activity and create new employment opportunities for local communities (refer to sections 6.8 and 6.9). The project also aligns with the strategies of the draft Regional Plan as it: • would provide new transmission infrastructure that would ensure the benefits of renewable energy projects in the region to the overall electricity network are fully realised • is designed in consultation with Aboriginal stakeholders and the local community to be compatible with surrounding land use practices and minimise environmental and social impacts (refer to Chapters 5 and 6).

2.3 Regional context

This section provides an overview of the regional context of the Central-West Orana REZ including the natural environment, built environment and the communities in the region. The regional context helps to inform the objectives to be addressed by the project.

2.3.1 Natural environment

The project is located within the Central-West Orana region, which is at the geographic heart of NSW and is the second largest region in NSW. The region includes some of Australia's most important ecosystems which also have significant Aboriginal cultural importance. This includes the RAMSAR-listed (Wetland of International importance) Macquarie Marshes, covering more than 200,000 hectares, the Lachlan Catchment Wetlands which supports 471,011 hectares of wetland with eight nationally significant wetlands, the Greater Blue Mountains World Heritage Area, State Forests and more than 149,000 hectares of national parks, including Warrumbungle, Coolah Tops, Blue Mountains, Pilliga and Goulburn River national parks.

The region's landscape includes the highlands, tablelands and slopes in the east with fertile volcanic soils and the plains that dominate the northern and western areas of the region with fertile alluvial soils.

Waterways and water resources in the region, including the Macquarie and Lachlan rivers, underpin the health of the natural environment and are integral parts of the broader Murray–Darling Basin. Rivers of the region connect the varied floodplain wetlands and vegetation communities including the sub-alpine forests in the east to the semi-arid woodland and grasslands in the west. The east and north of the region generally drain to the north west through the catchments of the Bogan, Macquarie and Castlereagh rivers which join the Barwon Darling in the adjoining Far West region. The southern part of the region drains westerly through the Lachlan River and its tributaries before joining the Murrumbidgee in the Riverina Murray region while parts of the Mid-Western, Lithgow and Oberon local government areas (LGAs) drain to the coast through the Goulburn/Hunter and Hawkesbury–Nepean rivers.

The region also has significant groundwater resources with the Great Artesian Basin and fractured rock aquifers in the north and the shallow alluvial fan aquifers of the Darling River Basin. Many towns in the region rely on groundwater as a primary or alternative source of water, and some industries and landholders rely on groundwater to support their activities, as well as for domestic and stock use.

2.3.2 Community and built environment

The Central-West Orana region consists of 19 LGAs. The region is home to more than 290,000 people, with 29,800 identifying as Aboriginal or Torres Strait Islander, and is expected to increase to more than 306,000 people by 2041.

The region's population lives in a diverse network of regional centres, including Dubbo, Mudgee, Wellington, Gulgong and Dunedoo, and smaller towns and rural localities, including Wollar, Ulan, Uarbry, Cassilis and Coolah. Most people live in or around the regional centres. Each regional centre has its own catchment, drawing people from the surrounding communities for employment, services and social networks. The nearest regional population centres to the project study area are Gulgong and Dunedoo. The nearest towns and villages to the project study area are Ulan, Wollar and Uarbry, all of which are located within five kilometres from the project study area.

Land tenure in the project study area is predominantly freehold, with some areas of Commonwealth land and Crown land, including road reserves, rail corridors, travelling stock reserves, State Forests and National Parks estate.

Aboriginal communities in the region retain a strong link with Country and include Traditional Owners and Custodians of the Wiradjuri, Wongaibon, Wailwan (also known as Weilwan and Wayilwan), Gamilaroi (also known as Gamilaraay and Kamilaroi), Ngiyampaa, Dharug and Gundungurra countries that the region sits within. Natural features within the region are important to the cultural heritage of these Aboriginal communities because of their traditions, observances, lore, customs, beliefs and history, and include pre-contact and habitation and usage sites, burial sites, battle sites, and camping, hunting and fishing sites.

The region's broad range of industries, its location and connections to Sydney, Canberra and Newcastle provide a foundation for a diverse regional economy. The top five regional industries, in order of economic contribution, are mining, agriculture, forestry and fishing, health care and social assistance, manufacturing and education and training. Mining and agriculture underpin the region's economy and together create 28 per cent of the region's economic output.

Agricultural production is the primary land use activity and occurs from the vast plains of the Orana in the north and west to the sub-alpine areas of the Central West in the east, from intensive and irrigated crops, including vegetables, fodder, stone fruits, grapes and cotton, to extensive broadacre cropping, meat and wool production and forestry. Agricultural production supports an extensive value chain including major livestock centres in Dubbo and Blayney, transport, logistics and inter-modal transport hubs, cotton gins, canneries, packing and processing, and is a significant employer across all parts of the region.

The protection of regionally significant agricultural land from incompatible land uses is identified as a regional strategic goal. This is reflected in Objective 13 of the draft Central West and Orana Regional Plan 2041 (DPIE, 2021). Parts of the region have also been identified as Biophysical Strategic Agricultural Land (BSAL), including areas in and around Dundeoo, Coolah, Dubbo and Wellington. BSAL is land with high quality soil and water resources capable of sustaining high levels of productivity, which have been mapped by the NSW Government to provide increased protection from mining and extraction projects.

The region also has an established mining industry and is rich with high-tech metals and critical mineral resources. The region sits within the Lachlan Orogen geological province which hosts traditional metal resources such as gold, silver and base metals, and a significant proportion of the State's emerging critical mineral resources such as cobalt, scandium, rare earth elements and titanium.

A number of renewable energy projects are proposed, approved or under construction within the Central-West Orana REZ, including the Liverpool Range wind farm, Valley of the Winds wind farm, Cobbora solar farm and Tallawang solar farm. In addition to renewable energy projects, a number of mining projects in and around Ulan and Wilpinjong are operational and subject to proposed or approved expansions. Cumulative impacts that have the potential to arise for the project based on known proposed or approved projects include land use and property, agriculture, landscape character and visual amenity, biodiversity, Aboriginal heritage, non-Aboriginal heritage, social, economic, noise and vibration, traffic and transport, waste management and resource use impacts.

Key risks and hazards for the project in the region include bushfire risk and mine subsidence risk, as parts of the project study area would be located within Category 1 (highest bushfire risk) and Category 3 bushfire prone land (medium bushfire risk) and/or a mine subsidence district.

2.4 Project objectives

EnergyCo, as the statutory Infrastructure Planner and proponent for the project, is delivering new transmission network infrastructure for the Central-West Orana REZ to ensure efficient aggregation and transfer of renewable energy from renewable energy generators and storage within the REZ to the NEM. The project forms part of the NSW Government's broader objective of encouraging and coordinating generation, storage and network investment in the Central-West Orana REZ under the NSW Electricity Infrastructure Roadmap (DPE, 2020).

A summary of the project challenges, corresponding objectives and overall project outcomes from a strategic and project design and delivery perspective are shown in Figure 2-1 and Figure 2-2. The objectives respond to the project need and the strategic and regional context identified in the preceding sections.

Strategic		
Challenges	Objectives	Outcomes
Ability to meet emission reduction targets set by the Australian Government	• Support government decarbonisation targets and the transition of the NEM from traditional energy sources to lower emission alternatives based on renewable energy.	• Reduced emissions and a greater mix of renewable energy in the NEM.
Planned closure of aging major coal-fired power generators over the coming decade will create power shortages if this generation capacity is not replaced	• Develop the architecture for the Central-West Orana REZ so that it encourages delivery of, and reduce barriers to the development of viable grid-scale renewable energy projects within the REZ in the near term to deliver a source of affordable and reliable energy. • Deliver the Central-West Orana Transmission Project, a key element of the NSW Electricity Strategy and Electricity Infrastructure Roadmap, by the mid 2020's before the retirement of key coal-fired power stations. • Provide high-capacity connections to mature grid-scale generation projects within the Central-West Orana REZ to enable earlier delivery of bulk power.	• Improved reliability and energy security, by delivering large amounts of new energy supply into the NEM. • Unlock major investment in new renewable energy and regional economies. • Placing downward pressure on customer bills through lower energy generation costs and increased competition.
Increased demand for electricity as technology and industry shifts towards electrification	• Design the Central-West Orana REZ to meet current bulk energy demands and enable efficient expansion to meet future demand as this grows.	• Network infrastructure that will: – meet current and future needs efficiently, reducing ongoing impacts to the community by building it right the first time; and – support ongoing development and investment in renewable energy projects within the REZ to meet growth in demand.
Traditional sources of inertia and stability in the network are lost as fossil fuel generators are retired	• Design the Central-West Orana REZ to address issues of inertia and stability by including equipment and technology within the design of the Central-West Orana REZ to ensure stability and reliability.	• Delivery of a transmission network that can efficiently and reliably deliver bulk power from renewable sources at reliability levels consumers expect of the NEM.

Figure 2-1 Strategic project challenges, objectives and outcomes

Delivery		
Challenges	Objectives	Outcomes
Potential for the project to result in conflict with other valued land uses such as agriculture	• Plan for, design and deliver a project that: – Seeks to utilise previously disturbed land to avoid and minimise impacts to other valued land uses. – Minimises the amount of prime agricultural land required for construction and permanent operational infrastructure. – Allows for continued agricultural land uses and farming practices within the Central-West Orana REZ.	• Impacts to agricultural land and farming practices would be avoided and minimised as much as possible throughout construction and operation of the project.
Cumulative impacts of network infrastructure and generation projects	• Plan and deliver transmission and generation projects in a coordinated manner and in consultation with stakeholders, including generators. • Reduce cumulative impacts from construction and operation of the project with other renewable energy projects in the Central-West Orana REZ.	• Efficient and coordinated delivery of network infrastructure and generation projects. • Reduced impacts on local communities during construction and operation.
Potential for the project to result in adverse environmental impacts	• Plan for, design and deliver a project that protects natural and cultural resources, and minimises impacts to: – natural systems, including biodiversity – Aboriginal and non-Aboriginal cultural heritage – visual amenity – water resources and water quality. • Implement strategies to mitigate and offset impacts and to recreate important environmental values in the region.	• Environmental impacts of the project during construction and operation would be avoided and minimised as much as possible. • The scale of the project allows new environmental values to be recreated for the benefit of the region. • The project will support the delivery of viable grid-scale renewable energy to reduce the need for fossil fuel generators.
Delivering a project that minimises impacts to local communities along the transmission route during construction and operation	• Engage in open and honest dialogue with the community and stakeholders during the development and delivery of the project, to improve the design and reduce impacts to the community and landowners where reasonable and feasible. • Through corridor development and refinement, avoid large centres of population. • Work with landowners to identify how the project may impact their properties and businesses and develop measures to manage and mitigate those impacts.	• Deliver a project that is supported by the local community and landowners by engaging in an open and transparent consultation process through the development of the projects design, as well as its construction and operation.

Figure 2-2 Project design and delivery challenges, objectives and outcomes

2.5 Strategic options assessment

The following strategic alternatives have been considered against their ability to deliver on the strategic project objectives:

- Strategic option 1: Base case ('do nothing')
- Strategic option 2: Optimisation and modification of existing transmission line infrastructure ('do minimum')
- Strategic option 3: Provision of new transmission capacity to meet known renewable energy demand and allow for future expansion.

2.5.1 Strategic option 1: Base case ('do nothing')

The base case option is to do nothing and to rely on the existing electricity generation and transmission network to meet current and future energy demand. This would involve continued reliance on coal-fired power generation to provide the majority of electricity generation in NSW, supplemented by the current extent of known and planned development of renewable energy projects. As outlined in Section 2.1, coal-fired generation is withdrawing faster than anticipated (AEMO, 2022), due to large coal-fired power plants closing ahead of originally anticipated retirement dates as competitive and operational pressures intensify with cleaner and lower-cost renewable energy generation. As such, the NEM needs to identify and connect to new low emission energy generation sources to continue to have enough energy to meet future demand, while meeting Australia's carbon emissions policy commitments.

The 'do nothing' option would limit investment in renewable energy generation within the Central-West Orana REZ as no additional transmission infrastructure would be provided to collect and transmit energy from renewable energy projects, and the strategic project objectives would not be able to be achieved.

The base case option has been rejected as a viable strategic alternative because it would not address the identified project need or adequately satisfy the strategic project objectives to decarbonise the NEM and provide an affordable and reliable source of energy.

2.5.2 Strategic option 2: Optimisation and modification of existing transmission line infrastructure ('do minimum')

The 'do minimum' option would involve the optimisation and modification of existing transmission line infrastructure to accept electricity from renewable energy projects in the Central-West Orana REZ. This alternative would be consistent with some of the objectives of the project, as it would connect renewable energy projects to consumers and would contribute to government decarbonisation targets and the transition of the NEM from traditional energy sources to lower emission alternatives, including renewable energy.

However, this option would not provide the increased network capacity needed to encourage the scale of renewable energy investment required to meet government emission reduction targets and to provide an affordable and reliable source of new energy to meet current and future electricity demand. Further, this option would also result in significant construction of transmission assets from the existing Transgrid transmission Line 79 and Line 72 to connect renewable energy generators to the existing network and would result in needing to de-energise existing lines during construction which would affect energy security.

The 'do minimum' option has been rejected as a viable strategic alternative for the project.

2.5.3 Strategic option 3: New transmission capacity to meet known renewable energy demand and allow for future expansion

This option would involve the construction and operation of new HV transmission infrastructure in the Central-West Orana REZ. The transmission infrastructure would include connections from the new HV transmission lines and would be planned so that the transmission alignment considers the location of known renewable energy projects currently under development. In addition, the transmission infrastructure to be provided as part of this option would be designed so that there is sufficient capacity for future renewable energy generators within the Central-West Orana REZ to connect, and there would be flexibility in the project design for it to be expanded and extended in the future to respond to the growing development of renewable energy projects in the Central-West Orana REZ.

This strategic option would be aligned with all of the strategic project objectives and is considered to be the preferred strategic option for the project.

2.5.4 Summary

A summary of the strategic project options against the project objectives is provided in Table 2-3.

Table 2-3 Summary of strategic project options against the strategic project objectives

Strategic project objective	Strategic option 1	Strategic option 2	Strategic option 3
Support government decarbonisation targets and the transition of the NEM from traditional energy sources to lower emission alternatives, including renewable energy.	×	✓	✓
Develop the architecture for the Central-West Orana REZ so that it encourages delivery of, and reduced barriers to the development of viable grid-scale renewable energy projects within the REZ in the near term to deliver a source of affordable and reliable energy.	×	×	✓
Deliver the Central-West Orana Transmission project, a key element of the NSW Electricity Strategy and Electricity Infrastructure Roadmap, by the mid 2020's before the retirement of key coal-fired power stations.	×	×	✓
Provide high-capacity connections to mature grid-scale generation projects within the Central-West Orana REZ to enable earlier delivery of bulk power.	×	×	✓
Design the Central-West Orana REZ to meet current bulk energy demands and enable efficient expansion to meet future demand as this grows.	×	×	✓
Design the Central-West Orana REZ to address issues of inertia and stability by including equipment and technology within the design of the CWO REZ to ensure stability and reliability.	×	×	✓

2.6 Project development

The project has undergone a process of the development and evaluation of alternative transmission corridor options from feasibility to early design development. A summary of the process completed to date is provided in Figure 2-3.

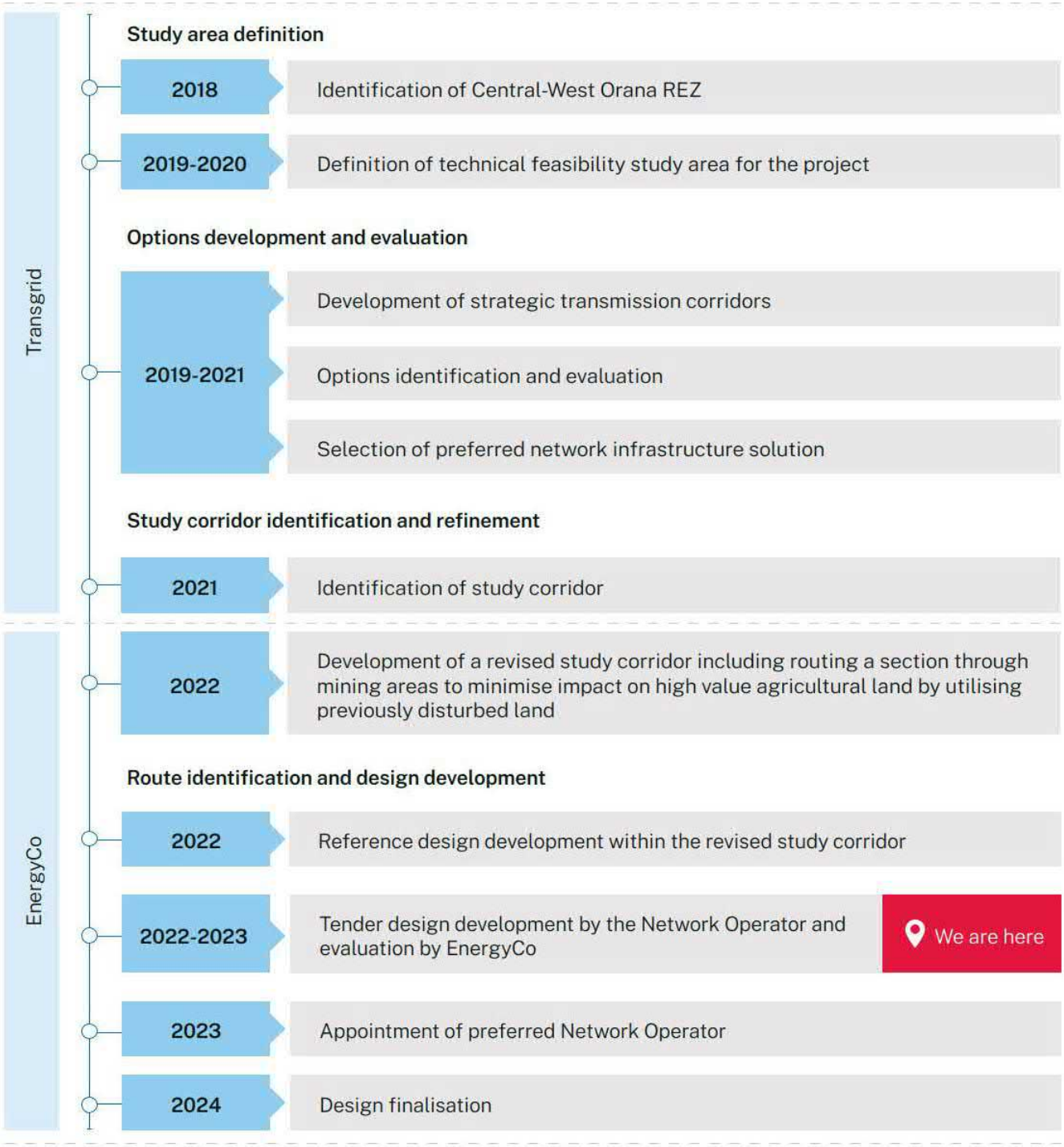


Figure 2-3 Project development process

In 2020, the NSW Government engaged Transgrid, as NSW's jurisdictional transmission planner at the time, to carry out early development work to guide the planning of new transmission infrastructure for the Central-West Orana REZ. In December 2020, Transgrid released a preliminary study corridor for the project that ran northwest from the existing network near Merriwa, passing south of Dunedoo before connecting to the existing network east of Wellington. The preliminary study corridor developed by Transgrid also included an option to extend the new HV transmission infrastructure for the Central-West Orana REZ south of Wellington towards Lake Burrendong, including an upgrade of the existing substation at Wollar.

Between December 2020 and September 2021, Transgrid carried out community and stakeholder engagement on the preliminary study corridor for the transmission route, which included letters sent out to landowners, community information sessions, community events, social media posts and print advertisements, meetings with landowners, community members, Aboriginal stakeholders, local councils and other stakeholders, and establishment of a dedicated phone number, email address and website to provide project information.

In November 2021, the Central-West Orana REZ was formally declared by the Minister for Energy and Environment and EnergyCo was appointed as the Infrastructure Planner to lead the delivery of REZs in NSW. At this time, EnergyCo assumed responsibility for planning and design of the transmission corridor and engaging local communities and stakeholders to inform the development of new transmission network infrastructure within the REZ.

2.6.1 Project development by EnergyCo

EnergyCo's approach to transmission corridor planning has combined technical and environmental considerations and feedback from discussions with landowners and the wider community with an objective to avoid and minimise impacts to the community and environment as much as possible through detailed transmission corridor planning.

For the purposes of corridor planning, constraints have been categorised into three tiers:

- Tier 1: Areas where locating transmission lines, substations and switching stations would result in a low likelihood of obtaining access, combined with the potential impacts to the environment, community and stakeholders at these locations, presenting a high risk for obtaining planning approval. Examples of potential tier 1 locations include town centres, areas of concentrated residential settlement, areas of high environmental value such as national parks, national heritage places and sensitive AHIMS sites.
- Tier 2: Areas to be avoided wherever possible because of the added complexity of obtaining site access, obtaining planning approval and the potential impact on community and stakeholder interests at these locations. Examples include areas containing listed threatened species and ecological communities, significant AHIMS sites, and high value agricultural land.
- Tier 3: Areas where impacts should be minimised and/or mitigated. In addition to the tier 2 constraints, examples include areas of key fish habitat, AHIMS sites, agricultural land and private properties.

Corridor planning has also considered opportunities to avoid impacts by routing the corridor through previously disturbed land such as mining areas and existing transmission easements as well as coordinating transmission connections to renewable energy generation and storage projects.

EnergyCo's first step in corridor planning was to identify preferable locations for the energy hubs, having regard to:

- proximity of energy hubs to renewable energy generators being planned or developed
- proximity of energy hubs to the existing road network
- availability of sufficient land to accommodate the space requirements for energy hubs
- ability to secure land through negotiated agreement
- environmental constraints
- other site constraints that might affect constructability such as topography, slope and geotechnical conditions.

Following confirmation of the location of the energy hubs, corridor options to connect the energy hub locations were developed having regard to the constraints identified earlier.

As part of project development, EnergyCo has considered the potential to place the HV transmission lines underground. Construction of an underground transmission option for the project would directly impact a larger amount of land via ground disturbance, associated with the need to excavate a trench, or multiple parallel trenches where more than one HV transmission line is required, over the entire length of the alignment. This has the potential for significant disturbance to agricultural activities, biodiversity and heritage as well as increasing project costs by approximately three times compared to overhead transmission lines.

In addition, the following environmental and engineering constraints would be associated with undergrounding of project infrastructure:

- should damage or a fault occur to the transmission network infrastructure, large sections of excavation may be required to identify the fault, resulting in longer repair times and interruptions to energy supply
- the transition from overhead to underground cables requires termination points which are large structures that require sensitive siting
- there may be areas of unsuitable geology along the transmission easement that would increase the cost of construction as a result of the construction methodology for trenching and excavation works.

Based on the above factors, locating HV transmission lines underground is not considered to be a viable option.

2.6.2 Revised study corridor by EnergyCo

In February 2022, EnergyCo announced a revised study corridor for the REZ Transmission project which reduced impacts on sensitive land uses in the region and delivered greater capacity to meet future energy needs (refer to Figure 2-4). Community feedback received by Transgrid was considered in developing the revised project study corridor. In particular, the eastern section of the preliminary study corridor was redesigned to locate the corridor on existing disturbed land such as mining areas, existing transmission lines and wind and solar development, to avoid high-quality agricultural land.

EnergyCo invited the community and stakeholders to provide feedback on the revised study corridor for the project in February and March 2022. A community feedback report was released in June 2022 which outlined the consultation outcomes and next steps.

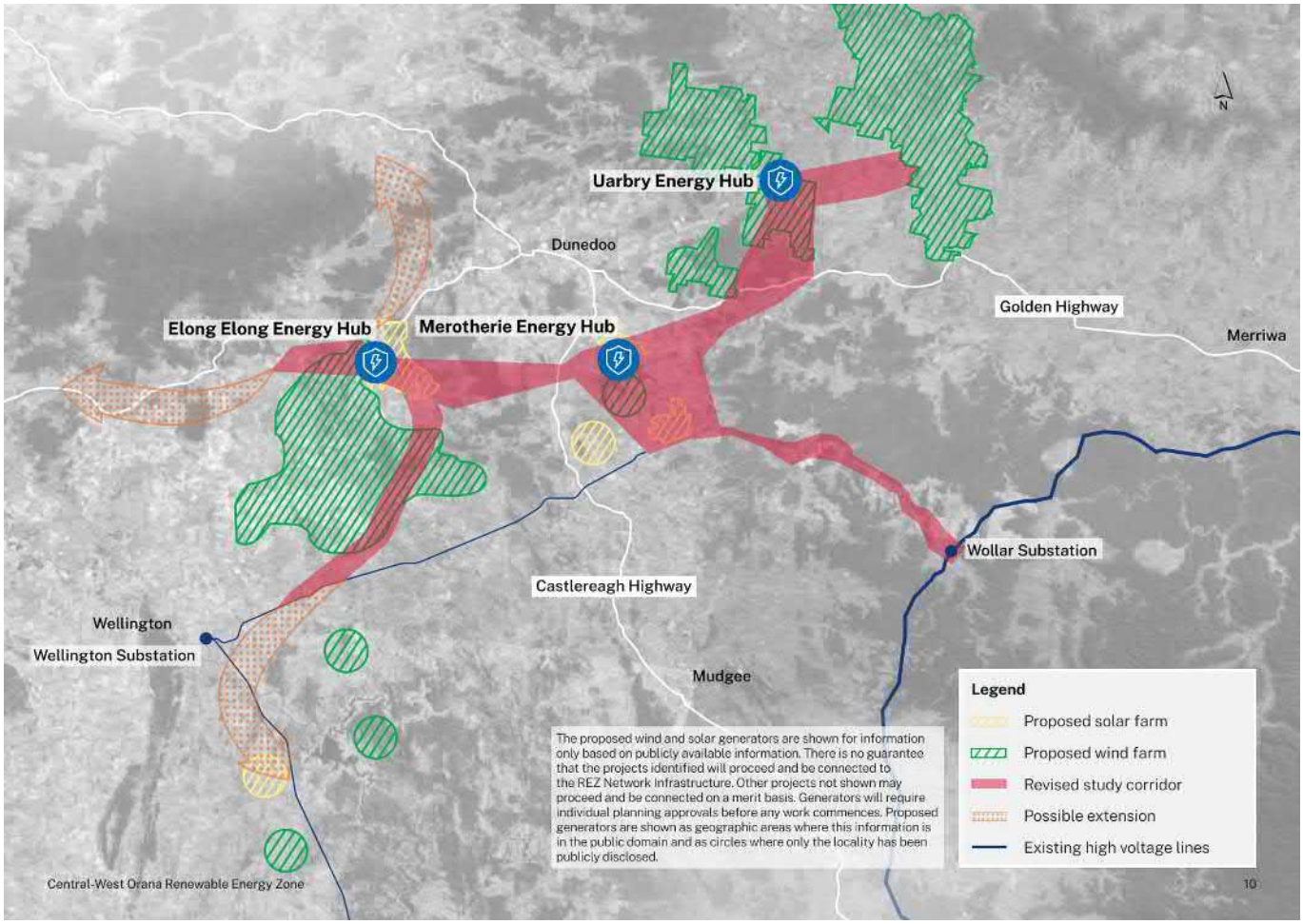


Figure 2-4 February 2022 Revised study corridor (EnergyCo, 2022)

2.6.3 Route identification and design development

To facilitate the delivery of the project, EnergyCo is currently leading the preparation and development of a reference design for the project.

The reference design sets out the high-level requirements for project infrastructure (including energy hubs, switching stations, transmission lines and towers) and is being prepared with consideration of environmental, social and economic constraints present within the revised corridor and surrounds, as well as the outcomes of consultation and feedback from local residents, organisations and stakeholders where possible, as described in Section 2.6.1.

The reference design will continue to be refined in response to the identification of additional environmental, social and economic constraints as more detailed site investigations are undertaken in consideration of community, landowner and renewable generator feedback received, and where opportunities to optimise the design are identified.

The reference design study area is provided in Figure 1-4 and represents a refinement of the revised study corridor (published in February 2022) to a one kilometre project study area within which detailed design and investigations will take place.

Further details regarding the development of the project design will be provided in the EIS.

3 Project description

This chapter outlines the project description including construction and operation, associated activities such as enabling works as well as the construction schedule. The current design for the project is described in this chapter; however, further design refinement will occur following the lodgement of the Scoping Report which will be documented in the EIS for the project.

3.1 Project context and location

The project is located in central-west NSW within the Warrumbungle, Mid-Western Regional, Dubbo and Upper Hunter LGAs. It extends north to south from Cassilis to Wollar and east to west from Cassilis to Goolma.

The project study area is shown in Figure 3-1. The project study area was derived from the corridor identification process summarised in Section 2.6.

The project study area is generally a one kilometre wide corridor in which the proposed transmission line, energy hubs and switching stations would be located. The majority of the ancillary activities associated with the project (including brake and winch sites, crane pads and laydown and staging areas) would be undertaken within the project study area. A refined study area for the project will be identified in the EIS. Additional locations that may be required for specific uses (such as access tracks, construction compounds and workforce accommodation camps) outside the project study area will also be identified in the EIS.

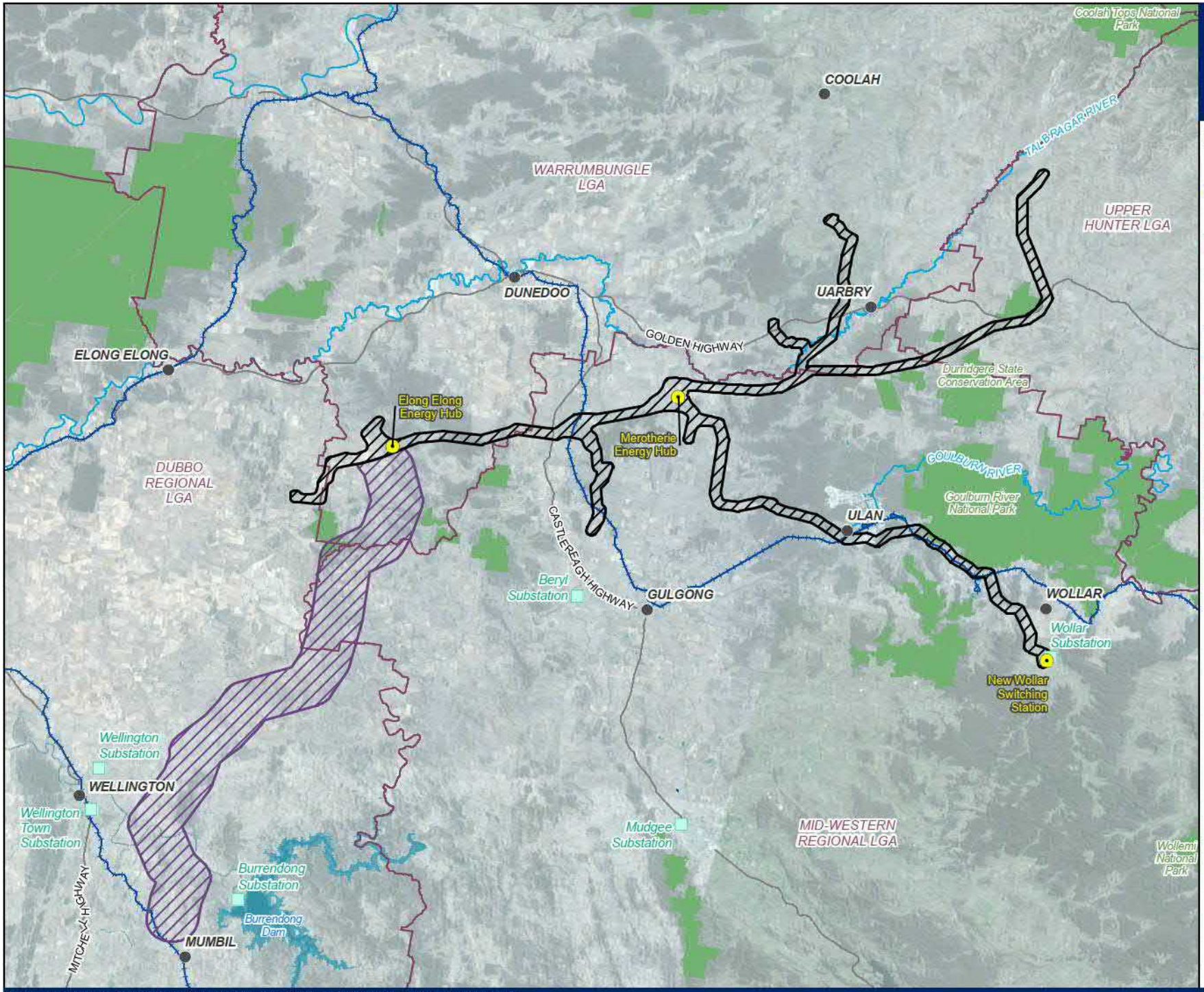
3.2 Project overview

Key components of the project include:

- a new switching station at Wollar, to connect the project to Transgrid's existing Wollar Substation and onto the NEM
- new twin double circuit 500 kV transmission lines and associated infrastructure to connect to the NEM and single and double circuit 330 kV single lines to connect energy generation and storage projects within the Central-West Orana REZ to the energy hubs
- energy hubs at Merotherie and Elong Elong, to connect energy generation and storage projects within the Central-West Orana REZ to the new 500 kV network infrastructure
- switching stations along the 330 kV network infrastructure to transfer the energy generated from the energy generation projects onto the 330 kV network infrastructure
- establishment and upgrade of access tracks and public roads, and other ancillary works such as laydown and staging areas, earthwork material sites with crushing and screening plants, concrete batching plants, brake/winch sites, site offices and workforce accommodation camps
- utility adjustments required for construction of the new network infrastructure.

The new HV transmission infrastructure would provide connections for renewable energy generation and storage projects within the Central-West Orana REZ to the existing electricity network. The twin double circuit HV transmission lines would efficiently transport electricity from large-scale renewable energy generators over long distances and allow for future expansion of renewable energy development.

The project includes a southern extension of the transmission network between Elong Elong and Mumbil with a connection to the NSW transmission network. This section is under investigation and will be subject to a separate planning approval.



Central-West Orana REZ Transmission

Figure 3-1
The project

Legend

- Energy hub/switching station indicative location
- Existing substation
- Town
- Road
- Railway
- Watercourse
- Waterbody
- Local government area
- NPWS estate
- Project study area
- *Southern extension

**The project includes a southern extension of the transmission network between Elong Elong and Mumbil with a connection to the NSW transmission network. This section is under investigation and will be subject to a separate planning approval.*

Coordinate system: GCS GDA 1994
Scale ratio correct when printed at A4
1:600,000
Data sources: WSP 2022

C:\Users\DaboV\WSP O365\AU-WIG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\02_ScopingReport\PS130593_ENV_F000b_TheProject_r1v11.mxd

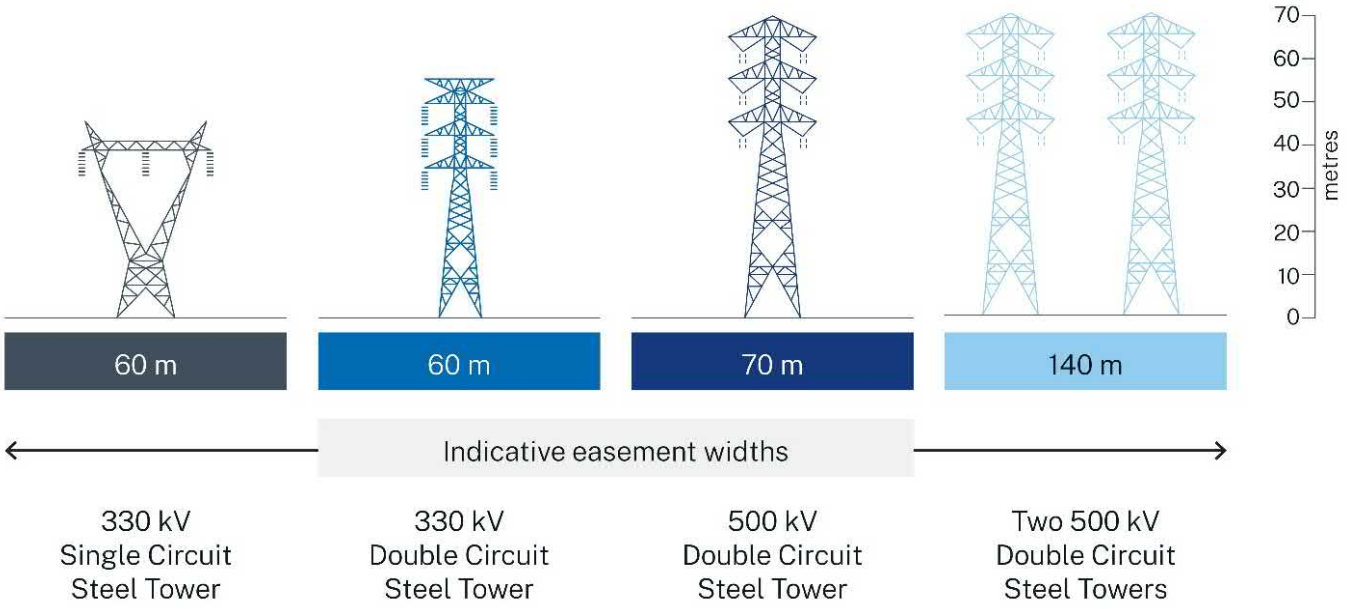
3.3 Key components of the project

The key components of the project are summarised in Table 3-1.

Table 3-1 Summary of key components of the project

Component	Description
Transmission lines and towers	The project would include a transmission lines and associated infrastructure within the project study area, which would be constructed to accommodate twin double circuit 500 kV electricity transmission or 330 kV single or twin transmission lines. Twin double circuit 500 kV transmission lines would generally run parallel. Short sections of the 330 kV network would also run adjacent to the 500 kV network. The nominal length of the 500 kV network transmission lines would be approximately 89 kilometres. The transmission line would be supported on a series of transmission line towers up to 70 metres in height and typically spaced at around 450 metres apart, although this would increase or decrease depending on the identified constraints. The 330 kV network infrastructure would comprise single and double circuit transmission lines that would connect renewable generation and energy storage projects to energy hubs. The nominal length of the 330 kV network transmission lines would be approximately 120 kilometres. The transmission lines would be supported on a series of transmission line towers up to 50 metres in height and spaced at around 400 metres apart, although this would increase or decrease depending on the identified constraints. Towers to support the transmission lines would most likely be free standing steel lattice structures, though alternative structure types would be investigated to mitigate a range of constraints that may arise, including the distance between existing and proposed transmission lines, ground conditions and the need to minimise impacts on existing environmental conditions and land uses. Indicative configurations of the potential transmission line towers that may be used as part of the project are shown in Figure 3-2. The type and arrangement of the transmission line towers will be refined during detailed design. The transmission lines would connect to the existing network at Wollar via a new switching station.
Transmission line easements	The transmission lines would be located within an easement of between 70 metres and 200 metres in width, depending on whether parallel transmission lines are required, the transmission tower type and/or if the new infrastructure would run alongside existing transmission lines. This will be confirmed as part of continued design refinement for the project. Indicative concept transmission line towers and minimum easement widths are shown in Figure 3-2. The transmission line easement would permit construction and future operations and maintenance of the new line. The easement also defines the initial vegetation clearance and on-going vegetation management to ensure safe electrical clearances during the operation of the lines. The vegetation clearing strategy for the project will be detailed in the EIS.
Energy hubs and switching stations	New energy hubs would be constructed at Merotherie and Elong Elong and a new switching station would be constructed at Wollar. Switching stations would also be constructed along transmission lines connecting renewable energy generators to energy hubs. These switching stations would enable connections to the renewable energy generators' internal networks and may in some cases allow multiple renewable energy generators to connect to the project. This would assist in reducing the number of transmission lines that would need to be constructed. The energy hubs would collect electricity from renewable energy and storage projects in the vicinity of the energy hub, where it would be transformed to a voltage suitable for transmission on to the new or existing transmission network. Each energy hub would occupy up to 90 hectares and would include lighting, fencing and security. The project would also include a communications connection to the existing Transgrid Wollar 500 kV Substation.

Component	Description
Access	Access to each transmission line tower, energy hubs and switching stations would be required during operation. Wherever possible, existing roads, tracks and other existing disturbed areas would be used to minimise vegetation clearing. In some areas, this would require an upgrade of existing roads, including pavement, bridge, utilities and drainage works. In areas where there are no existing roads or tracks, suitable access would be constructed.



Note: figure not to scale and represents indicative maximum heights and minimum easement widths. The maximum easement width of 200 metres would occur where a 330 kV easement (60 metres) is located alongside a twin 500 kV transmission line easement (140 metres).

Figure 3-2 Indicative concept design for the transmission line towers

3.4 Construction of the project

3.4.1 Project timeframes

Based on the current design and preliminary construction staging, it is expected that construction of the project would commence in the second half of 2024 and take approximately three years to complete with initial operations commencing as early as mid-2027.

The project timeframes are indicative and will continue to be refined and be further considered as part of the EIS.

3.4.2 Construction methodology

Construction activities will be generally undertaken within the identified project study area (refer to Figure 3-1). Ancillary sites, in particular large, centralised staging and workforce accommodation facilities, may be located outside the project study area. The construction methodology for the project will be developed in more detail during the preparation of the EIS for the project. Indicative construction activities for the project are outlined in Table 3-2.

Table 3-2 Indicative construction phases and activities

Construction phase	Construction activities
Site establishment works	• establishment of temporary environmental controls (where required) • establishment of construction site(s), access tracks and utility protection and relocations/adjustments • vegetation clearance • utility supply to construction ancillary sites.
Civil works associated with transmission lines	• construction of access tracks to accommodate safe access of construction machinery and materials to each transmission line tower site • earthworks and establishment of construction pads for each transmission line tower • construction of footings and foundation works for the new transmission line towers including boring and/or excavation, steel fabrication works and concrete pours • erection of the new transmission line towers using crane(s) and or helicopter(s) • stringing of the conductors and overhead earth wires and optical ground wire • installation of earthing conductors.
Civil, electrical and building works associated with the energy hubs and switching stations	• construction of internal roads • earthworks and levelling, including the removal of spoil from energy hub and switching station sites if required • establishment of hardstands • construction of any support buildings and infrastructure • construction of boundary fences • delivery and installation of transformers and other electrical equipment • electrical fit out with new equipment.
Pre-commissioning	• testing and commissioning of the energy hub and switching station equipment • point to point testing of the new transmission lines, energy hub and switching station connections • earthing testing • HV testing • HV equipment operational checks • connection to the existing transmission network • protection, control, and metering system and communication system testing.
Commissioning	• transmission line cut in and connection to the electrical network • protection, control, and metering checks • HV equipment operation and energisation • audible noise, thermographic imaging and electric and magnetic field (EMF) testing.
Demobilisation and site rehabilitation	• removal of all construction plant and equipment, and all materials not required during operation • removal and/or handover of construction compounds and camp sites • removal of any temporary site buildings and temporary environmental controls • restoration works, including restoration of construction sites, compounds and camp sites, irrigation and water infrastructure facilities, natural drainage in areas where temporary facilities were provided and fences and gates, which may have been damaged during construction • rehabilitation of access roads or tracks (where they are not required for further construction or maintenance activities, or where a landowner has requested the access track to remain).

Where subsurface rock is encountered during the excavation of transmission line tower, energy hub or switching station site footings, blasting may be required (subject to further ground condition investigations and identified as part of the EIS). The extent of earthworks required for the project will be subject to continued design refinement.

Water supply during construction will be identified during further design development and assessed as part of the EIS.

During the construction peak, the project is expected to require approximately 650 construction workers. However, the construction workforce at any one time would vary depending on the stage of construction and associated activities.

3.4.3 Construction plant and equipment

An indicative list of construction plant and equipment likely to be required for the key construction elements is provided below. Not all the equipment identified below would be required for all phases of the proposed construction of the energy hubs, switching stations and transmission lines:

- air compressors
- backhoes
- bob cats
- bulldozers
- concrete batch plants
- concrete agitator
- concrete pump
- cranes (various sizes)
- crushing plants
- drill and blast units and associated support plant/ equipment
- dumper trucks
- elevated work platform
- excavators (various sizes)
- explosives for blasting (subject to further geotechnical investigations and identified as part of the EIS)
- flatbed trucks
- fuel trucks
- generators
- graders
- helicopter and associated support plant/ equipment
- piling rigs
- pneumatic jackhammers
- rigid tippers
- rollers
- screening plants
- semi-trailers
- tilt tray trucks
- transport trucks
- trenchers
- watercarts.

3.4.4 Ancillary facilities

Various ancillary sites would be required during the construction of the project, including construction compounds, staging and laydown areas and workforce accommodation camps.

Staging and laydown areas would be required along the transmission line for the temporary storage of materials, plant and equipment required to construct the various elements of the project, and to facilitate assembly of the transmission line towers and stringing of the conductors. Earthwork material sites may be required to supplement fill requirements, with crushing and screening plants to process the extracted material. Concrete batching plants and a helipad and helicopter support facilities would also be required to support construction for the transmission line towers, energy hubs and switching stations.

Potential locations for the construction compounds, staging and laydown areas and workforce accommodation camps will be identified during further design development and assessed as part of the EIS. These areas will be preferentially located on existing disturbed land not subject to inundation and a reasonable distance from houses, watercourses and drainage lines.

3.4.5 Utilities

Utility relocations would be required where the new infrastructure would clash with existing utilities. These works would be minimised, where feasible, by designing the new infrastructure to avoid impacts to existing utilities.

Utility works may also be required for the connection of construction ancillary sites with existing utility services.

3.4.6 Construction hours

It is proposed that the majority of construction works would generally be undertaken across a seven-day work week between 7 am and 7 pm, consisting of a mixture of both standard and non-standard construction hours as defined in the *Interim Construction Noise Guideline* (DECC, 2009). Construction works could occur up to 24 hours a day, seven days a week, within the mining operations areas at Ulan and Wilpinjong, to allow for the coordination of the project's construction with mining activities. As the details of construction methodology and project needs are developed, these hours will be refined for certain activities and locations and assessed in the EIS.

Workforce accommodation camps would be operated 24 hours a day, seven days a week.

The extended construction hours are proposed given the distance to sensitive receivers for the majority of the project study area, and likely shift arrangements of the workforce given the remote nature of the project. Extended working hours would also achieve reductions in the overall duration of construction.

Where the extended hours are proposed for activities in proximity to noise affected sensitive receivers (and the works cannot be undertaken during standard work hours), additional mitigation measures will be provided in the EIS where works would potentially exceed noise management levels (NMLs) through an out of hours work protocol.

3.4.7 Construction traffic

Construction vehicle movements would be required throughout the duration of the construction stage. Where feasible, this would be undertaken within the disturbance area for the project (to be determined as part of development of the construction methodology) to minimise impacts on the public road network; however, the use of public roads would also be required.

Traffic would comprise heavy vehicle movements for transporting equipment, waste, materials and spoil, as well as light vehicle movements. Larger volumes of heavy vehicle movements would occur during the main civil construction works for the project. Non-standard or oversized loads would be required for the construction of the project (such as for the delivery of transformer units and other electrical infrastructure).

Most of the light vehicle traffic would be associated with construction workers travelling between individual construction sites and workforce accommodation camps.

The haulage (transit) routes for the project would use the surrounding road network between the construction sites and beyond. This includes the transport of materials and equipment from main shipping ports (i.e. in Newcastle and Sydney). Construction haulage routes will be confirmed and documented in the EIS.

3.5 Operation and maintenance

The energy hubs, switching stations and transmission lines would be inspected by field staff and contractors on a regular basis, with other operational activities occurring in the event of an emergency (as required). Likely maintenance activities would include:

- regular inspection (ground and aerial) and maintenance of electrical equipment and easements
- general building, asset protection zone and landscaping maintenance
- fire detection system inspection and maintenance
- stormwater maintenance.

4 Statutory context

This chapter describes the statutory context of the project and identifies the NSW and Commonwealth legislation that may apply.

Environmental planning approval for the project is required in accordance with the *Environmental Planning and Assessment Act 1979* (EP&A Act). It is assumed that the project would likely be considered a controlled action and would therefore require Commonwealth assessment and approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). A referral under the EPBC Act has been submitted to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) to consider whether the project is a controlled action.

4.1 NSW environmental planning approval

4.1.1 Permissibility

The State Environmental Planning Policy (Transport and Infrastructure) 2021 (Transport and Infrastructure SEPP) is a key environmental planning instrument that sets out the permissibility of infrastructure development and subsequently under which part of the EP&A Act it is assessed.

Clause 2.44 of the Transport and Infrastructure SEPP permits 'development for the purpose of an electricity transmission or distribution network' to be carried out by, or on behalf of, an electricity supply authority or public authority without consent on any land. However, development may not be carried out on land reserved under the *NSW National Parks and Wildlife Act 1974* (NP&W Act) without consent unless the development is (in general terms) authorised by or has approval under that Act.

The project falls within the definition of an 'electricity transmission or distribution network' under clause 2.43 of the Transport and Infrastructure SEPP, which defines that term as including the following components:

a. above or below ground electricity transmission or distribution lines (including related bridges, cables, conductors, conduits, poles, towers, trenches, tunnels, access structures, access tracks and ventilation structures) and telecommunication facilities that are related to the functioning of the network
b. above or below ground electricity switching stations or electricity substations, feeder pillars or transformer housing, substation yards or substation buildings
c. systems for electricity storage associated with a component specified in paragraphs a. and b.

EnergyCo is constituted under section 7(1) of the *Energy and Utilities Administration Act 1987* (NSW). Under section 36(1)(e) of that Act, EnergyCo is, for the purposes of any Act, a statutory body representing the Crown. As such, it is a 'public authority' within the meaning of section 1.4(1) of the EP&A Act. Accordingly, it is a 'public authority' within the meaning of clause 2.3(1) of the Transport and Infrastructure SEPP and is, therefore, a 'public authority' for the purposes of clause 2.44 of that SEPP.

The project is permissible without consent pursuant to clause 2.44 of the Transport and Infrastructure SEPP as it is defined as an electricity transmission and distribution network, will be carried out by or on behalf of EnergyCo (public authority) and will not be located on land reserved under the NP&W Act. Although there are small sections of the one kilometre project study area that encroaches into land that forms part of the Goulburn River National Park and Durridgere State Conservation Area, the project will be designed to not be located in this National Park or state conservation area.

4.1.2 NSW Environmental Planning Legislation and Approvals

The EP&A Act and the Environmental Planning and Assessment Regulation 2021 (EP&A Regulation) are the primary pieces of legislation regulating land use planning and development assessment in NSW. This legislation is supported by a range of environmental planning instruments including State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs).

Sections 5.12 and 5.13 of the EP&A Act provide for the declaration of State significant infrastructure (SSI) and CSSI. On 23 November 2020, the (then) Minister for Planning and Public Spaces (the relevant minister now is the Minister for Planning) made the Environmental Planning and Assessment Amendment (Central-West Orana Renewable Energy Zone Transmission Order) 2020. The Order declares the whole Central-West Orana REZ Transmission project to be CSSI by adding that project as a new clause, gazetted on 16 December 2020, in Schedule 5 of the State Environmental Planning Policy (State and Regional Development) 2011, now clause 23 in Schedule 5 of the Planning Systems SEPP:

23 Central-West Orana REZ Transmission project

(1) Development for the purposes of the Central-West Orana REZ Transmission project.

(2) The Central-West Orana REZ Transmission project is a program of works to construct and operate the high-voltage electricity transmission infrastructure required to connect energy generation and storage projects within the Central-West Orana REZ to the existing electricity network.

(3) The Central-West Orana REZ Transmission project includes the following —

(a) the construction and operation of new electricity transmission lines connecting from the existing electricity network south-west of Merriwa to south-west of Dunedoo and then to the existing electricity network west of Lake Burrendong,

(b) the construction and operation of new electricity substations,(c) the augmentation of the existing electricity substation at Wollar,

(d) ancillary development including, but not limited to the following —

(i) the carrying out of works to upgrade or augment existing electricity transmission lines and substation infrastructure,

(ii) the construction and operation of access roads,

(iii) the installation and operation of communication infrastructure and facilities, excluding microwave technology,

(iv) the installation and operation of construction accommodation, compounds and power supplies.

(4) The development is to be carried out on land in the following local government areas —

(a) Dubbo Regional,

(b) Mid-Western Regional,

(c) Upper Hunter Shire,

(d) Warrumbungle Shire.

(5) In this section—

Central-West Orana REZ means the Central-West Orana Renewable Energy Zone.

development does not include—

(a) tests or investigations for the assessment of the Central-West Orana REZ Transmission project including, but not limited to, the carrying out of the following—

(i) surveys,

(ii) sampling,

(iii) environmental investigations,

(iv) geotechnical borehole drilling,

(v) test drilling,

(vi) test excavations, or

(b) the construction of temporary access tracks and temporary site facilities to allow for the carrying out of tests or investigations described in paragraph (a), or

(c) minor works within existing switchyards.

Division 5.2 of the EP&A Act establishes the assessment and approval regime for SSI and CSSI projects. An EIS will be prepared for the project in accordance with section 5.17 of the Act.

4.1.3 Other NSW approvals

Other relevant NSW approvals that may be required for the project or approvals that are not required for CSSI are summarised in Table 4-1.

Table 4-1 Other approvals required to carry out the project

Relevant provision	Application of provision to project
Approvals that should be substantially consistent with approved CSSI	Approvals or authorisations that cannot be refused if they are necessary for carrying out approved CSSI and are substantially consistent with the Division 5.2 approval, including: • an approval under Part 3 of the *Coal Mine Subsidence Compensation Act 2017* (CMSC Act) • environment protection licences (EPLs) under Chapter 3 of the *Protection of the Environment Operations Act 1997* (POEO Act) • consent (Road Occupancy Licence) under section 138 of the *Roads Act 1993* (Roads Act) from the relevant roads authority for the erection of a structure, or the carrying out of work in, on or over a public road, or the digging up or disturbance of the surface of a road. With respect to the CMSC Act, EnergyCo would require approval as the project would be located within the Mudgee mine subsidence district. With respect to EPLs, Schedule 1 of the POEO Act, does not define electrical transmissions lines or substations as a scheduled activity requiring an EPL. However, subject to development of the construction methodology, certain construction activities may be classified as a scheduled activity triggering the requirement for an EPL (refer to Table 4-3). With respect to Road Occupancy Licences, the project will potentially require temporary/partial closure of classified and unclassified roads for the construction of the project. EnergyCo would require approval to undertake work on classified roads. However, by reason of clause 5(1) of Schedule 2 of the Roads Act, EnergyCo is not required to obtain approval to carry out work on unclassified roads other than a Crown road (subject to that clause ceasing to have effect by proclamation). In practice, EnergyCo would consult the roads authority on its proposed works.

Relevant provision	Application of provision to project
Approvals that are not required for approved CSSI	Approvals of potential relevance to the project which are not required under section 5.23(1) of the EP&A Act, include: • a permit under sections 201, 205 or 219 of the *Fisheries Management Act 1994* (FM Act) • an approval under Part 4, or an excavation permit under section 139 of the *Heritage Act 1977* • an Aboriginal heritage impact permit under section 90 of the NP&W Act • a bush fire safety authority under section 100B of the *Rural Fires Act 1997* • various approvals under the *Water Management Act 2000*, namely a water use approval under section 89, a water management work approval under section 90, and an activity approval (other than aquifer interference approvals) under section 91. Section 5.23 of the EP&A Act also specifies that directions, orders or notices cannot be made or given so as to prevent or interfere with the carrying out of approved CSSI. Of relevance to the project would be: • an interim protection order (within the meaning of the NP&W Act) • an order under Division 1 (Stop work orders) of Part 6A of the NP&W Act or Division 7 (Stop work orders) of Part 7A of the FM Act • a remediation direction under Division 3 (Remediation directions) of Part 6A of the NP&W Act • an order or direction under Part 11 (Regulatory compliance mechanisms) of the *Biodiversity Conservation Act 2016* (BC Act) • an environment protection notice under Chapter 4 of the POEO Act • an order under section 124 of the *Local Government Act 1993*.
NSW legislation and concurrent approvals	See sections 4.3.1 to 4.3.3 for other NSW legislation and approvals that are relevant to the project.

4.2 Planning approval process

The NSW Minister for Planning is the approval authority for the project with an EIS required to be lodged to the Department of Planning and Environment (DPE). A referral under the Commonwealth EPBC Act has been submitted to the DCCEEW at the same time as this report. If the project is determined to be a controlled action, the approval of the Australian Minister for the Environment will be required in addition to the State CSSI approval.

Before preparing the EIS, the proponent must request the SEARs for the EIS. This Scoping Report has been prepared to support that request in accordance with the 'State Significant Infrastructure Guidelines' (DPE, 2021).

The EIS will be prepared to address the SEARs (once issued) and the form and content requirements set out in Part 8 Division 5 of the EP&A Regulation. EnergyCo anticipates that, if Commonwealth approval is required, the impacts would be assessed via the EIS process in accordance with the NSW Assessment Bilateral Agreement.

The EIS will be submitted to DPE for review before it is publicly exhibited for at least 28 days. During the exhibition period, the public and agencies will be invited to make submissions. After the exhibition period closes, DPE will ask the proponent to respond to issues raised in the submissions and prepare a Submissions Report.

Following the publication of the Submissions Report (and Amendment Report or Preferred Infrastructure Report if required) by the proponent, the Secretary will prepare an Assessment Report for the Minister for Planning in accordance with the provisions of section 5.18 of the EP&A Act. The Assessment Report must be considered by the Minister in determining whether or not to approve the carrying out of the project. The Minister's approval may be subject to conditions of approval, in accordance with section 5.19 of the EP&A Act.

A summary of the overall assessment and approval process for the project is shown in Figure 4-1.

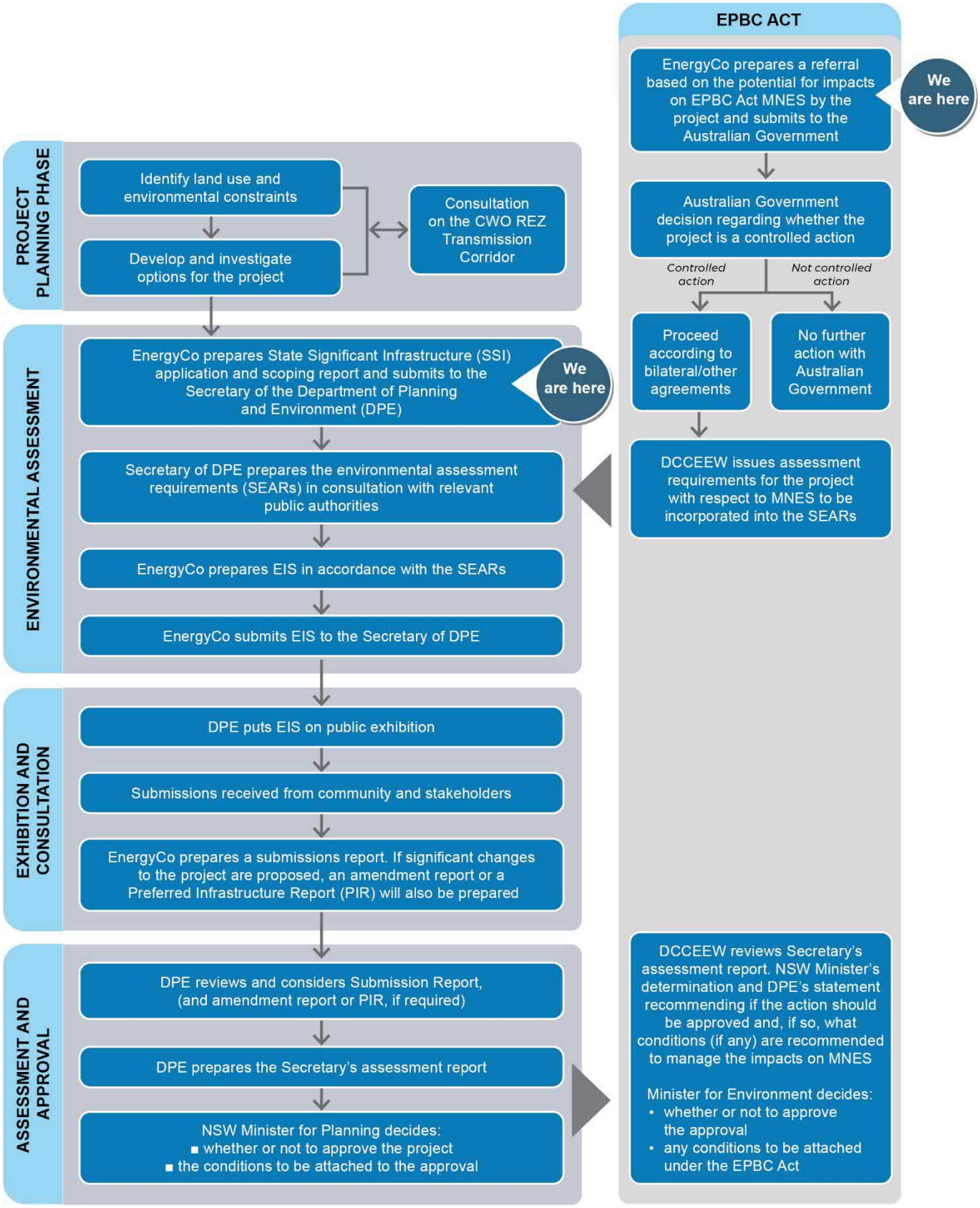


Figure 4-1 Assessment and approval process for the project

4.3 Mandatory matters for consideration

4.3.1 Applicable NSW Environmental Planning Instruments

Section 5.22 of the EP&A Act provides that environmental planning instruments (EPIs, such as LEPs and SEPPs) do not apply to CSSI projects except to the extent they apply to the declaration of infrastructure as SSI or CSSI and to the declaration of development that does not require consent. Consequently, the Transport and Infrastructure SEPP and the Planning Systems SEPP do have some limited effect. Notwithstanding, as a matter of good practice in respect of addressing environmental impacts, key environmental planning instruments have been considered. These instruments are discussed in Table 4-2.

Table 4-2 Environmental Planning Instruments relevant to the project

Environmental planning instrument	Relationship to project
State Environmental Planning Policy (Planning Systems) 2021 (Planning Systems SEPP)	The Planning Systems SEPP identifies development that is CSSI. As discussed in Section 4.1.2, the Environmental Planning and Assessment Amendment (Central-West Orana Renewable Energy Zone Transmission Order) 2020 was made by the (then) Minister for Planning and Public Spaces on 23 November 2020 (and gazetted on 16 December 2020). The order amended the Planning Systems SEPP that identifies the project as CSSI under Schedule 5 clause 23.
State Environmental Planning Policy (Primary Production) 2021 (Primary Production SEPP)	The Primary Production SEPP aims to facilitate the orderly economic use and development of land for primary production and 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. The SEPP is also intended to identify land which has been declared to be State Significant agricultural land (currently no land identified by the SEPP). As the project would likely impact on areas of primary production and agriculture, the provisions of this SEPP will be further considered as part of the EIS process for the project. Potential impacts on agricultural land are discussed in Section 6.3 (Agriculture).
State Environmental Planning Policy (Resilience and Hazards) 2021 (Resilience and Hazards SEPP)	Chapter 4 of the Resilience and Hazards SEPP provides a State-wide approach to the remediation of contaminated land for the purpose of minimising the risk of harm to the health of humans and the environment. Clause 4.6(1) of the Resilience and Hazards SEPP provides that a consent authority must not consent to the carrying out of development on any land unless: • it has considered whether the land is contaminated • if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or would be suitable, after remediation) for the purpose for which the development is proposed to be carried out • if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land would be remediated before the land is used for that purpose. A Phase 1 contamination investigation will be undertaken as part of the EIS in accordance with *Managing Land Contamination Planning Guidelines SEPP 55–Remediation of Land* (Department of Urban Affairs and Planning and Environment Protection Authority, 1998) to inform the design of the project and EIS process. Refer to Section 6.16 (Soils and contamination). Chapter 3 of the Resilience and Hazards SEPP aims to (among other things) ensure that consent authorities have sufficient information to assess whether development is hazardous or offensive and to impose conditions on potentially hazardous or offensive development to reduce or minimise any adverse impacts. During construction and operation of the project, dangerous goods and hazardous materials are likely to be transported to and from the project, and dangerous goods may be stored on site. The relevant provision of this SEPP will be further considered as part of the EIS process for the project. Potential risks related to dangerous goods and hazardous materials are discussed in Section 6.11 (Hazard and risk).

Environmental planning instrument	Relationship to project
State Environmental Planning Policy (Resources and Energy) 2021 (Resources and Energy SEPP)	The Resources and Energy SEPP contains provisions to facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources. The project would be located on land that is subject to mining leases and exploration licences. Clause 2.15 provides that, development for the purpose of the construction, maintenance and use of electricity distribution lines is complying development if it is on the site of an approved mine or approved extractive industry. Since the project has been declared as CSSI, the provisions of the Resources and Energy SEPP do not apply.
State Environmental Planning Policy (Biodiversity and Conservation) 2021 (Biodiversity and Conservation SEPP)	The Biodiversity and Conservation SEPP contains provisions for the conservation and management of natural vegetation areas that provide habitat for koalas. Potential impacts on koala populations have been considered in Appendix C (Preliminary Biodiversity Assessment) and are summarised in Section 6.5 (Biodiversity).

4.3.2 Local Environmental Plans

The project would be located within the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter LGAs. The project would therefore fall under the following local environmental plans if it had not been declared as CSSI:

- Warrumbungle Local Environmental Plan 2013
- Mid-Western Regional Local Environmental Plan 2012
- Dubbo Regional Local Environmental Plan 2022
- Upper Hunter Local Environmental Plan 2013.

The zoning which is applicable to the project includes the following:

- RU1 Primary Production (consisting of a majority of the land on which the project would be located)
- RU5 Village (a small area at Ulan)
- RU3 Forestry (areas at Dunedoo and Turill)
- R5 Large Lot Residential (a small area at Tallawang)
- C1 National Parks and Nature Reserves (along the southwestern border of Goulburn River National Park and southeastern border of a section of Durridgere State Conservation Area)
- C3 Environmental Management (areas at Barneys Reef, Cope, Cumbo, Merotherie, Ulan and Wollar)
- IN3 Heavy Industrial (small areas at Ulan)
- SP2 Infrastructure (at the crossing points of the Golden Highway, Castlereagh Highway, Wallerawang Gwabegar Railway and Sandy Hollow Gulgong Railway).

While the LEPs listed above guide local development within the LGA, the EP&A Act expressly provides that LEPs do not apply to SSI and CSSI projects. Therefore, the remaining provisions of the LEPs have not been considered further in this Scoping Report. However, this report has provided preliminary consideration of heritage items listed under the LEPs in Section 6.7 (Non-Aboriginal heritage) and has considered preliminary potential impacts to land use in Section 6.2 (Land use and property).

4.3.3 Other NSW planning legislation

Table 4-3 discusses other NSW legislation that may be applicable regardless of the project being declared CSSI.

Table 4-3 Other NSW planning legislation of potential relevance to the project

Legislation	Requirement
Aboriginal Land Rights Act 1983	This Act establishes the NSW Aboriginal Land Council and local Aboriginal land councils (LALCs) and requires the LALCs to, among other things: • acquire land and to use, manage, control, hold or dispose of, or otherwise deal with, land vested in or acquired by the LALC • take action to protect the culture and heritage of Aboriginal persons in the LALC's area, subject to any other law • promote awareness in the community of the culture and heritage of Aboriginal persons in the LALC's area. Under this Act, LALCs can claim Crown land which, if granted, is transferred as freehold title. In broad terms, 'claimable Crown lands' mean Crown lands that are not lawfully used or occupied and that are not needed, nor likely to be needed, for an essential public purpose, when a claim for the land is made. The potential impacts of the project on claimable Crown land will be confirmed in the EIS. EnergyCo will consult with Aboriginal stakeholders during continued design development to avoid or minimise impacts on claimable Crown land where possible (refer to Section 6.2 (Land use and property)).
Biodiversity Conservation Act 2016 (BC Act)	This Act aims to conserve threatened species, populations and ecological communities through ensuring appropriate assessment, management and regulation of actions that may damage critical or other habitat for a listed threatened species, or may otherwise significantly affect a threatened species, population or ecological community. A preliminary assessment of biodiversity risks associated with the project has been carried out in accordance with the BC Act. The results of this assessment are presented in Appendix C (Preliminary Biodiversity Assessment) and summarised in Section 6.5 (Biodiversity).
Biosecurity Act 2015 (Biosecurity Act)	Under the Biosecurity Act, all plants (among other living things other than humans) are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable. A preliminary assessment of biosecurity risks associated with the project has been provided in Appendix C (Preliminary Biodiversity Assessment) and summarised in Section 6.5 (Biodiversity).
Contaminated Land Management Act 1997 (CLM Act)	The CLM Act outlines the circumstances in which notification to the NSW Environment Protection Authority (EPA) is required in relation to the contamination of land. This may be relevant for this project during construction and/or operation and will be discussed in the EIS. A Phase 1 contamination investigation will be undertaken in accordance with the *Managing Land Contamination Planning Guidelines SEPP 55–Remediation of Land* (Department of Urban Affairs and Planning and Environment Protection Authority, 1998) to inform the design of the project and EIS process. Contamination is further discussed in Section 6.16 (Soils and contamination).
Crown Land Management Act 2016	This Act sets out the requirements for the management of Crown land in NSW. This includes the permissions and authorisations needed when planning the development of activities on Crown Land as well as the process for the acquisition of Crown Land. There are areas of Crown Land that would be affected by the project (see Section 6.2 (Land use and property)).

Legislation	Requirement
Electricity Infrastructure Investment Act 2020 (Electricity Infrastructure Investment Act)	The Electricity Infrastructure Investment Act aims, among other things, to co-ordinate investment in new generation, storage and network infrastructure in NSW. It establishes a process under which the Minister can declare a geographical area of the State a REZ and specify the generation, storage or network infrastructure that will be implemented in that zone. There are currently five REZs declared in the Act, including the Central-West Orana REZ. The Electricity Infrastructure Investment Act also gives power to the Minister to declare "access schemes" that operate in REZs. A REZ access scheme authorises (or prohibits) access to, and the use of, specified network infrastructure by operators of generation and storage infrastructure within a REZ. The declaration of an access scheme may specify how access rights are to be conferred on participants and the fees payable. These access schemes are intended to support investment in the network and provide investors with comfort that their project will be authorised to access a stable grid connection. Future connections to the project will be managed through the access scheme for the Central-West Orana REZ.
Land Acquisition (Just Terms Compensation) Act 1991 (Just Terms Act)	The Just Terms Act applies to the acquisition of land (by agreement or compulsory process) by a public authority with the statutory power to acquire the land. The Just Terms Act requires that independent valuers assess the current market value for each property interest being acquired. In addition to the market value of the property, valuers assess any additional costs that would fairly and reasonably be incurred as a result of the acquisition; such as stamp duty, professional costs (e.g. legal fees and valuation fees), relocation costs (if relevant), losses resulting from severance, and losses relating to disturbance. The valuation informs the offer made to the property owner. The provisions of the Just Terms Act apply to the acquisition of interests in land by EnergyCo. Some of the land on which the project is proposed to be located is privately owned and may need to be acquired to accommodate the project. Further discussion of potential land acquisition associated with the project is discussed in Chapter 5 (Stakeholder and community engagement) and Section 6.2 (Land use and property).
Native Title (NSW) Act 1994 (Native Title Act)	This Act provides for the recognition of native title in relation to land or waters in NSW in accordance with the Commonwealth *Native Title Act 1993* (refer to Section 4.3.5). Searches of the registers maintained by the National Native Title Tribunal identified two known native title claims under the *Native Title Act 1993* (NC2011/006 and NC2018/002) in the project study area, which have not been determined. The status of these claims will be confirmed as part of the EIS. There are no Indigenous Land Use Agreements that apply to the project study area. A preliminary assessment of potential impacts on native title and Aboriginal heritage is provided in Appendix D (Preliminary Heritage Assessment) and Section 6.6 (Aboriginal heritage).
Protection of the Environment Operations Act 1997 (POEO Act)	The POEO Act establishes, among other things, pollution management, pollution incident reporting and the procedures for issuing licences for environmental protection on aspects such as waste, air, water and noise pollution control. An environment protection licence (EPL) is required under Chapter 3 of the POEO Act to undertake a scheduled activity (listed in Schedule 1 of the Act) or scheduled development work (outlined in section 47 of the Act). Construction activities that require an EPL in the event that they exceed the criteria listed in Schedule 1 of the POEO Act may include: • crushing, grinding or separating materials (clause 16) • helicopter-related activities (clause 20). Licensing requirements for the project will be considered in consultation with the EPA and confirmed in the EIS. Construction activities must comply with the requirements for the POEO Act, including (but not limited to) requirements in relation to the disposal of waste, leaks, spillages and other escapes (sections 115 and 116), pollution of waters (section 120), air pollution (section 124 and 126), noise pollution (Section 139), land pollution (section 142A), waste offences (sections 143 and 144) and the maintenance and operation of plant and equipment (section 167). Appropriate management and mitigation will be identified in the EIS in relation to these aspects, as discussed in sections 6.10 (Noise and vibration), 6.13 (Waste management and resource use), 6.14 (Hydrology, flooding and water quality), 6.15 (Groundwater), 6.16 (Soils and contamination) and 6.17 (Air quality).

4.3.4 Ecologically sustainable development

Part 8, Division 5 (clause 193) of the EP&A Regulation and section 6(2) of the *Protection of the Environment Administration Act 1991* outline the four principles of ecologically sustainable development (ESD). The four ESD principles comprise the precautionary principle; intergenerational equity; conservation of biological diversity and ecological integrity; and improved valuation, pricing and incentive mechanisms.

EnergyCo will consider the principles of ESD in design development of the project. A discussion of how the project has considered ESD principles and how these are incorporated into the project will be included in the EIS.

4.3.5 Commonwealth legislation

Environment Protection and Biodiversity Conservation Act 1999

Under the EPBC Act, proposed actions with the potential to significantly impact matters protected by the EPBC Act must be referred to the Australian Minister for the Environment (Minister) to determine whether they are controlled actions and require approval from the Minister. Under Part 3 of the EPBC Act, approval from the Minister is required for:

- an action that is likely to have a significant impact on Matters of National Environmental Significance (MNES)
- an action taken by any person on Commonwealth land (including Commonwealth leased land) that is likely to have a significant impact on the environment
- an action taken by any person outside of Commonwealth land (including Commonwealth leased land) that is likely to have a significant impact on the environment on Commonwealth land
- an action taken by a Commonwealth agency anywhere in the world that is likely to have a significant impact on the environment.

EnergyCo is not a Commonwealth agency. A preliminary assessment of the project indicates that one Commonwealth landholding is located within the southeastern section of the project study area. The potential impacts of the project on this landholding would be assessed in the EIS.

As discussed in the sub-section below, there is potential for the project to have an impact on MNES, being a Commonwealth listed threatened species or ecological community.

Matters of National Environmental Significance

A search of the EPBC Act Protected Matter Search Tool (PMST) for the project study area was conducted in August 2022 to identify potential MNES that may trigger the need for referral of the action to the Minister. This has been supplemented by the results of a Preliminary Biodiversity Assessment (refer to Appendix C). A summary of the potential MNES within the project study area is presented in Table 4-4.

Table 4-4 MNES under the EPBC Act

MNES	Matters within the project area
World heritage properties	None
National heritage places	None
Wetlands of international importance	None
Commonwealth listed threatened species and ecological communities	The results of likelihood of occurrence assessments have identified 13 EPBC listed threatened flora species and 19 threatened fauna species with a moderate or higher likelihood of occurrence within the project study area (refer to Appendix C). Of these, one flora species and five threatened fauna species have already been recorded within the project study area. Based on preliminary field verification surveys and broad scale state vegetation mapping, two EPBC Act listed Threatened Ecological Communities (TECs) are considered as likely to occur within the project study area: • Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (Grey Box Grassy Woodland and Derived Native Grasslands) (Endangered) • White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box-Gum Woodland and Derived Native Grasslands) (Critically Endangered). In addition, a further nine candidate TECs were identified from database searches being: • Central Hunter Valley eucalypt forest and woodland (Critically Endangered) • Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland (Endangered) • Natural Temperate Grassland of the South Eastern Highlands (Critically Endangered) • River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria (Critically Endangered) • Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion (Endangered) • Poplar Box Grassy Woodland on Alluvial Plains (Endangered) • Weeping Myall Woodlands (Endangered) • Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland (Critically Endangered) • Coolibah – Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions (Endangered).
Commonwealth listed migratory species	The results of likelihood of occurrence assessments identified that seven migratory species have a moderate or higher likelihood of occurrence within the project study area (see Appendix C). None of these species have been recorded in the project study area.
Nuclear action	The project would not result in any nuclear action nor would any nuclear activity need to be undertaken.
Commonwealth marine area	None
Great Barrier Reef Marine Park	None
Protection of water resources from coal seam gas development and large coal mining	None

Based on the current project study area, the proposed preliminary design for the project and understanding of site conditions, it is anticipated that the project could potentially result in significant impacts on Commonwealth listed threatened species and ecological communities.

An EPBC Act referral has been submitted to the Minister (at the same time as this report) to consider whether the project would be considered to be a controlled action. The Minister will decide if the project is a 'controlled' action on the basis of potential impacts to the listed threatened species. If determined to be controlled, then the project is expected to be assessed in accordance with the NSW Assessment Bilateral Agreement.

Native Title Act 1993

The Australian Government *Native Title Act 1993* provides for the recognition of native title and establishes ways in which future dealings affecting native title may proceed, sets the standards for those dealings and establishes a mechanism for determining claims to native title. Section 8 states that the *Native Title Act 1993* is not intended to affect the operation of any law of a State or a Territory that is capable of operating concurrently with the Act. *The Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW, 2010) stipulates that, where relevant, consultation must be conducted with Native title holders or registered native title claimants.

Searches of the registers maintained by the National Native Title Tribunal identified two known native title claims under the *Native Title Act 1993* (NC2011/006 and NC2018/002) in the project study area, which have not been determined. The status of these claims will be confirmed as part of the EIS.

There are no Indigenous Land Use Agreements that apply to the project study area.

5 Stakeholder and community engagement

This chapter outlines engagement carried out for the project and provides a summary of views of the community and other stakeholders. This chapter also outlines engagement that is proposed to be carried out for the project.

5.1 Overview

The project is a large and complex infrastructure project with a high-level of interest from the community and key stakeholders. EnergyCo recognises the diverse engagement and information needs of the community and is committed to a robust plan of engagement that will be inclusive and encourage participation.

Engagement with communities and stakeholders about proposed new transmission network infrastructure in the Central-West Orana REZ has been ongoing since 2020.

Between December 2020 and September 2021, community consultation was carried out by Transgrid on the preliminary study corridor for new transmission network infrastructure in the Central-West Orana REZ. EnergyCo assumed responsibility for engaging communities and stakeholders for the project when it was appointed as Infrastructure Planner for the Central-West Orana REZ in November 2021. Since this time, EnergyCo has carried out a comprehensive program of community and stakeholder engagement to build on the engagement previously carried out by Transgrid.

A key aim of engagement activities to date has been to gather community and stakeholder feedback to be considered in the refinement of the study corridor and design for the project and the subsequent EIS.

The feedback received covers a wide range of issues relating to the proposed transmission network infrastructure, renewable energy developments and issues relating to the wider REZ. Key topics raised by the community included feedback on the proposed locations for transmission infrastructure, cumulative impacts on communities within the REZ, impacts to the environment and local amenity, property impacts including acquisition and land values and feedback and suggestions about community engagement activities. Local councils have raised issues in relation to community benefits, cumulative impacts from transmission and renewable generation projects, potential impacts to local business and tourism, upgrades and maintenance of local roads, waste management and construction workforce accommodation and services.

The feedback and suggestions received from the community and stakeholders have been considered in combination with engineering and environmental studies, to further refine the project study area and the development of this Scoping Report.

Engagement activities are ongoing and will continue during the preparation and exhibition of the EIS to ensure the community and stakeholders receive comprehensive updates about the project and have the opportunity to provide feedback on the project. Engagement approaches will be evaluated and reviewed on a regular basis to ensure they are providing adequate participation opportunities and responding to stakeholder needs and expectations.

5.2 Engagement strategy

5.2.1 Engagement approach

EnergyCo will work closely with communities and stakeholders to inform the planning and delivery of the project. EnergyCo has developed a comprehensive Community and Stakeholder Engagement Strategy for the Central-West Orana REZ which describes how engagement with the community and stakeholders will be carried out during the development of the project. The strategy is a working document that will be updated regularly as the project progresses.

EnergyCo recognises the importance of early and effective engagement with communities and stakeholders and is committed to:

- implementing a transparent, meaningful and inclusive approach to working with communities and stakeholders who are directly and indirectly affected by the project
- enabling stakeholder participation in the route identification process in a manner that is clear and transparent and ensures stakeholders understand how their feedback will be used to inform the project development process
- providing sufficient and timely information to enable communities and stakeholders to give informed feedback
- tailoring engagement and communications to consider different stakeholder needs and expectations.

EnergyCo's communication and engagement approach broadly aligns with the following documents and guidelines:

- *Undertaking Engagement Guidelines for State Significant Projects* (DPIE, 2021f)
- *Quality Assurance Standard for Community and Stakeholder Engagement* (International Association for Public Participation (IAP2), 2015)
- *Community Engagement Guidelines For Building Powerlines For Renewable Energy Developments – A guide for proponents, landholders and communities* (Clean Energy Council (CEC), 2018)
- *Property Acquisition Standards* (NSW Government, 2019)
- *Community Participation Plan* (DPIE, 2019b).

5.2.2 Engagement objectives

The key communication and engagement objectives for the project are to:

- provide regular and targeted information to the community and stakeholders about the progress of the project and the broader Central-West Orana REZ, including opportunities to provide feedback
- inform interested and affected communities and stakeholders about the project and its potential impacts
- ensure community and stakeholder feedback informs the project development process
- respond to enquiries, complaints and requests for information in a timely manner
- effectively manage expectations of the community and stakeholders in relation to project impacts, including cumulative impacts from the project and renewable generation projects
- promote the benefits the REZ will bring to local communities in the Central-West Orana region
- establish EnergyCo as the point of contact for the REZ as a whole
- build community and stakeholder confidence in EnergyCo and the REZ
- promote the project in the broader context of the NSW Electricity Infrastructure Roadmap (DPE, 2020).

5.3 Key stakeholders

EnergyCo has identified relevant stakeholders across the project study area. Table 5-1 provides an initial list of stakeholder groups who have been or will be engaged with in relation to the project. EnergyCo expects this list to grow and diversify as the development of the project continues and the engagement broadens.

Stakeholder identification and engagement will continue throughout the development of the project and will be updated as appropriate.

Table 5-1 Key stakeholder groups for the project

Stakeholder group	Stakeholders
NSW Government elected representatives	• Premier of NSW, the Hon Dominic Perrottet MP • Treasurer and Minister for Energy, the Hon Matthew Kean MP • Minister for Planning and Homes, Anthony Roberts MP • Minister for Agriculture and Minister for Western NSW, Member for Dubbo, Hon Dugald Saunders MP • Member for Barwon, Roy Butler MP • Member for Upper Hunter, David Layzell MP.
Australian Government elected representatives	• Minister for Climate Change and Energy, Hon Chris Bowen MP • Member for Calare, Hon Andrew Gee MP • Member for Parkes, Hon Mark Coulton MP • Member for New England, Hon Barnaby Joyce MP.
Energy industry stakeholders	• Australian Energy Market Operator (AEMO) • Consumer Trustee (AEMO Services) • Australian Energy Regulator (AER) • Australian Energy Market Commission • Australian Energy Infrastructure Commissioner • Energy Security Board • Australian Renewable Energy Agency • Australian Energy Council • Clean Energy Council • Energy Consumers Australia.
Local governments within the study area	• Mid-Western Regional Council • Dubbo Regional Council • Warrumbungle Shire Council • Upper Hunter Shire Council • Orana Joint Organisation of Councils.

Stakeholder group	Stakeholders
Government departments and agencies	• Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) • NSW Department of Planning and Environment (DPE) and its divisions: — Crown Lands — Environment and Heritage — National Parks and Wildlife • NSW Environment Protection Authority (EPA) • NSW Department of Premier and Cabinet • Infrastructure NSW • Transport for NSW • Department of Regional NSW and its divisions: — Local Land Services — Mining, Exploration and Geoscience • NSW Telco Authority • Forestry Corporation of NSW • Subsidence Advisory NSW • Heritage Council of NSW • Aboriginal Affairs NSW • Regional Development Australia • National Indigenous Australians Agency.
Developers of renewable generation projects	• Proponents of renewable generation projects in the Central-West Orana REZ (existing, under approval and future).
Directly impacted landowners in the project study area	• Landowners within the project study area, including: — owner occupiers — investment owners — other interest holders — mining landowners.
First Nations stakeholders	• Dubbo Local Aboriginal Land Council • Gilgandra Local Aboriginal Land Council • Mudgee Local Aboriginal Land Council • Walhallow Local Aboriginal Land Council • Wellington Local Aboriginal Land Council • Wanaruah Local Aboriginal Land Council • National Native Title Tribunal • Three Rivers Regional Assembly (TRRA) • NTSCORP (Native Title Service Provider for Aboriginal Traditional Owners in New South Wales and the Australian Capital Territory) • Office of Registrar of NSW Land Claims.
Wider community	• Local land users e.g. irrigators, farmers near the project study area that are not considered directly impacted or adjacent landowners • Local communities within the Mid-Western Regional, Dubbo Regional, Warrumbungle and Upper Hunter LGAs • Road users • Community groups with an interest in the Central-West Orana REZ • Local employment and training organisations • NSW Farmers Association • Local emergency services.
Suppliers	• NSW and Australian suppliers for the construction and operation of Central-West Orana REZ projects.

Stakeholder group	Stakeholders
Network service providers	• Transgrid • Essential Energy.
Other utility providers	• Service/utility providers (e.g. electrical, telecommunications, sewer, water) that may be impacted by the project.
Media	• The Land Magazine • Mudgee Guardian • Dubbo Daily Liberal • Gulgong Gossip • Merriwa District Diary • Wellington District Leader • Coolah District Diary • Dunedoo District Diary • National media • Industry publications.
General public	• Members of the public who may take an interest in the project.

5.4 Engagement to date

5.4.1 Overview

In 2020, the NSW Government engaged Transgrid, as NSW's jurisdictional transmission planner (at the time), to carry out early development work to guide the planning of new transmission infrastructure for the Central-West Orana REZ. In December 2020, Transgrid released a preliminary study area for the project that ran northwest from the existing network near Merriwa, passing south of Dunedoo before connecting to the existing network east of Wellington. The preliminary study area also included an option to extend further south near Lake Burrendong and included an upgrade of the existing substation at Wollar.

Between December 2020 and September 2021, Transgrid carried out community and stakeholder engagement on the preliminary study area for the transmission route, which included letters sent out to landowners, community information sessions, community events, social media posts and print advertisements, meetings with landowners, community members, Aboriginal stakeholders, local councils and other stakeholders, and establishment of a dedicated phone number, email address and website to provide project information.

In November 2021, the Central-West Orana REZ was formally declared by the Minister for Energy and Environment and EnergyCo was appointed as the Infrastructure Planner to lead the delivery of REZs in NSW. At this time, EnergyCo assumed responsibility for engaging local communities and stakeholders to inform the development of new transmission network infrastructure within the REZ.

In February 2022, EnergyCo announced a revised study corridor for the REZ Transmission project which would reduce impacts on sensitive land uses in the region and deliver greater capacity to meet future energy needs. Community feedback received by Transgrid was considered in developing the revised project study area. In particular, the eastern section of the preliminary study area was redesigned to locate the corridor on existing disturbed land such as mining areas, existing transmission lines and wind and solar development, to avoid high-quality agricultural land.

EnergyCo invited the community and stakeholders to provide feedback on the revised study area for the project in February and March 2022. A community feedback report was released in June 2022 which outlined the consultation outcomes and next steps.

Since early 2022, EnergyCo has continued to have ongoing direct engagement with landowners within the vicinity of the proposed route for the project to inform the design and environmental assessment process.

5.4.2 Summary of engagement activities

EnergyCo's communication and engagement activities to date are summarised in Table 5-2.

Table 5-2 Engagement activities

Activity	Description
Ongoing activities	
Dedicated phone number and email address	A dedicated email address and phone number are provided to receive and respond to enquiries from the community and interested stakeholders: Phone: 1800 032 101 (9 am to 5 pm, Monday to Friday) Email: cwo@energyco.nsw.gov.au
EnergyCo project website	The EnergyCo project website (energyco.nsw.gov.au) provides information on the project background and need (including details about the Central-West Orana REZ), how the community can get involved, community consultation that has been carried out and links to project documents. The project is updated regularly as new information becomes available.
Landowner engagement	Ongoing direct engagement has been carried out with landowners to inform the development of the project, including relevant mining companies.
Stakeholder meetings and briefings	Regular briefings have been carried out with key stakeholders including local councils, elected representatives, agencies and stakeholder groups to discuss matters relating to the project and broader REZ issues, including cumulative impact strategies and community benefit initiatives. EnergyCo holds regular briefings with a number of important key stakeholders including generation projects, local mine operators, local councils, government agencies and elected representatives.
Stakeholder management database	Records of all stakeholder correspondence have been maintained in the project's stakeholder management database (Consultation Manager).
Field work notifications	Notifications of field investigation work have been provided to landowners in the vicinity of where field work will be carried out between mid-2022 and mid-2023, including survey, geotechnical and environmental investigations to inform the EIS and design for the project. These are also published on the project website.
Cumulative impact studies	EnergyCo is coordinating whole of REZ studies including workforce accommodation, roads and transport, telecommunications, training and skills, waste and circular economy and social infrastructure. These studies will identify measures to manage REZ-wide cumulative impacts, with further details to be provided in the EIS. EnergyCo has been carrying out interviews with stakeholders as part of these studies.
February / March 2022 consultation	
Project overview	A project overview document was published on 25 February 2022 to inform people about the project and explain the next steps. The document was made available online and in hard copy format at engagement events. It contains information about the background and need for the project, Central-West Orana REZ, EnergyCo, route identification process, planning and approval process, property acquisition, planned community and stakeholder consultation, contact details and figures and maps of the REZ, preliminary project study area and proposed transmission infrastructure.
Media release	Media release was distributed to local and regional media outlets on 25 February 2022 announcing the revised preliminary project study area.
Letter to landowners	Letters were sent out to about 350 landowners within the revised study corridor to inform them about the project and invite feedback.

Activity	Description
Advertisements	Print advertisements were published in late February and early March in the Daily Liberal, Mudgee Guardian and Gulgong Advertiser to promote the project and provide opportunities for engagement.
Information sessions	Six drop-in information sessions were held for community members to meet the project team and ask questions. These were attended by about 130 individuals. The sessions were held in local venues at Wellington, Gulgong and Dunedoo.
Stakeholder briefings	Briefings were conducted with local councils and key industry stakeholders, including elected representatives, organisations and interest groups. The briefings included presentations and discussions on the need for the project, any upcoming planning issues that all parties should be aware of, how stakeholders would like to be engaged, and any other relevant topics.
June 2022 Registered Aboriginal Party advertising	
Advertising	Print advertisements requesting registration of First Nations stakeholders interested in the project published in the following newspapers during mid-June: • Koori Mail • Mudgee Guardian and Gulgong Advertiser • Dubbo Daily Liberal • Dunedoo District Diary • Merriwa District Diary • Western Magazine • Coolah District Diary • Wellington District Leader.
Direct letters	Letters were sent directly to First Nations stakeholders inviting them to become a Registered Aboriginal Party (RAP) for the project.
June 2022 project update	
Project update	A project update newsletter was published on EnergyCo's website on 27 June 2022. It was distributed via letterbox distribution to properties in the study area in early July via Australia Post. The project update was used to inform people about the current status of the project and next steps, including an invitation for community members to submit applications for the Central-West Orana REZ Community Reference Group.
E-newsletter	An e-newsletter was sent to about 200 registered community members and key stakeholders.
Website update	Updated project information was uploaded to EnergyCo's website.
Community feedback report	A community feedback report was published on EnergyCo's website which summarises the consultation carried out in February and March 2022 on the revised study corridor.
Advertisements	Print advertisements were published in early July to promote the project update and invite applications to join the Community Reference Group: • Mudgee Guardian and Gulgong Advertiser • Dubbo Daily Liberal • The Land • Dunedoo District Diary • Merriwa District Diary • Western Magazine • Coolah District Diary • Wellington District Leader.

5.4.3 Agency consultation

Consultation was carried out with the following NSW Government agencies:

- meetings were held with DPE during July and August 2022 to introduce the project
- a meeting was held with the Biodiversity Conservation and Science (BCS) Directorate within DPE to discuss the approach to biodiversity field surveys and assessment
- NSW Crown Lands was consulted about easement and property acquisition matters on Crown Land
- Forestry Corporation NSW (FCNSW) was engaged about property access to lands managed by FCNSW
- a meeting was held with Subsidence Advisory NSW in May 2022 to identify subsidence related design requirements for the project as it is located in a mine subsidence district
- meetings were held with NSW Government agencies in July and August 2022 to inform EnergyCo's cumulative impact studies for the REZ. This included DPE, Department of Regional NSW, Department of Education, Investment NSW, Transport for NSW and Department of Communities and Justice
- consultation was also carried out with a number of Australian Government agencies, including engagements on biodiversity and environmental approvals (DCCEEW), and matters of employment (Department of Education, Skills and Employment)
- energy regulators, such as AEMO and AER, and other key stakeholders were engaged by EnergyCo in a regulatory consultation process, focusing on project investment.

5.4.4 Working groups

EnergyCo is in the process of establishing a number of working groups that will inform the development of the Central-West Orana REZ, as detailed below.

Community Reference Group

EnergyCo established a Community Reference Group in August 2022 to provide an open forum for discussion between EnergyCo, community representatives and key stakeholders in relation to the project and Central-West Orana REZ. The Community Reference Group will discuss matters relating to the planning and delivery of the project, as well as broader REZ issues.

The objectives of the Community Reference Group are to:

- establish good working relationships and promote information-sharing between EnergyCo, local community representatives and key stakeholders
- provide Community Reference Group members with visibility of the project and enable them to share project information via their networks
- keep members informed about project activities, key milestones and opportunities to provide feedback
- provide an avenue for EnergyCo to seek community and stakeholder input on project matters
- allow community members to seek information from EnergyCo and provide feedback.

The Community Reference Group consist of:

- an Independent Chairperson who acts as the convenor, facilitator, mediator and advisor for the Community Reference Group. The Independent Chairperson acts independently and impartially and is the key point of contact between the Community Reference Group and EnergyCo
- four community representatives who are current residents and/or landowners in the REZ
- five representatives from local community or stakeholder groups.

In addition, representatives from local councils and LALCs are invited to participate in the Community Reference Group, including Dubbo Regional Council, Warrumbungle Shire Council, Mid-Western Regional Council, Upper Hunter Shire Council, Dubbo LALC, Mudgee LALC, Gilgandra LALC, Wellington LALC, Walhallow LALC and Wanaruah LALC. It is at these organisations' discretion if they nominate to attend the Community Reference Group meetings.

Developers of generation projects will be invited to participate in the Community Reference Group on a regular basis to discuss matters such as the management of cumulative impacts within the REZ. Other non-Community Reference Group members, such as individuals or stakeholder organisations with specific remits and expertise, will be invited to join Community Reference Group meetings as appropriate.

Once appointed, the future Network Operator of the project will participate in the Community Reference Group.

The first meeting of the Community Reference Group was held on 1 September 2022 in Dubbo, and future meetings will be held at least once per quarter, with the meeting dates and times to be agreed upon by the Community Reference Group members.

First Nations Working Group

EnergyCo will establish a First Nations Working Group to support and coordinate local Aboriginal community engagement and negotiations during the planning and development phase.
The First Nations Working Group would consist of First Nations stakeholders such as First Nations groups, organisations and landowners.

Industry Working Group

The Industry Working Group (the former Regional Reference Group) for the CWO REZ will be re-established to focus on matters related to:

- the design and development of the project and the Central-West Orana REZ, including ways to secure enduring benefits and regional development opportunities
- issues and concerns held by regional stakeholders and how these may be managed, including cumulative impacts
- regional strategies including workforce accommodation, employment and training, operational impacts from construction and the use of regional assets.

The Industry Working Group will include:

- local MPs
- government agencies
- local councils
- major renewable energy generators
- NSW Electricity Jobs Advocate.

Generator Project Interface Group

The Generator Project Interface Group has been established to manage the interface and cumulative impacts of the major renewable energy generators and the project. Participants will consist of EnergyCo and major generators, including:

- Acciona Energy
- CWP Renewables
- Lightsource BP
- Marble Energy
- Origin Energy
- RES Group
- Tilt Renewables
- ACEN Australia.

5.5 Feedback received to date

Feedback received from communities and stakeholders to date has been used to inform various aspects of the project.

5.5.1 Community views

In June 2022, EnergyCo published a consultation report (EnergyCo, 2022) outlining community feedback received and EnergyCo's responses to the revised study corridor consultation carried out in February and March 2022.

In total, 35 submissions were received from landowners and community members and organisations during the engagement period. This feedback was received in writing via email and through feedback forms which were made available at the drop-in information sessions.

In addition to receiving feedback through formal submissions from landowners, EnergyCo also collected additional informal feedback about landowner sentiment and community views through direct discussion with landowners and other community members at the drop-in information sessions held in early March 2022.

Of the 35 submissions received during the consultation period, 22 were from local landowners within the project study area. Three of these landowners said they were interested in hosting transmission infrastructure, while 16 indicated they were opposed to hosting transmission infrastructure on their land. Three did not indicate a preference in their submission.

The feedback received covered a wide range of issues relating to the project, renewable energy developments and the wider Central-West Orana REZ. Key topics raised included:

- feedback on the proposed locations for transmission infrastructure
- cumulative impacts to communities within the Central-West Orana REZ
- impacts to the environment and local amenity
- property impacts including acquisition and land values
- feedback and suggestions about community engagement activities.

Since this time, EnergyCo has continued to have ongoing direct engagement with landowners who may be potentially affected by the project. This includes meeting with landowners to gauge their sentiment about hosting transmission infrastructure. Landowner sentiment has formed a critical part of the route selection process to date and will continue as EnergyCo further refines the transmission route. Sentiment mapping to date indicates a high level of support for the proposed corridor.

The community and stakeholders have provided a variety of feedback across numerous themes. Table 5-3 provides a high-level overview of the feedback received by theme and the frequency that feedback within the theme was received.

Table 5-3 Community feedback themes

Topic	Key items raised and number of submissions received
Design	
Locations for transmission infrastructure	• Opposition to hosting transmission infrastructure (11) • Opposition to the use of prime agricultural land (4) • Supportive of the corridor moving away from the Merriwa Cassilis plateau (4) • Supportive of hosting transmission infrastructure (3) • Supportive of the revised study corridor using public land, mining land and existing power line easements (3).
Socio-economic	
Cumulative impacts	• Cumulative impacts from renewable energy projects (6) • Cumulative impacts due to existing coal mines (2).
Impacts to agriculture	• General concern about impacts to agriculture (4) • Impacts to aerial agricultural activities near transmission lines (3).
Community benefits	• Suggestions on how funding for community benefits should be delivered (2).
Societal impacts	• Concerns about community division and mental health impacts (3).
General	
Project governance	• EnergyCo's role in coordinating the REZ (3).
Renewable energy generation projects	• Lack of consultation on generation projects (1) • How will generators connect into the REZ infrastructure (1).
Environment	
General environment	• General concern about environmental impacts from the project (5).
Biodiversity offsets	• Biodiversity offset areas should be avoided (3).
Visual amenity	• General visual amenity impacts as a result of the project (3).
Flora and fauna	• Concern about wildlife impacts (3) • Threatened species habitat should be avoided (2).
Health impacts	• Concern about electric and magnetic fields (1).
Heritage	• Cultural heritage sites should be avoided (1).
Property	
Acquisition	• Concern that compensation will be insufficient or inequitable in comparison to hosting renewable generation infrastructure (4).
Property values	• Concern about impacts to property values in the area (2).
Community engagement	
Feedback and suggestions	• An information session should have been held in Coolah (2) • Concern that landowners were not adequately informed about the revised study corridor consultation (2) • Concern about lack of consultation in declaring the REZ (2) • Negative feedback about website and communication collateral (2).
Construction	
Road maintenance & upgrades	• Questions about who will be responsible for road maintenance.
Worker accommodation	• Worker accommodation and services (1).
Construction fatigue	• Temporary impacts during construction (1).

5.5.2 Councils

EnergyCo regularly meets with councils to discuss the development of the Central-West Orana REZ, including Mid-Western Regional Council, Dubbo Regional Council, Warrumbungle Shire Council and Upper Hunter Shire Council. A range of issues are discussed during these meetings, with particular focus on cumulative impacts within the REZ. Key topics discussed with councils include:

- workforce accommodation and services required to support the Central-West Orana REZ transmission and generation projects
- impacts to council assets including local roads, waste management and utilities
- opportunities to provide legacy initiatives for local communities.

EnergyCo is consulting councils on a series of studies to inform how cumulative impacts in the Central-West Orana REZ will be managed. The studies cover a range of issues which EnergyCo has identified as priorities to the community:

- workforce accommodation
- road upgrades and traffic management
- training and skills
- waste management
- mobile connectivity
- social infrastructure.

Feedback received from councils as part of the studies will be used to identify mitigation strategies for managing cumulative impacts in the Central-West Orana REZ.

EnergyCo will continue to work closely with councils on cumulative impact strategies and other issues as the project progresses, including during the preparation and exhibition of the EIS.

5.5.3 Agency feedback

In July 2022, EnergyCo discussed the conceptual scope of the project with DPE, including the approach to the 330 kV REZ network infrastructure, project program, as well as key issues raised by the DPE.

DPE confirmed the need for effective community and stakeholder engagement and detailed field surveys for biodiversity and heritage to support impact assessments by relevant regulators.

In May 2022, a meeting was held with Subsidence Advisory NSW to identify subsidence related design requirements for projects located in a mine subsidence district. Subsidence Advisory NSW outlined the approval process, that would include a review of the design in consultation with the mine lease holder, and timeframes relevant to the project.

5.5.4 Traditional owners and other Aboriginal groups

EnergyCo is committed to meaningful and genuine consultation and engagement with First Nations communities during the development and delivery of the project in accordance with the NSW Electricity Infrastructure Roadmap (DPE, 2020).

In August 2022, the Minister for Energy issued guidelines on consultation with First Nations communities for energy infrastructure delivered under the NSW Electricity Infrastructure Roadmap, including the Central-West Orana REZ (Energy NSW, 2022).

These guidelines, required under section 4(1) of the *Electricity Infrastructure Investment Act 2020* (the enabling legislation of the NSW Electricity Infrastructure Roadmap), build on, but not replace, existing consultation requirements under other legislation, in particular the NP&W Act and the Australian Government *Native Title Act 1993*.

EnergyCo and the DPE worked with First Nations advisors to engage with local First Nations communities on the development of the guidelines.

A First Nations Working Group comprised of Aboriginal community representatives, LALCs, Aboriginal working parties, government support services and local First Nations organisations will be established. The working group will aim to support and coordinate local First Nations community engagement during the planning and development phase of the REZ Transmission project (refer to Section 5.4.4).

In June 2022, EnergyCo sent notification letters to First Nations stakeholders, including LALCs, National Native Title Tribunal, NTS Corp, Office of the Registrar of NSW Land Claims, Local Land Services and local councils, to provide information about the project and invite Aboriginal knowledge holders to become a RAP for the project. Print advertisements requesting registration of First Nations stakeholders interested in the project were also published in a number of local newspapers during mid-June 2022 (refer to Table 5-2).

RAP representatives have participated in field surveys with EnergyCo's heritage consultants to provide feedback on Aboriginal heritage values in the project study area to inform the design of the project and location of infrastructure.

5.6 How feedback has been used

The feedback and suggestions received from the community and stakeholders have been considered in combination with engineering, environmental, land use and social studies, to further refine the project study area and inform the development of this Scoping Report. Community and landowner feedback has formed a key role in the initial development and refinement of the transmission corridor.

5.7 Future engagement

5.7.1 Engagement approach

Engagement will continue on specific issues and opportunities relevant to the project to inform the preparation of the EIS, in accordance with *Undertaking Engagement Guidelines for State Significant Projects* (DPIE, 2021f). EnergyCo is committed to continue to engage landowners, the community and stakeholders throughout all project stages and to build and maintain strong relationships within the communities where the proposed transmission infrastructure will be located.

The next stage of community and stakeholder engagement will build on relationships established through early engagement activities and will complement and support formal consultation required under planning regulations, including activities that may be stipulated in the SEARs and in the preparation of the EIS as well as for cumulative impacts, social benefits, and other milestones related to the development of the Central-West Orana REZ.

The general project information and feedback mechanisms summarised in Table 5-2 will continue to be available during further design development and preparation of the EIS. These mechanisms will be complemented with further direct community and stakeholder engagement activities focused on:

- providing information and project updates at key stages during design development and preparation of the EIS
- engagement with affected landowners and community groups about the project and key design decisions that may impact them
- engagement and coordination with generation projects in the Central-West Orana REZ, particularly around project interfaces and in relation to cumulative impacts
- engagement with regulatory agencies during preparation of the EIS to ensure a complete and robust EIS.

The Network Operator will lead community and stakeholder engagement during future stages of project development, following their appointment in mid-2023 (refer to Section 1.5).

5.7.2 Preparation of the EIS

Key stakeholders

EnergyCo will continue to work closely with councils to manage any impacts to council assets, as well as engaging with them to develop community benefit sharing opportunities and strategies to mitigate cumulative impacts to local communities and businesses.

EnergyCo is establishing a number of working groups for the project to promote engagement with local communities, First Nations stakeholders, government, industry, major renewable energy generators and other key stakeholders during the development of the project (refer to Section 5.4.4).

Engagement activities

The following community and stakeholder engagement mechanisms and activities will occur/ continue to occur during the preparation of the EIS, either in person or via digital platforms:

- one-on-one meetings
- stakeholder briefings
- direct engagement with landowners to access private property for field work including geotechnical investigations, ecology, cultural heritage surveys, hydrological surveys
- community information sessions
- stakeholder and community group presentations and briefings
- EnergyCo toll-free community information number, email address and project webpage
- interactive project map outlining key features and up to date information about the project
- communications materials (project overview document, newsletters, letters and factsheets)
- e-newsletter
- media releases and advertisements
- social media
- field work notifications
- cumulative impact studies.

All stakeholder engagement will continue to be collected and recorded in a structured and formal manner. Engagement approaches will be evaluated and reviewed on a quarterly basis or as needed to ensure they are providing adequate participation opportunities and responding to stakeholder needs and expectations. Regular community and stakeholder check-ins will also be conducted to track engagement performance, sentiment and issues of concern and opportunity.

The EIS will include details of issues raised during engagement with the community and other stakeholders. It will also clearly identify where these issues have been responded to through the design development process and the EIS.

5.7.3 Exhibition of the EIS

Public exhibition of the EIS will be for a minimum of 28 days as stated in section 5.17 of the EP&A Act. Advertisements will be placed in local media giving information regarding the project and display of the EIS. During the exhibition period, government agencies, stakeholders and the community will be able to review the EIS and will have the opportunity to make a written submission to the DPE for consideration in its assessment of the project.

Consultation activities during the public exhibition of the EIS will be consistent with those undertaken for the Scoping Report and will include:

- community information sessions
- local newspaper advertising
- project website updates and online tools and resources
- letterbox distribution
- stakeholder meetings
- government stakeholder engagement.

Interactive map

An interactive map will be made available on the EnergyCo project website. This will provide an online tool to show the project study area and other geographical information about the project and explore the key outcomes of the EIS through interactive mapping. The interactive map will also allow its viewers to:

- relate the project to the broader geographic context
- analyse multiple datasets for the project simultaneously
- view up-to-date information about the project
- use specialised tools for retrieving information.

Project notifications and updates

As part of the exhibition of the EIS, EnergyCo will publish and distribute information to communicate the EIS. This will include:

- project update newsletter
- EIS guide and fact sheets
- website update and online tools and resources
- advertising in local media outlets
- e-newsletter
- media release
- display information at drop-in community information sessions.

5.7.4 Construction of the project

Should the project be approved, EnergyCo would continue to consult with stakeholders and the community during construction in accordance with the conditions of approval. Further information about the consultation activities and tools during the construction phase will be provided in the EIS.

EnergyCo is also in the process of undertaking a competitive tender process for the appointment of a Network Operator, who would be responsible for the design, construction, financing, operation and maintenance of the Central-West Orana REZ network infrastructure (refer to Section 1.5). The preferred Network Operator will be responsible for compliance of the project with planning approval requirements under the EP&A Act and engagement with communities and stakeholders about project-related matters during construction and operation.

6 Proposed environmental assessment

This section considers the environmental, social and economic issues requiring further assessment in the EIS for the project and the level of assessment that should be undertaken for each issue. A summary of the identified issues and level of assessment in the EIS is also provided in the Scoping Summary Table in Appendix A.

6.1 Overview

A preliminary environmental assessment has been undertaken to identify the potential environmental, social and economic issues that may arise as a result of the construction and operation of the project. This assessment considers the project study area, as shown in Figure 3-1 and defined in Section 1.7. Additional locations that may be required for specific uses (such as access tracks, construction compounds and accommodation camps) outside the project study area will be identified in the EIS.

To inform this assessment, a preliminary environmental risk analysis was completed (refer to Appendix B) to identify and categorise the potential issues that require further consideration and assessment in the EIS. The risk assessment has considered the sensitivity of the project study area and surrounds, the scale and nature of the likely impacts of the project and the ability to avoid, minimise and/or offset these impacts. The significance of each issue has been based on the potential environmental impact and likely level of community and stakeholder interest.

Environmental, social and economic issues have been categorised as 'key' or 'other' issues, based on the consequence of each potential impact (minor, moderate and major) and likelihood of the impact (unlikely, likely, certain). In determining the consequence, the scale of the impact (severity, geographical extent, and duration) and sensitivity of the receiving environment is considered (including values held by stakeholders and vulnerability to change). A 'key issue' is an issue that has the potential for major or moderate impacts to occur and requires further detailed investigation to better understand the impact and potential mitigation measures. An 'other' issue would result in minor impacts as a result of construction and/or operation of the project and can be managed effectively with the implementation of standard and/or best practice management and mitigation measures. Further detail on the risk assessment methodology that was used to identify key and other issues for the project is provided in Appendix B.

The *State significant infrastructure guidelines – preparing a scoping report* (DPIE, 2021c) (Scoping Report guidelines) also requires the identification of issues that require a 'detailed' or 'standard' assessment. A 'detailed' assessment will be completed for an issue where a significant impact may occur (including cumulative impact), where the approach to impact prediction is complex, and/or where uncertainties may occur in the assessment or the effectiveness of mitigation. A 'standard' assessment will be completed for issues that are unlikely to result in significant impacts (including cumulative), and where the impacts are well understood, relatively easy to predict and/or capable of being mitigated.

In most instances, a key issue identified by the preliminary environmental risk analysis will require a 'detailed' assessment and an 'other' issue will require a 'standard' assessment. However, the complexity of the technical assessment will also inform whether or not an issue is categorised as requiring a 'detailed' or a 'standard' assessment in the EIS for the project. As such, there may be instances where an issue that is considered to be an 'other' issue requires a detailed assessment in the EIS.

Key issues for the project, identified by the preliminary risk analysis as having high or moderate impacts are as follows:

- land use and property
- agriculture
- landscape character and visual amenity
- biodiversity
- Aboriginal heritage
- non-Aboriginal heritage
- social
- economic
- noise and vibration
- hazard and risk
- traffic and transport
- cumulative impacts.

Other issues requiring assessment but are expected to generate minimal or low potential impacts are waste management and resource use, hydrology, flooding and water quality, groundwater, soils and contamination, air quality and climate change and greenhouse gas.

For each environmental issue, an overview of the existing environment has been provided along with a description of the potential impacts of the project. The preliminary environmental risk analysis has been based on a preliminary design for the project and limited information about the environment obtained from desktop studies, and will be updated in the EIS when more detailed information is available. The required level (detailed or standard) and the proposed scope of further assessments to be completed as part of the EIS has been identified, as well as the relevant government plans, policies and guidelines that will apply. A summary of the identified issues and level of assessment in the EIS is also provided in the Scoping Summary Table in Appendix A.

The process of key issue identification and analysis will continue as the EIS progresses to ensure that the detailed information gathered for the project is used to identify and review potential environmental issues. The outcomes of this review will be included in the EIS.

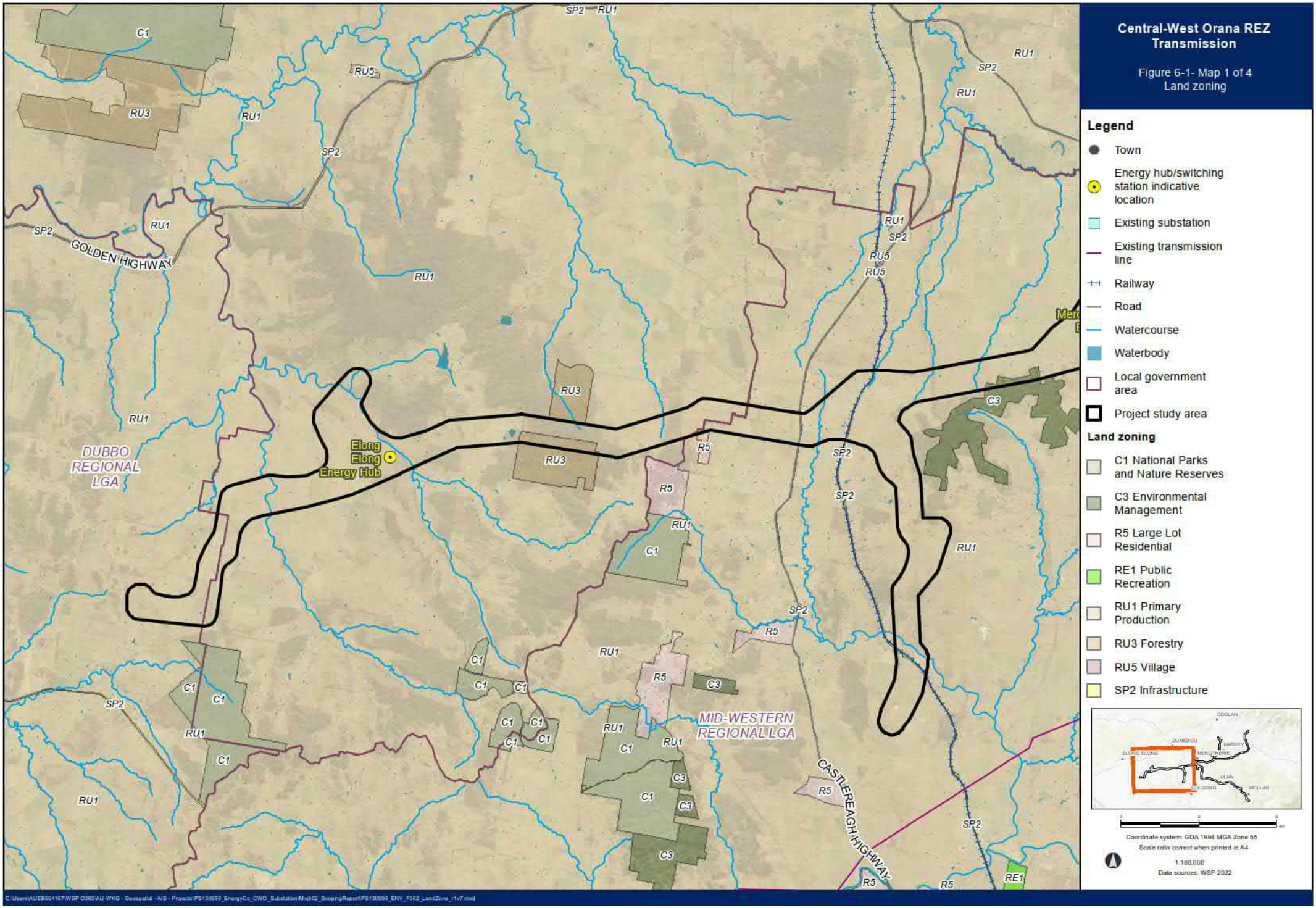
6.2 Land use and property

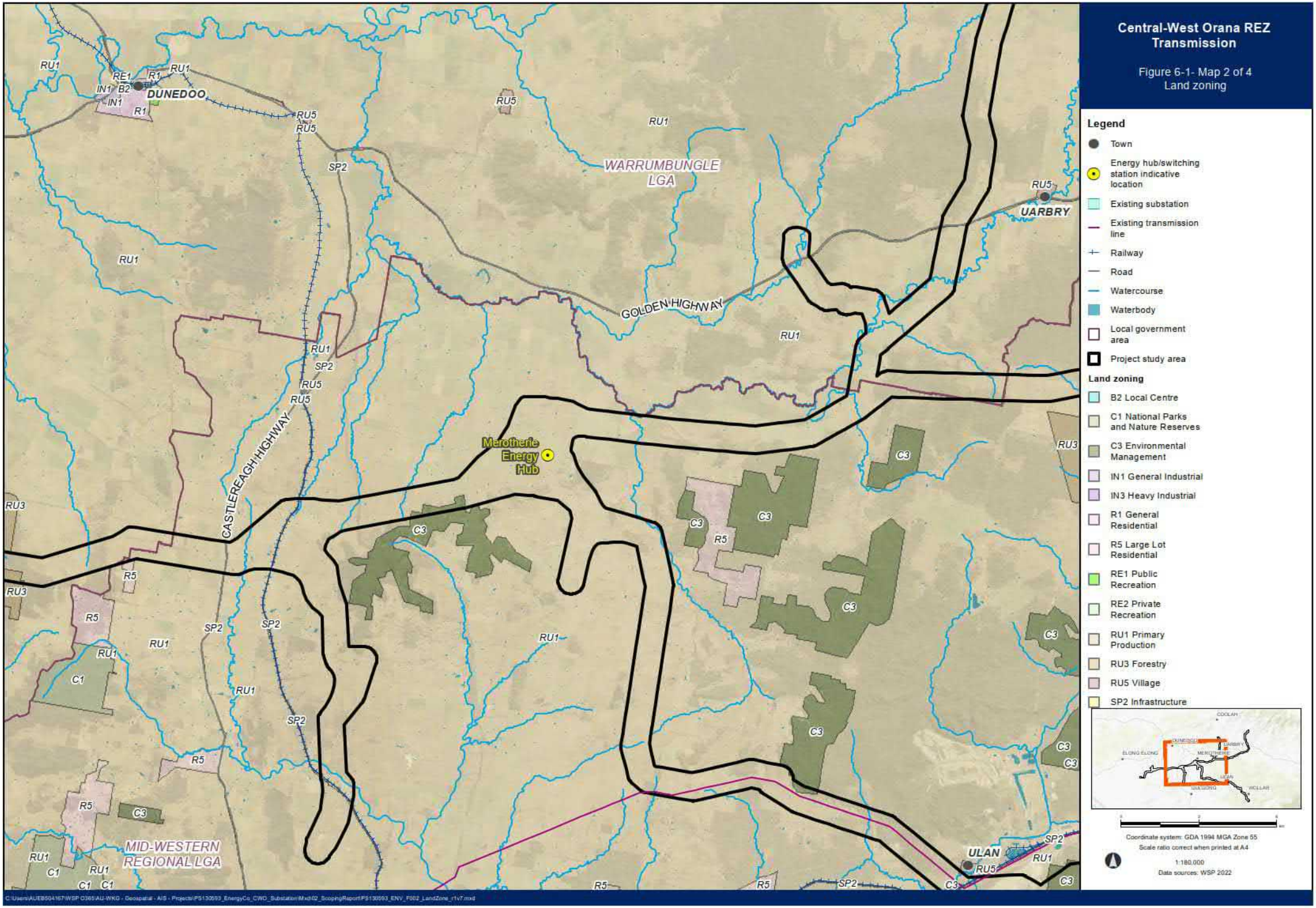
6.2.1 Existing environment

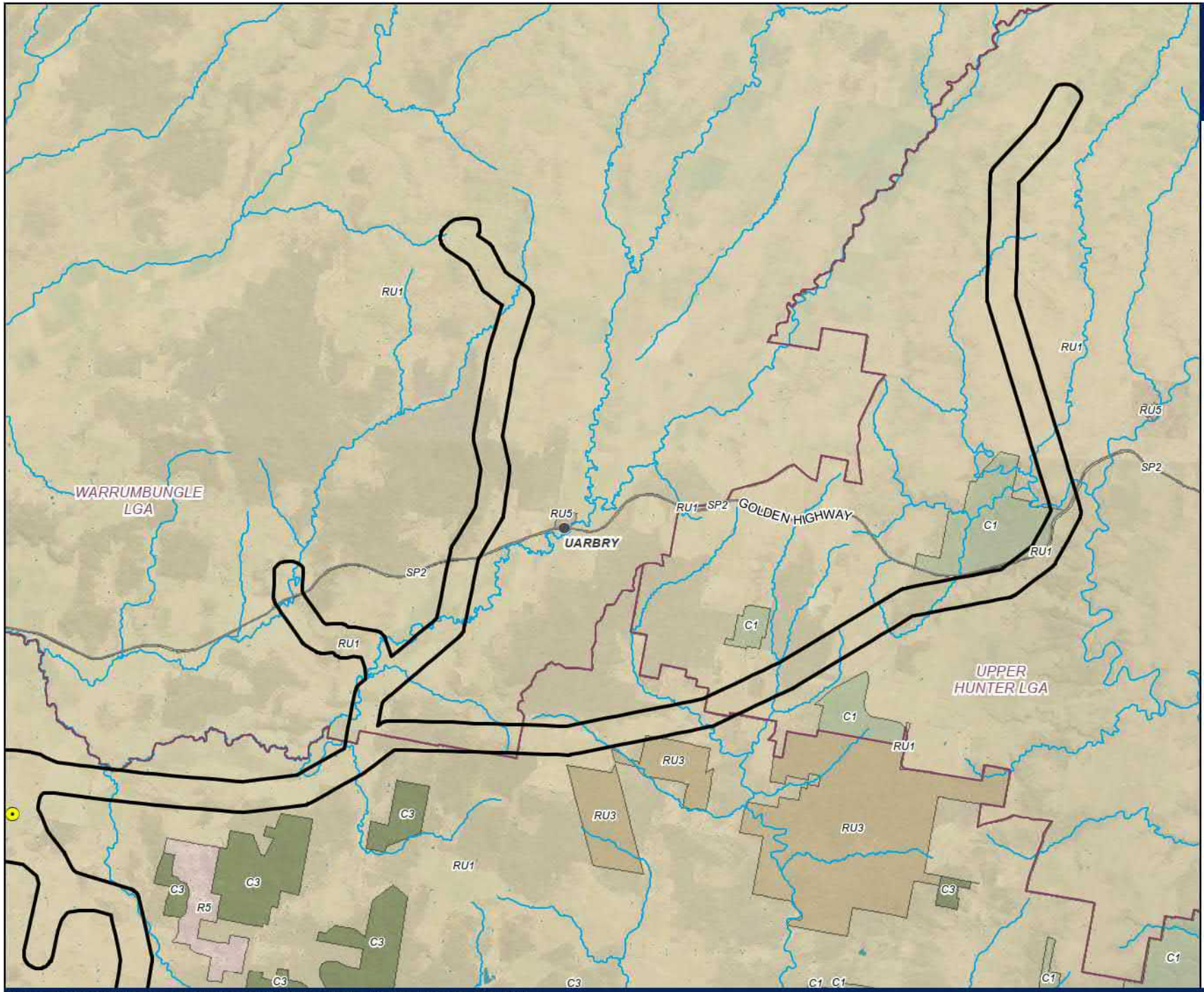
The project is located within the local government areas (LGAs) of Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter. The nearest regional population centres to the project study area are Gulgong, located about nine kilometres southeast of the southern arm of the central section of the project study area; and Dunedoo, located about 16 kilometres to the north of the central section of the project study area (refer to Figure 3-1). The next nearest towns and villages to the project study area are Ulan, located about 200 metres northeast of the southeastern section of the project study area; Wollar, located about 1.9 kilometres northeast of the southeastern section of the project study area and Uarbry, located about 2.2 kilometres southeast of the central arm of the northeastern section of the project study area (refer to Figure 3-1).

The majority of the project study area is zoned as RU1 Primary Production (refer to Figure 6-1). Other key zones in the project study area include:

- RU5 Village (a small area at Ulan)
- RU3 Forestry (areas at Dunedoo and Turill)
- R5 Large Lot Residential (a small area at Tallawang)
- C1 National Parks and Nature Reserves (along the southwestern border of Goulburn River National Park and southeastern border of a section of Durridgere State Conservation Area)
- C3 Environmental Management (areas at Ulan, Wollar, Barneys Reef, Cope, Cumbo and Merotherie)
- IN3 Heavy Industrial (small areas at Ulan).


Central-West Orana REZ Transmission
Figure 6-1- Map 1 of 4
Land zoning
Legend
Town
Energy hub/switching station indicative location
Existing substation
Existing transmission line
Railway
Road
Watercourse
Waterbody
Local government area
Project study area
Land zoning
C1 National Parks and Nature Reserves
C3 Environmental Management
R5 Large Lot Residential
RE1 Public Recreation
RU1 Primary Production
RU3 Forestry
RU5 Village
SP2 Infrastructure
Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:180,000
Data sources: WSP 2022
GOLDEN HIGHWAY
DUBBO REGIONAL LGA
Elong Elong Energy Hub
MID-WESTERN REGIONAL LGA
CASTLEREAGH HIGHWAY


Central-West Orana REZ Transmission
Figure 6-1- Map 2 of 4
Land zoning
Legend
Town
Energy hub/switching station indicative location
Existing substation
Existing transmission line
Railway
Road
Watercourse
Waterbody
Local government area
Project study area
Land zoning
B2 Local Centre
C1 National Parks and Nature Reserves
C3 Environmental Management
IN1 General Industrial
IN3 Heavy Industrial
R1 General Residential
R5 Large Lot Residential
RE1 Public Recreation
RE2 Private Recreation
RU1 Primary Production
RU3 Forestry
RU5 Village
SP2 Infrastructure
DUNEDOO
WARRUMBUNGLE LGA
GOLDEN HIGHWAY
UARBRY
CASTLEREAGH HIGHWAY
Merotherie Energy Hub
MID-WESTERN REGIONAL LGA
ULAN
COOLAH
ELONG ELONG
MERRYGENEE
WOLLAR
Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:180,000
Data sources: WSP 2022



Central-West Orana REZ Transmission

Figure 6-1- Map 3 of 4
Land zoning

Legend

- Town
- Energy hub/switching station indicative location
- Existing substation
- Existing transmission line
- Railway
- Road
- Watercourse
- Waterbody
- Local government area
- Project study area

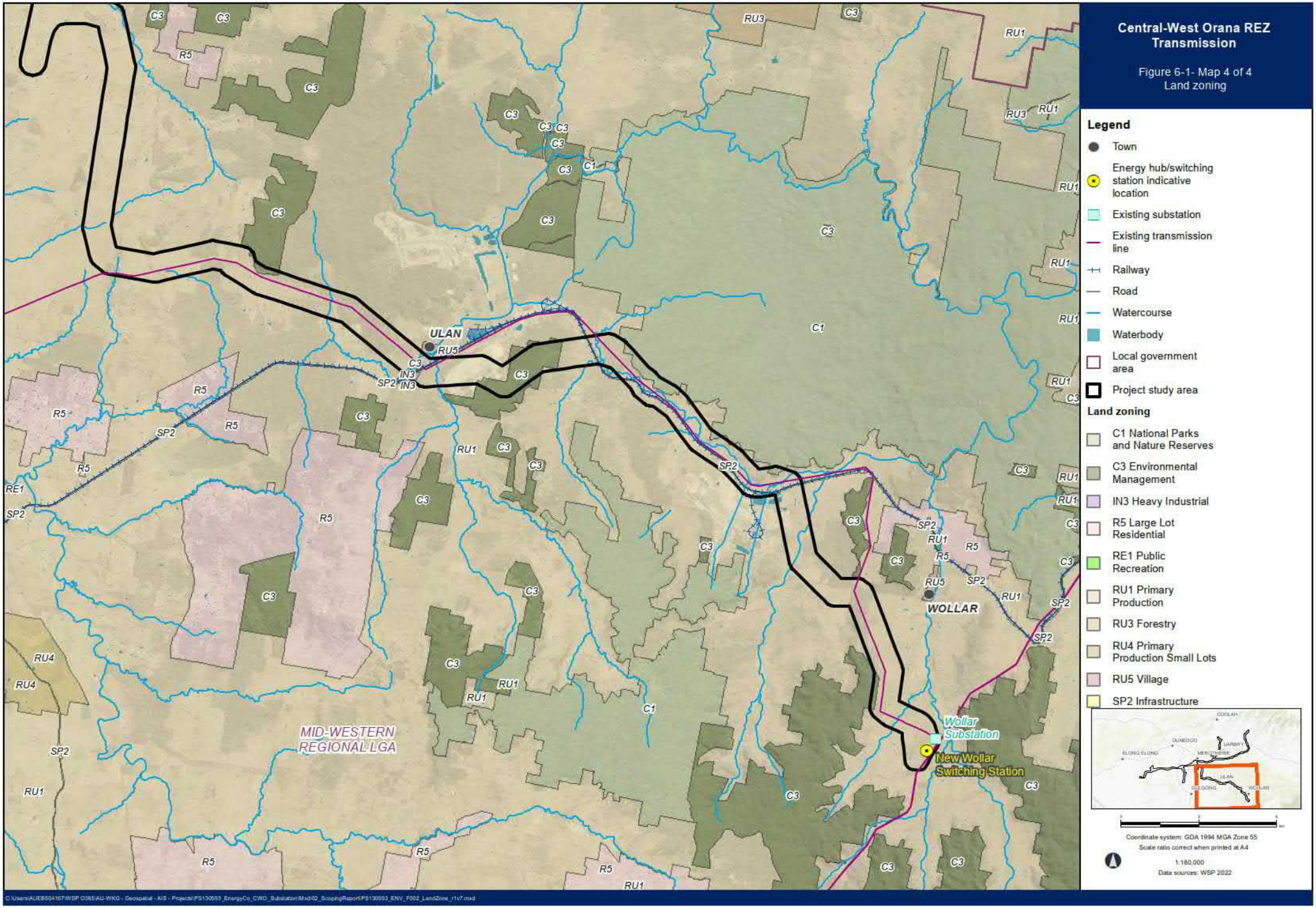
Land zoning

- C1 National Parks and Nature Reserves
- C3 Environmental Management
- R5 Large Lot Residential
- RU1 Primary Production
- RU3 Forestry
- RU5 Village
- SP2 Infrastructure

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4

1:180,000

Data sources: WSP 2022


Central-West Orana REZ Transmission
Figure 6-1- Map 4 of 4
Land zoning
Legend
Town
Energy hub/switching station indicative location
Existing substation
Existing transmission line
Railway
Road
Watercourse
Waterbody
Local government area
Project study area
Land zoning
C1 National Parks and Nature Reserves
C3 Environmental Management
IN3 Heavy Industrial
R5 Large Lot Residential
RE1 Public Recreation
RU1 Primary Production
RU3 Forestry
RU4 Primary Production Small Lots
RU5 Village
SP2 Infrastructure
ULAN
WOLLAR
MID-WESTERN REGIONAL LGA
Wollar Substation
New Wollar Switching Station
COOLAH
DUNEDOO
WARRIEWOOD
ELONG ELONG
MERRIWERRE
ULAN
GULGONG
WOLLAR
Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:180,000
Data sources: WSP 2022
C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\02_ScopingReport\PS130593_ENV_F002_LandZone_r1v7.mxd

The project is located within the Central-West Orana REZ, one of five REZs prioritised by the NSW Government to deliver affordable energy into the future (DPE, 2018a). The key land uses within and surrounding the study area are as follows (as shown in Figure 6-2 and Figure 6-3):

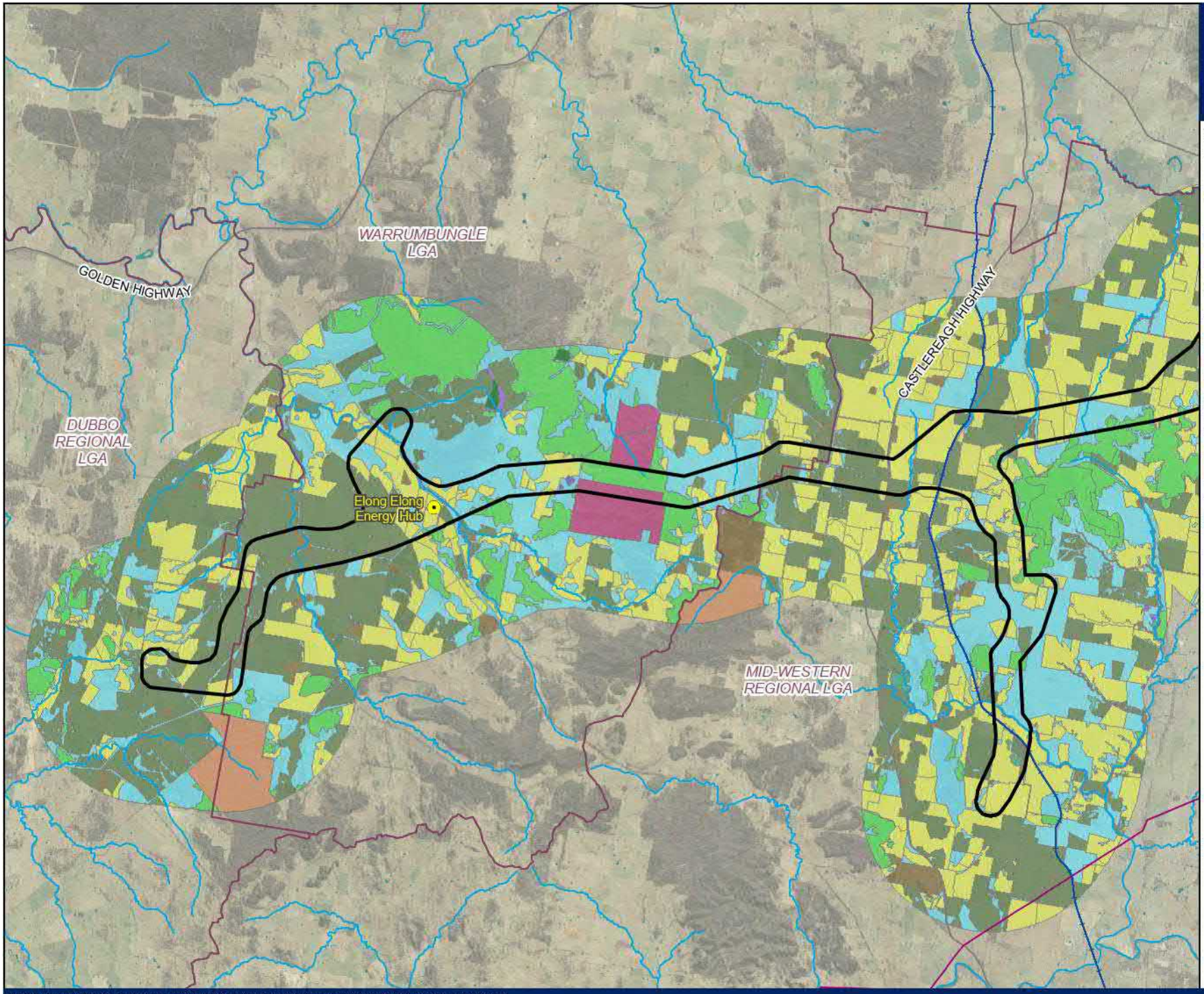
- Agriculture – The majority of the project study area comprises agricultural land, as described in Section 6.3.
- Transport infrastructure – The project study area crosses two state roads, the Castlereagh Highway, and Golden Highway, as well as regional roads, local roads and tracks, as shown in Figure 6-3. Two existing railway lines traverse the project study area, namely the Wallerawang Gwabegar Railway and Sandy Hollow Gulgong Railway. Tracks of the proposed Gulgong Mary Vale Railway also traverse the study area.
- Electrical infrastructure – The project study area includes the existing Transgrid Wollar 500 kV Substation and several existing medium and HV transmission lines between 66 kV and 500 kV, including the Bayswater to Mount Piper line (500 kV), Wollar to Mount Piper line (500 kV) and Wellington to Wollar line (330 kV) (refer to Figure 6-3).
- Energy generation and storage – One solar farm that is currently under construction, Wollar solar farm (south of Wollar), is located in the project study area (refer to Figure 6-3). There are also several wind farms and solar farms that are either proposed or approved within or near the project study area, including:
  - proposed wind farms: Spicers Creek (south of Medway), Valley of the Winds (between Leadville and Coolah) and Barneys Reef (east of Tallawang), at various stages of project development
  - proposed solar farms: Birriwa (east of Birriwa), Sandy Creek (west of Laheys Creek), Coborra (west of Laheys Creek), Bellambi Heights (northwest of Gulgong) and Tallawang (northwest of Gulgong), at various stages of development
  - approved solar and wind farm projects: Liverpool Range wind farm (between Coolah, Cassilis and Ulan) and Stubbo solar farm (east of Barneys Reef Road).
- Protected environments – Goulburn River National Park is located east of Ulan-Wollar Road (Ulan) within the southeastern section of the project study area and Durridgere State Conservation Area is located north of the Golden Highway and Ulan Road within the eastern arm of the northeastern section of the project study area. The project will be designed to not be located within the Goulburn River National Park or Durridgere State Conservation Area. Other National Park estates near the project study area include Dapper Nature Reserve, Munghorn Gap Nature Reserve, Yarrobil National Park, Goodiman State Conservation Area, Coolah Tops National Park and other areas of Durridgere State Conservation Area.
- Biodiversity offset areas – Three conservation areas that form part of the offsets strategy for the Peabody Wilpinjong Coal Mine and areas nominated for regeneration under that strategy are located within the southeastern section of the project study area. Other offset areas have been transferred to national park estate and are located outside the project study area. Two offset areas protected under the Moolarben Coal Complex offset strategy are located within the southeastern section of the project study area. A further twelve offset areas that form part of this offset strategy are located within 10 kilometres of the southeastern section of the project study area.
- Forestry – The project study area includes the Tuckland and Cope State Forests.
- Rivers, watercourses and dams – The Talbragar River is the key watercourse that traverse the project study area, as well as several creeks and minor streams.
- Mining and exploration – Current mining exploration and tenements within the project study area are shown in Figure 6-3. Exploration titles are located across the central, northeastern and southeastern sections of the project study area and mining titles are located within the southeastern section of the project study area, including the Moolarben (open cut and underground), Ulan (open cut and underground) and Wilpinjong (open cut) coal mines.

- Aviation – The project is located about 55 kilometres east of Dubbo Regional Airport and about 30 kilometres northeast of the Wellington Aerodrome, also known as Bodangora Airport. Gulgong Aero Park used by light aircraft, hang gliders and glider aircraft, is located about six kilometres southwest of the project study area. The location of airports as well as smaller landing grounds within and near the project study area are shown in Figure 6-3.

Land tenure in the project study area is predominantly freehold, with some areas of Crown land, including road reserves, rail corridors, travelling stock reserves, State Forests and NSW National Parks and Wildlife estate. There is one Commonwealth landholding within the southeastern section of the project study area.

There are two known native title claims under the *Native Title Act 1993* (NC2011/006 and NC2018/002) in the project study area, which have not been determined. The status of these claims will be confirmed as part of the EIS. One native title claim that has not been determined (NC2016/005) includes three small areas near the project study area near the Peabody Wilpinjong coal mine in Wilpinjong, Wollar and Munghorn. One of these areas is directly adjacent to the project study area.

There are no Indigenous Land Use Agreements that apply to the project study area.



Central-West Orana REZ Transmission

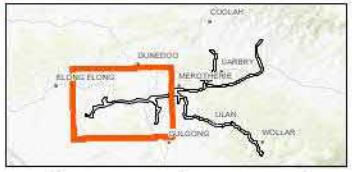
Figure 6-2 - Map 1 of 4
Key land uses

Legend

- Town
- Energy hub/switching station indicative location
- Existing substation
- Existing transmission line
- Railway
- Road
- Watercourse
- Waterbody
- Local government area
- Project study area

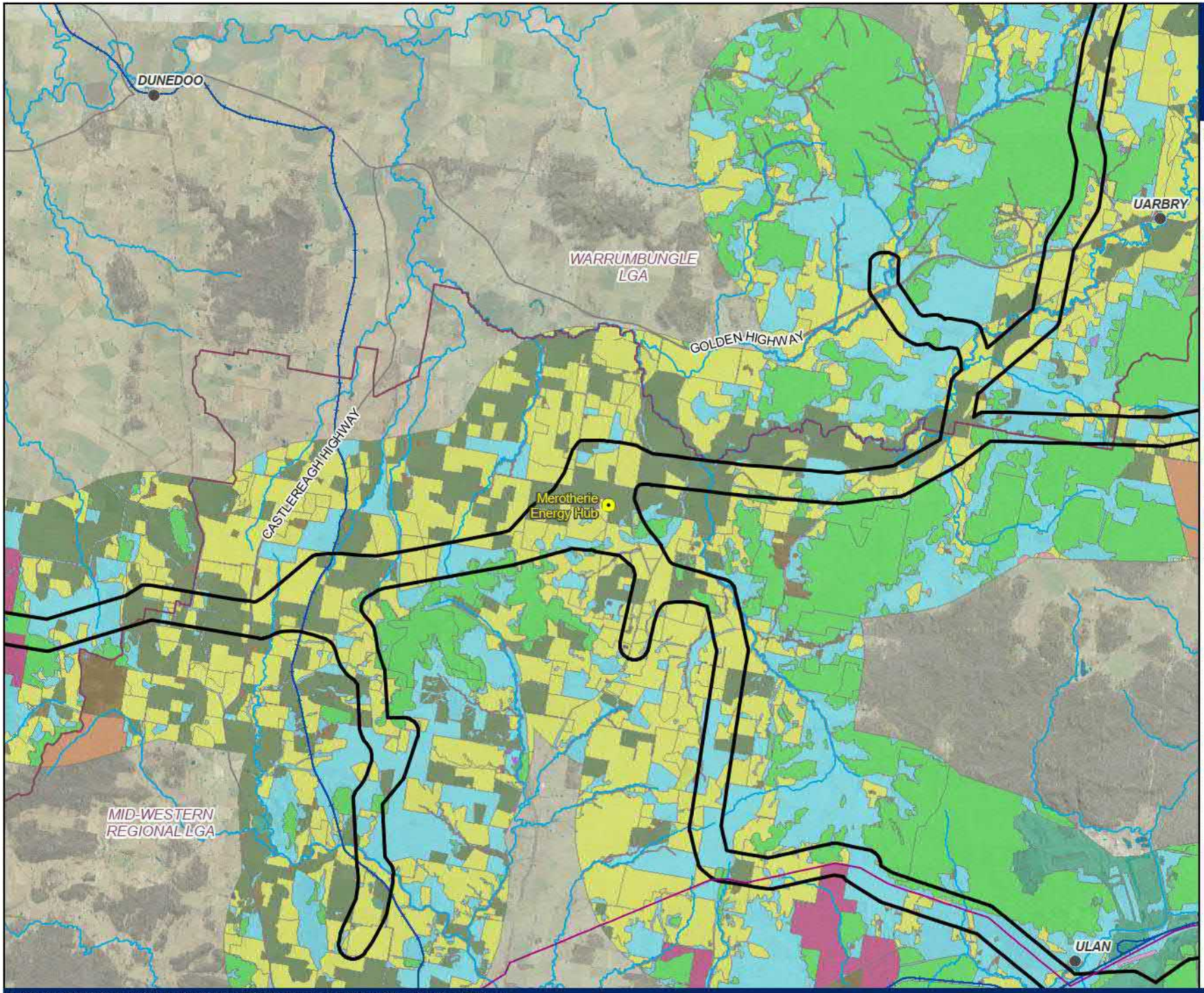
Land use

- 1.1.0 Nature conservation
- 1.2.0 Managed resource protection
- 1.3.0 Other minimal use
- 2.1.0 Grazing native vegetation
- 2.2.0 Production native forestry
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 3.4.0 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
- 6.2.0 Reservoir/dam
- 6.3.0 River
- 6.5.0 Marsh/wetland



Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:180,000
Data sources: WSP 2022

C:\Users\Data\V\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\02_ScopingReport\PS130593_ENV_F001_LandUse_r1v7.mxd



Central-West Orana REZ Transmission

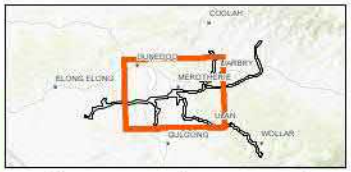
Figure 6-2 - Map 2 of 4
Key land uses

Legend

- Town
- Energy hub/switching station indicative location
- Existing substation
- Existing transmission line
- Railway
- Road
- Watercourse
- Waterbody
- Local government area
- Project study area

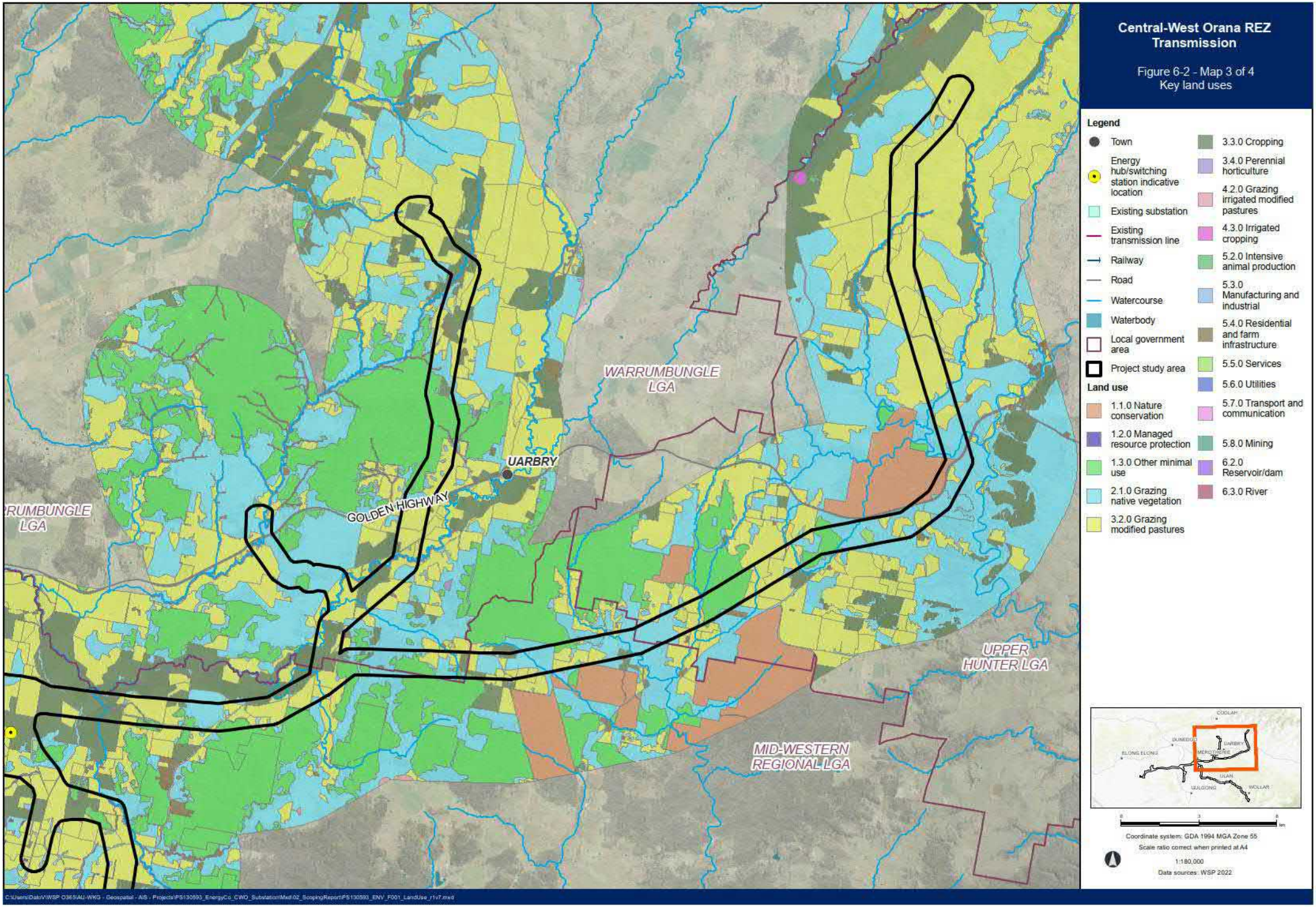
Land use

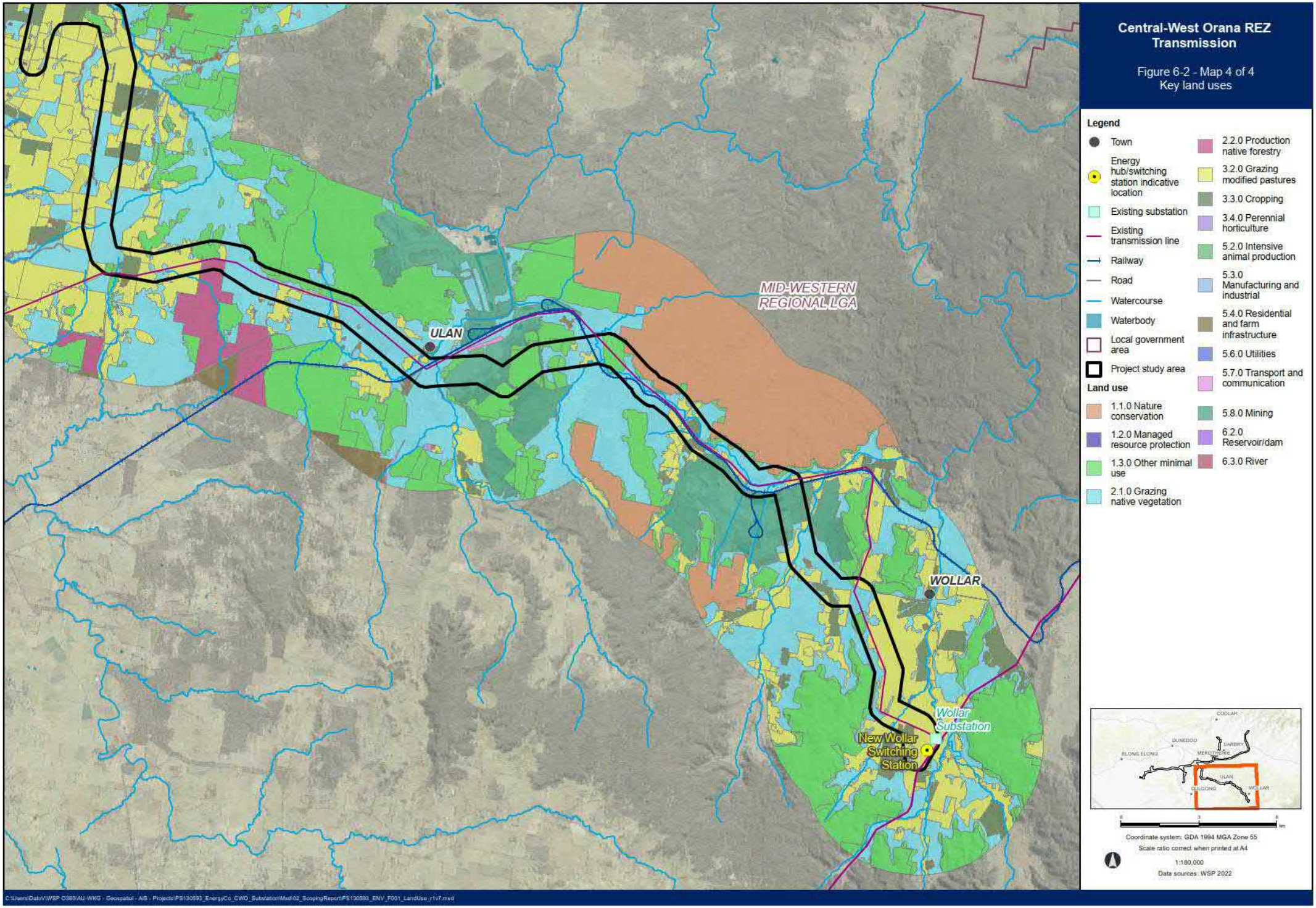
- 1.1.0 Nature conservation
- 1.2.0 Managed resource protection
- 1.3.0 Other minimal use
- 2.1.0 Grazing native vegetation
- 2.2.0 Production native forestry
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 3.4.0 Perennial horticulture
- 4.2.0 Grazing irrigated modified pastures
- 5.2.0 Intensive animal production
- 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
- 6.2.0 Reservoir/dam
- 6.3.0 River



Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:180,000
Data sources: WSP 2022

C:\Users\DaboV\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\02_ScopingReport\PS130593_ENV_F001_LandUse_r1v7.mxd


Central-West Orana REZ Transmission
Figure 6-2 - Map 3 of 4
Key land uses
Legend
Town
Energy hub/switching station indicative location
Existing substation
Existing transmission line
Railway
Road
Watercourse
Waterbody
Local government area
Project study area
Land use
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
3.4.0 Perennial horticulture
4.2.0 Grazing irrigated modified pastures
4.3.0 Irrigated cropping
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
6.2.0 Reservoir/dam
6.3.0 River
WARRUMBUNGLE LGA
UARBRY
GOLDEN HIGHWAY
RUMBUNGLE LGA
UPPER HUNTER LGA
MID-WESTERN REGIONAL LGA
COOLAH
DUNEDOO
UARBRY
MERRYGORE
ELONG ELONG
ULAN
WOLLAR
UJULGONG
Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:180,000
Data sources: WSP 2022
C:\Users\DaloV\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\02_ScopingReport\PS130593_ENV_F001_LandUse_r1v7.mxd



Central-West Orana REZ Transmission

Figure 6-2 - Map 4 of 4
Key land uses

Legend

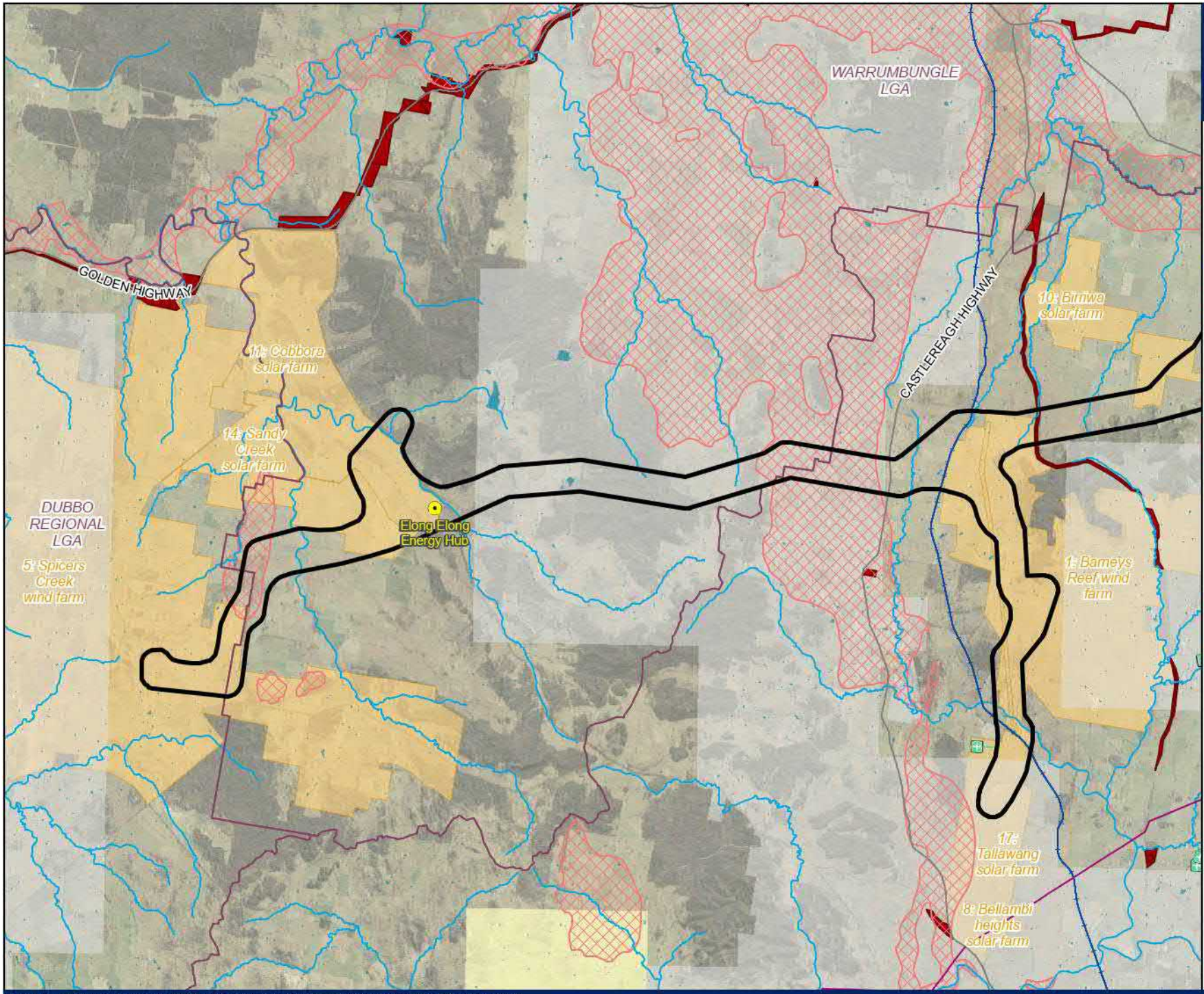
- Town
- Energy hub/switching station indicative location
- Existing substation
- Existing transmission line
- Railway
- Road
- Watercourse
- Waterbody
- Local government area
- Project study area

Land use

- 1.1.0 Nature conservation
- 1.2.0 Managed resource protection
- 1.3.0 Other minimal use
- 2.1.0 Grazing native vegetation
- 2.2.0 Production native forestry
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 3.4.0 Perennial horticulture
- 5.2.0 Intensive animal production
- 5.3.0 Manufacturing and industrial
- 5.4.0 Residential and farm infrastructure
- 5.6.0 Utilities
- 5.7.0 Transport and communication
- 5.8.0 Mining
- 6.2.0 Reservoir/dam
- 6.3.0 River

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:180,000
Data sources: WSP 2022

C:\Users\DatoV\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\02_ScopingReport\PS130593_ENV_F001_LandUse_r1v7.mxd



Central-West Orana REZ Transmission

Figure 6-3 - Map 1 of 4
Other key land uses

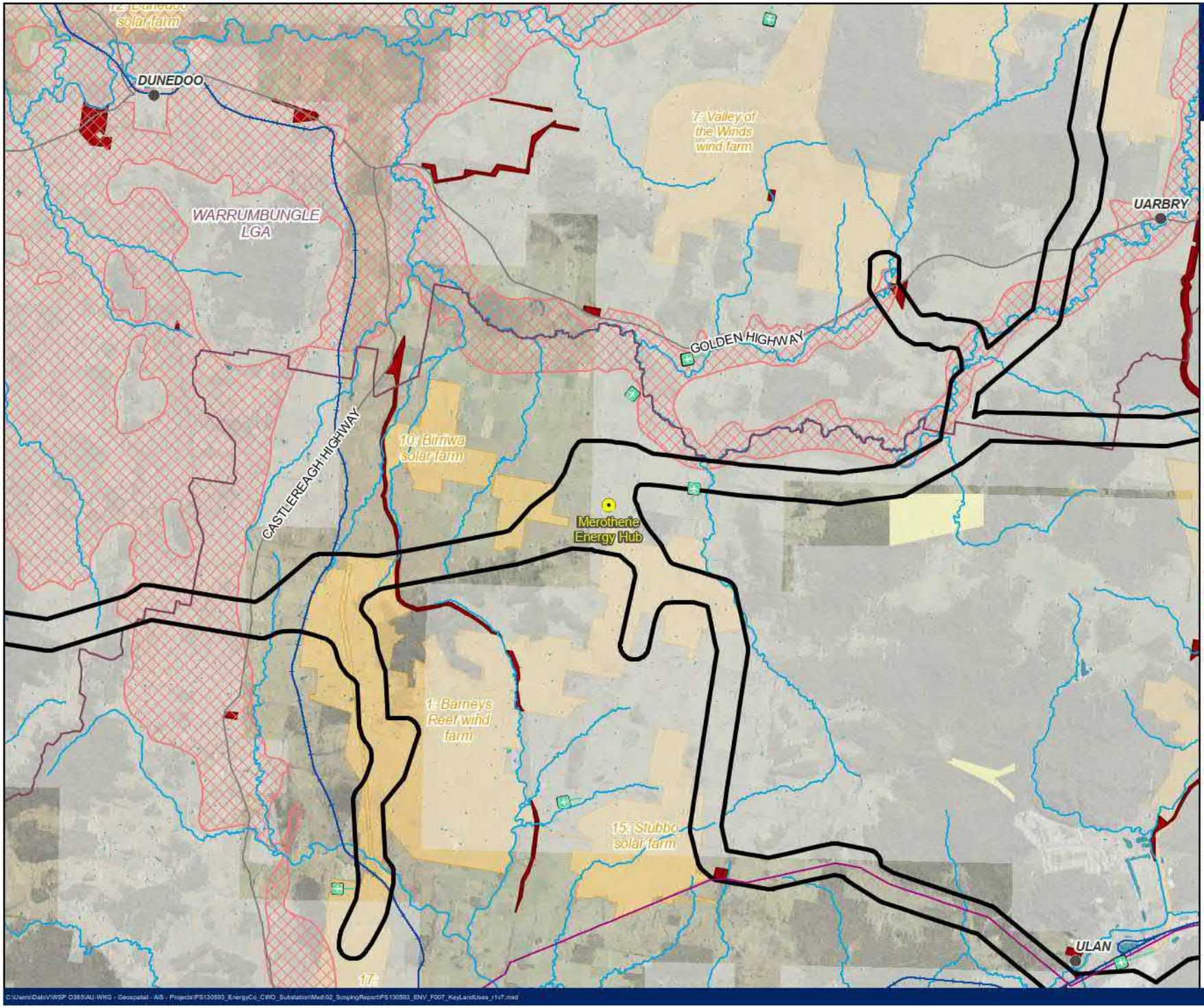
Legend

- Town
- Airport and landing ground
- Existing substation
- Energy hub/switching station indicative location
- Existing transmission line
- Railway
- Road
- Watercourse
- Waterbody
- Biophysical strategic agricultural land
- Exploration and mining applications
- Exploration and mining titles
- Local government area
- Project study area
- Travelling stock reserves
- *Major renewable energy projects in proximity

*Based on a search of the DPE planning portal August 2022

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:180,000
Data sources: WSP 2022

C:\Users\DaloV\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\02_ScopingReport\PS130593_ENV_F007_KeyLandUses_r1v7.mxd



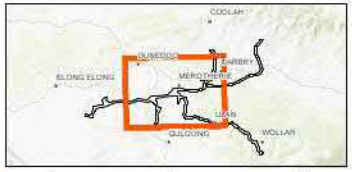
Central-West Orana REZ Transmission

Figure 6-3 - Map 2 of 4
Other key land uses

Legend

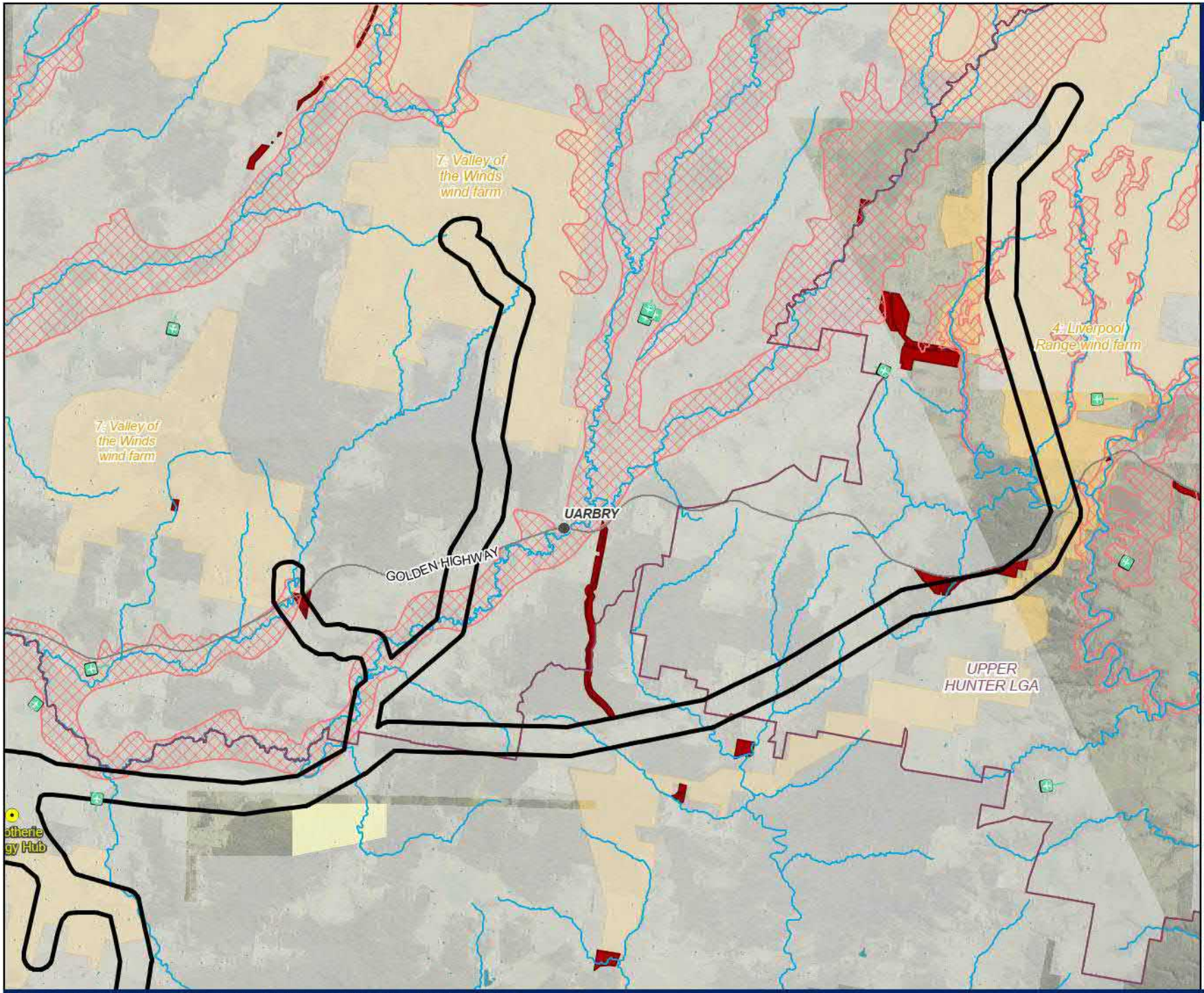
- Town
- Airport and landing ground
- Existing substation
- Energy hub/switching station indicative location
- Existing transmission line
- Railway
- Road
- Watercourse
- Waterbody
- Biophysical strategic agricultural land
- Exploration and mining applications
- Exploration and mining titles
- Local government area
- Project study area
- Travelling stock reserves
- *Major renewable energy projects in proximity

*Based on a search of the DPE planning portal August 2022



Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:180,000
Data sources: WSP 2022

C:\Users\DaloV\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\02_ScopingReport\PS130593_ENV_F007_KeyLandUses_r1v7.mxd



Central-West Orana REZ Transmission

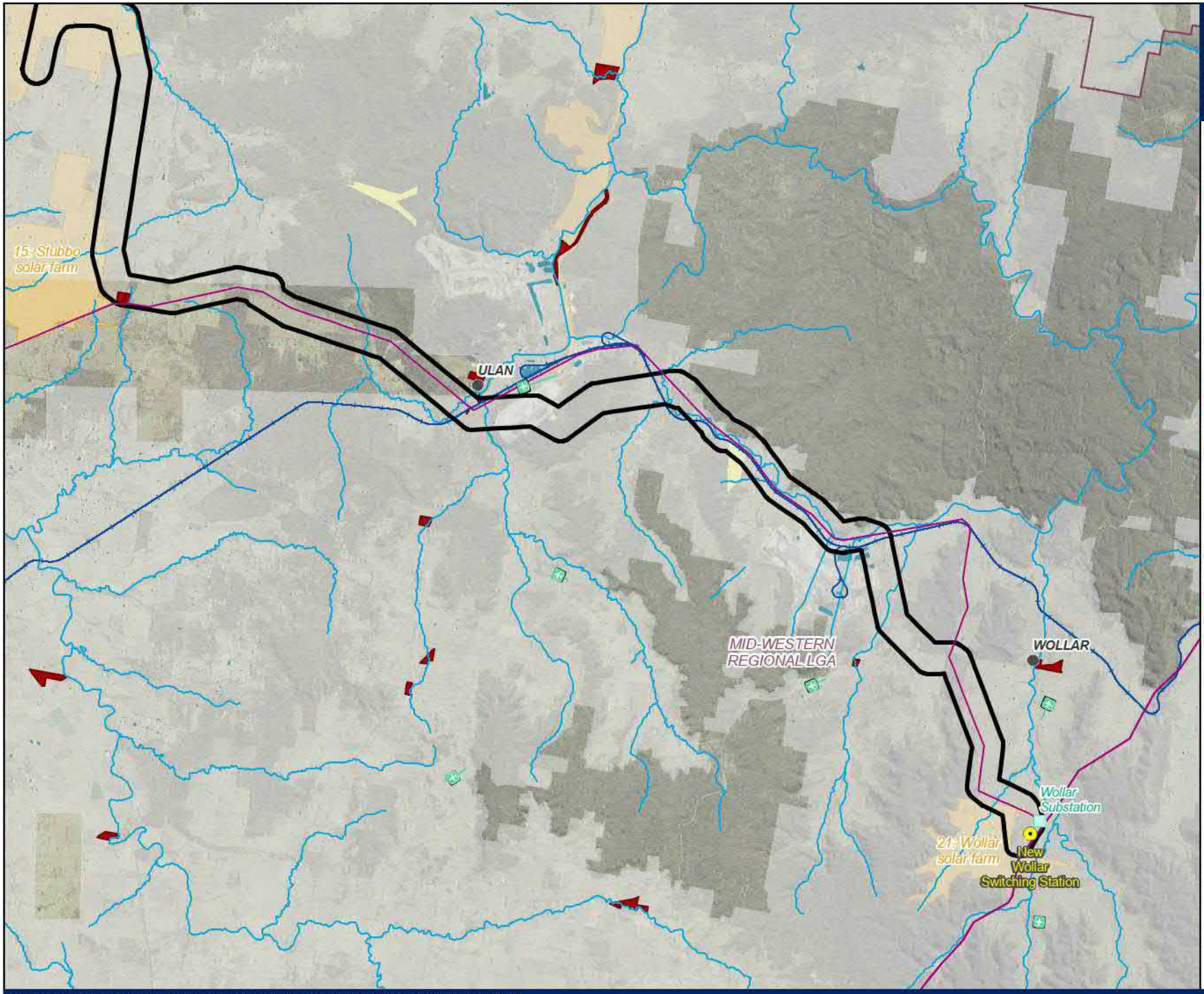
Figure 6-3 - Map 3 of 4
Other key land uses

Legend

- Town
- Airport and landing ground
- Existing substation
- Energy hub/switching station indicative location
- Existing transmission line
- Railway
- Road
- Watercourse
- Waterbody
- Biophysical strategic agricultural land
- Exploration and mining applications
- Exploration and mining titles
- Local government area
- Project study area
- Travelling stock reserves
- *Major renewable energy projects in proximity

*Based on a search of the DPE planning portal August 2022

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:180,000
Data sources: WSP 2022



Central-West Orana REZ Transmission

Figure 6-3 - Map 4 of 4
Other key land uses

Legend

- Town
- Airport and landing ground
- Existing substation
- Energy hub/switching station indicative location
- Existing transmission line
- Railway
- Road
- Watercourse
- Waterbody
- Biophysical strategic agricultural land
- Exploration and mining applications
- Exploration and mining titles
- Local government area
- Project study area
- Travelling stock reserves
- *Major renewable energy projects in proximity

*Based on a search of the DPE planning portal August 2022

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:180,000
Data sources: WSP 2022

C:\Users\DaloV\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\02_ScopingReport\PS130593_ENV_F007_KeyLandUses_r1v7.mxd

6.2.2 Potential impacts

The potential impacts on land use and property during construction and/or operation of the project may include:

- temporary changes in land use due to the leasing and use of land for the disturbance area, access, compounds and workforce accommodation camps
- permanent removal of land or restrictions on current land use due to land acquisition to accommodate permanent infrastructure, including easements for the transmission lines, energy hubs, switching stations and permanent access tracks
- impacts on forestry operations that would result in a decrease in productivity
- impacts on access to properties as a result of changes to private access roads and internal access arrangements, which may also require temporary or permanent adjustments to existing fences and gates to accommodate construction and/or ongoing access for maintenance
- conflicts with aviation activities at airports and landing strips, including Dubbo Regional Airport, Bodangora Airport and Gulgong Aero Park
- impacts on mining leases and licences such that mine operations are affected, due to the construction of permanent infrastructure
- impacts on Commonwealth land
- impacts on services and utilities during construction.

The transmission line easement is the area surrounding and including the transmission line which is a legal 'right of way' and allows for ongoing access and maintenance of the line. Easements will preferentially be acquired by agreement with landowners or by compulsory acquisition in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991*.

The indicative location and disturbance areas of permanent and temporary land required for construction and operation of the project will be confirmed and assessed as part of the EIS. Areas within the disturbance area that are not required for operation of the project will be rehabilitated at the completion of construction to a similar condition as the existing land.

6.2.3 Proposed further assessments

A detailed assessment of the potential impact of the project on land use and property will be undertaken for the EIS, which will include:

- a description of the existing environment as it relates to land use and property, including existing land use and zoning, land capability, mining licenses, infrastructure easements, travelling stock reserves and ownership patterns (government and private)
- an assessment of potential property and land use impacts (including forestry, protected environments and biodiversity offset areas), due to temporary and permanent land requirements for the project and land use conflicts
- assessment of impacts to forestry productivity due to restrictions or changes in operations due to construction or operational activities
- assessment of potential impacts on mineral resources
- assessment of potential impacts on Commonwealth land
- assessment of potential impacts on aviation operations at airports and private landing strips due to conflicts with construction cranes and/or the transmission line. EnergyCo will consult with Airservices Australia and the Civil Aviation Safety Authority (CASA) to ensure that the project will not compromise safe aviation operations and that the proposed new transmission lines will be represented on aeronautical charts for the benefit of pilots conducting low level operations
- identification of potential utilities that may require adjustment to accommodate the project
- mitigation measures to avoid, minimise and manage any identified potential impacts of the project on property and land use.

EnergyCo will continue to consult with landowners as well as native title land claimants during continued design development to further avoid or minimise impacts on land use and property, where possible.

Land use planning plans, policies and strategies that apply to the project study area include:

- *Central West and Orana Regional Plan 2036* (DPE, 2017) and the *Draft Central West and Orana Regional Plan 2041* (DPE, 2021a)
- *Mid-Western Regional Draft Comprehensive Land Use Strategy* (Mid-Western Regional Council, 2017)
- *Warrumbungle Shire Council Land Use Strategy* (Warrumbungle Shire Council, 2013)
- *Warrumbungle Shire Local Strategic Planning Statement* (Warrumbungle Shire Council, 2019a)
- *Cobbora Land Use Planning Strategy* (Warrumbungle Shire Council, 2019b)
- *Dubbo Local Strategic Planning Statement* (Dubbo Regional Council, 2020)
- *Upper Hunter Land Use Strategy* (Upper Hunter Shire Council, 2017)
- *Draft Upper Hunter Shire Council Local Strategic Planning Statement* (Upper Hunter Shire Council, 2020).

6.3 Agriculture

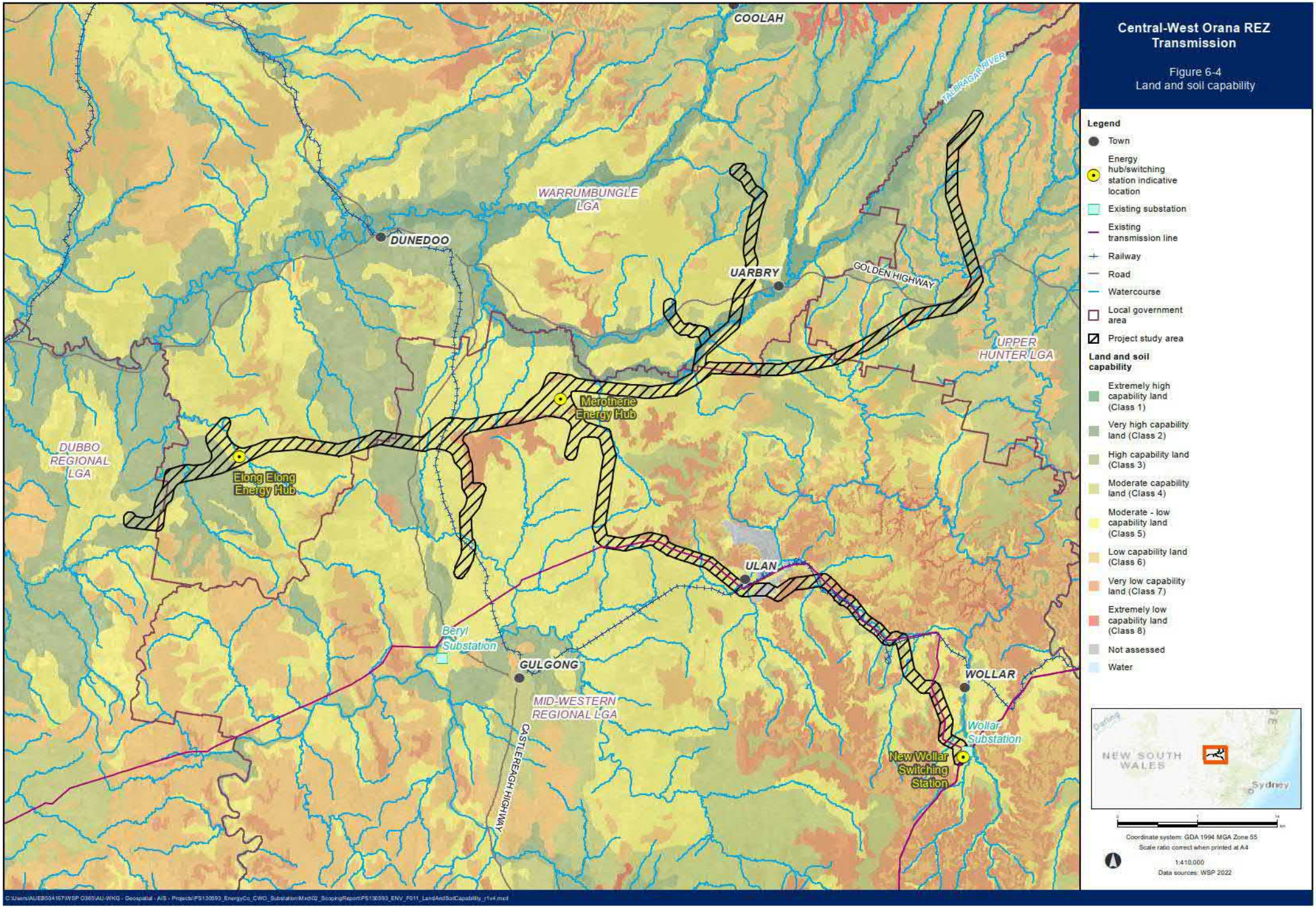
6.3.1 Existing environment

The majority of the project study area comprises agricultural land including irrigated cropping, dryland cropping and dryland grazing. This land is typically used for sheep grazing for wool and meat, cattle grazing and cereal cropping. Several travelling stock routes also exist within the project study area (refer to Figure 6-3).

Biophysical Strategic Agricultural Land (BSAL) is land with high quality soil and water resources capable of sustaining high levels of productivity. The BSAL designation is used for the purposes of assessing impacts from state significant mining and coal seam gas proposals and is defined in the State Environmental Planning Policy (Resources and Energy) 2021 by reference to the Strategic Agricultural Land Map. The project study area traverses several areas identified as BSAL, including areas around Turee Creek (Coolah), Talbragar River and its tributaries (Uarbry and Cassilis), Turill Creek (Cassilis), Cainbill Creek (Leadville), and other areas in Cobbora, Goolma, Dunedoo and Tallawang, as shown in Figure 6-3.

The NSW Land and Soil Capability (LSC) assessment scheme (OEH, 2012a) defines LSC classes based on biophysical features of the land (including soil type, slope, landform position, acidity, salinity, drainage, rockiness and climate), 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. The purpose of the LSC class is to provide an indication of the land management practices that can be applied to a parcel of land without causing degradation of the land and soil on-site, and to the environment, ecosystems and infrastructure off-site. LSC 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 to minimise land and environmental degradation.

The majority of the project study area (about 59 per cent of the project study area) consists of land classified as LSC Class 5 (moderate to low capability land that has high limitations for high-impact land uses such as cropping, high-intensity grazing and horticulture), as shown in Figure 6-4. About 13 per cent of the project study area is classified as LSC Class 3 (high capability land that has moderate limitations and is capable of sustaining high-impact land uses) and another 13 per cent of the project study area is classified as LSC Class 4 (moderate capability land that has moderate to high limitations for high-impact land uses) (refer to Figure 6-4).



Central-West Orana REZ Transmission

Figure 6-4
Land and soil capability

Legend

- Town
- Energy hub/switching station indicative location
- Existing substation
- Existing transmission line
- Railway
- Road
- Watercourse
- Local government area
- Project study area

Land and soil capability

- Extremely high capability land (Class 1)
- Very high capability land (Class 2)
- High capability land (Class 3)
- Moderate capability land (Class 4)
- Moderate - low capability land (Class 5)
- Low capability land (Class 6)
- Very low capability land (Class 7)
- Extremely low capability land (Class 8)
- Not assessed
- Water

There are also scattered areas of LSC Class 2 (very high capability land), LSC Class 6 (low capability land) and LSC class 7 (very low capability land).

LSC Class 2 land (very high capability land) is located in the northeastern section of the project study area and LSC Class 3 land (high capability land) is located in the central, western and northeastern sections of the project study area.

6.3.2 Potential impacts

The potential impacts on agriculture during construction and/or operation of the project may include:

- temporary or permanent changes to land available for agriculture due to the leasing or acquisition of land for the project
- impacts on agricultural operations that would result in a decrease in productivity, including:
  - interference with normal crop production practices (such as cultivation, ground and aerial spraying, harvesting, controlled traffic farming) and precision agriculture
  - restrictions on irrigated agriculture such as movement of linear and centre pivot irrigation machinery in the easement
  - safety risks and limitations on the use of agricultural machinery and aerial agricultural practices (use of drones and small aircraft) in the easement
  - impacts on farm infrastructure and layout, including dams and paddocks, and the efficient movement of livestock, vehicles and machinery due to the creation of the easement and impacts on access to Travelling Stock Reserves
  - limitations to the height of vegetation permitted in the easement
  - impacts on livestock due to noise and dust emissions during construction
  - impacts on soil or water resources due to pollution of stormwater runoff with sediments, fuel and other hazardous materials from construction sites
  - interference with radiocommunication, navigation or surveillance equipment used near the transmission line
- potential for biosecurity risks during construction and operation, due to the introduction or spread of animal diseases, plant diseases, feral pests and/or weeds.

6.3.3 Proposed further assessments

A detailed assessment of the potential impact of the project on agriculture will be undertaken for the EIS, which will include:

- a description of the existing environment as it relates to agricultural resources and operations
- an assessment of the potential impacts of the project on agricultural operations during construction and operation due to the removal or restriction to agricultural land capability and/or impacts to farm management activities. This will identify land to be temporarily and permanently removed from agricultural production, an assessment of the potential impacts of the project on agricultural operations during construction and operation, including limitations on agricultural machinery, impacts to crop production practices, movements of livestock, vehicles and machinery, irrigation, biosecurity and workplace health and safety, and potential impacts on BSAL
- mitigation measures to avoid, minimise and manage any identified potential impacts of the project on agriculture.

6.4 Landscape character and visual amenity

6.4.1 Existing environment

Elevations in the project study area range from 370 metres Australian Height Datum (mAHD) near Wilpinjong, in the southeastern section of the project study area, to 690 metres mAHD north of Cassilis, in the northeastern section of the study area.

The southeastern section of the project study area is mainly characterised by relatively flat to gently undulating grasslands with scattered trees or isolated remains of open woodland, with views towards the forested areas of Goulburn River National Park and Cope State Forest. In Ulan and Wilpinjong, the landscape has been disturbed by mining operations and is dominated by exposed ground and heavy machinery.

The western and central sections of the project study area are mainly characterised by flat to gently undulating land that has been extensively cleared for agricultural purposes, including broad acre cropping and grazing. Remnant vegetation in these areas is typically found along roads, rivers and creeklines and in stands of native vegetation within paddocks. Steeper vegetated slopes are found near Barneys Reef, Merotherie and Tuckland State Forest in Dunedoo.

The visual landscape in the southeastern and central parts of the study area includes existing transmission lines (500 kV, 330 kV, 132 kV and 66 kV) as well as the existing Wollar Substation.

The landscape of the northeastern section of the project study area is characterised by low rolling hills, ridgelines and broad valleys below a series of complex ridges and gullies with steeper topography. The hills and valleys incorporate cleared undulating farmland, open forests and woodlands and areas of dense timber stands. Moderate to dense stands of tree cover are also found on steeper side slopes and alongside riparian areas of the series of ridges and gullies.

The majority of potential sensitive visual receivers within the project study area would be residents and road users. Main roads within the project study area include Castlereagh Highway and Golden Highway.

There are no major or regional towns within the project study area, however there are small rural villages, localities and residential dwellings located in or near the project study area (refer to Section 6.2.1).

The project study area is also located within the Dark Sky Region for the Siding Springs Observatory, located outside the project study area. Significant developments within this zone (which extends 200 kilometres from the observatory) need to consider the lighting used within the development so that it does not impact the effectiveness of the observatory.

6.4.2 Potential impacts

The project would change the landscape character and visual amenity of the project study area and surrounding landscape through the introduction of new structures, clearing of vegetation and the temporary presence of construction ancillary sites. The prevailing undulating topography of the project study area and surrounding areas, together with remnant roadside vegetation and woodlands, serve to provide a degree of screening of the project study area when viewed from surrounding residences, roads, and adjacent agricultural land. Notwithstanding, there is potential for views of the proposed project infrastructure, particularly where the landscape is relatively flat or from residences and landholdings that have elevated views over the project study area.

Construction of the project may potentially result in temporary impacts on landscape character and the visual amenity of sensitive receivers resulting from:

- temporary presence of construction compounds, laydown areas and workforce accommodation camps
- construction plant and vehicles on the local road network and within the disturbance area
- light spill from construction sites at night
- clearing of vegetation and ground disturbance within the disturbance area.

Potential landscape character and visual amenity impacts that could occur during operation of the project would be as a result of the introduction of transmission line, energy hub and switching station infrastructure into the landscape, some of which would potentially be noticeable from distances of several kilometres or visible at night. The exact location of transmission towers will be confirmed as part of continued design development of the project; however, the 500 kV network transmission line towers would be up to 70 metres in height and generally be placed at around 450 metres apart and the 330 kV network transmission line towers would be up to 50 metres in height and generally be placed at around 400 metres apart. The distance between transmission line towers would increase or decrease depending on the identified constraints.

Where possible during continued design development, visual impacts will be minimised by locating the transmission line structures, energy hubs and switching stations as far away as possible from sensitive visual receivers and viewing locations or parallel to existing transmission line infrastructure where the degree of landscape change will be less. However, there is a need to balance visual impact mitigation with avoidance of impacts on other environmental values.

6.4.3 Proposed further assessments

A detailed landscape character and visual impact assessment will be undertaken as part of the EIS, which will identify the potential visibility of the project from different viewpoints along the corridor. The assessment will identify and describe potential sensitive visual receivers and landscape character areas, consider the unique qualities of these areas, identify heritage and other social values present within the landscape, and consider the impacts on the landscape character and views during construction and operation of the project during the day and night.

The assessment of landscape character and visual amenity impacts will include:

- public realm views from roads and villages, open space viewing areas and reserves to energy hubs, switching stations and transmission lines
- views from private residences or other sensitive receivers identifying the potential viewshed of the project through aerial photograph interpretation.

The sensitivity of the landscape and visual receivers will be evaluated, followed by a prediction of the magnitude of the change that each would experience as a result of the project. These will be combined to determine the significance of the effect during construction and operation. The assessment will develop mitigation measures to minimise the impacts of the project, where practicable.

The following guidelines will be considered in the landscape and visual impact assessment:

- *Guideline for Landscape Character and Visual Impact Assessment – Environmental impact assessment practice note EIA-N04* (Transport for New South Wales (TfNSW), 2020b)
- *Guidelines for Landscape and Visual Impact Assessment (GLVIA3) Third Edition* (Landscape Institute and Institute of Environmental Management and Assessment (LIIEMA), 2013)
- *Guidance Note for Landscape and Visual Assessment* (Australian Institute of Landscape Architects, 2018).

6.5 Biodiversity

This section provides a summary of a preliminary biodiversity assessment that has been prepared based on background database searches, literature review and limited field surveys (provided in Appendix C). The findings of this assessment are mainly based on desktop assessment, with limited field surveys carried out during February and September 2021 to inform the assessment.

The project study area and a 20 kilometre buffer around the project study area was used for threatened flora and fauna searches, consistent with the *BioNet Atlas user manual* (Office of Environment and Heritage (OEH), 2019) and standard practice for the DCCEEW Protected Matters Online Search Tool (PMST). Broad-scale state vegetation type mapping (DPIE, 2019a; DPIE, 2019b) was used to generate a list of potential native plant community types (PCTs) in the project study area and was used in conjunction with data obtained during the limited field surveys to inform the assessment of likelihood of occurrence for threatened communities, species and populations in the project study area.

6.5.1 Existing environment

Native vegetation

The project study area traverses a diverse range of native vegetation types that can be categorised into the following broad vegetation formations:

- grassy woodlands
- grasslands
- dry Sclerophyll Forests (Shrubby sub-formation)
- dry Sclerophyll Forest (Shrub/grass sub-formation)
- freshwater wetlands
- forested wetlands
- semi-arid Woodlands (Shrubby sub-formation).

Based on a combination of broad scale vegetation mapping and limited field validation, 34 native PCTs have the potential to occur within the project study area. Of these, 16 PCTs are linked to threatened ecological communities (TECs) listed under the BC Act and/or EPBC Act (refer to Table 3.1 in Appendix C). These are:

- Grey Box (E*ucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (Grey Box Grassy Woodland and Derived Native Grasslands) (Endangered under the EPBC Act)
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box-Gum Woodland and Derived Native Grasslands) (Critically Endangered under the EPBC Act)
- Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South bioregions (Endangered under the BC Act)
- Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South bioregions (Endangered under the BC Act)
- White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina bioregions (Critically Endangered under the BC Act).

Twelve additional candidate TECs, listed as endangered or critically endangered under the EPBC Act or BC Act, were identified from database searches and have a lower likelihood of occurring in the project study area:

- Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (Endangered under the BC Act)
- Hunter Valley Weeping Myall Woodland of the Sydney Basin bioregion (Critically Endangered under the BC Act)
- *Eucalyptus camaldulensis* population in the Hunter catchment (Endangered under the BC Act)
- Central Hunter Valley eucalypt forest and woodland (Critically Endangered under the EPBC Act)
- Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland (Endangered under the EPBC Act)
- Natural Temperate Grassland of the South Eastern Highlands (Critically Endangered under the EPBC Act)
- River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria (Critically Endangered under the EPBC Act)
- Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion (Endangered under the EPBC Act)
- Poplar Box Grassy Woodland on Alluvial Plains (Endangered under the EPBC Act)
- Weeping Myall Woodlands (Endangered under the EPBC Act)
- Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland (Critically Endangered under the EPBC Act)
- Coolibah – Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions (Endangered under the EPBC Act).

Further detailed field surveys will be undertaken to confirm and assess the extent of potential and recorded TECs within the project study area.

Threatened flora

Twenty-one threatened flora species and three threatened populations listed under the BC Act, have a moderate or higher likelihood of occurrence within the project study area. Six of these threatened flora species have been recorded in the project study area during the preliminary targeted flora surveys or have Bionet records within the project study area:

- Ausfeld's Wattle (*Acacia ausfeldii*)
- Pine Donkey Orchid (*Diuris tricolor*)
- Capertee Stringybark (*Eucalyptus cannonii*)
- Scant Pomaderris (*Pomaderris queenslandica*)
- Silky Swainson-pea (*Swainsona sericea*)
- Tarengo Leek Orchid (*Prasophyllum petalum*).

Bionet records of the threatened population, *Eucalyptus camaldulensis*, occurs in the project study area.

No species that have been recorded within the project study area are identified as 'serious and irreversible impact' (SAII) entities under the BC Act. However, three flora species and one population with a moderate or higher likelihood to occur within the project study area are identified as SAII entities under the BC Act:

- *Acacia pendula* population in the Hunter catchment
- Sand-hill Spider Orchid (*Caladenia arenaria*)
- Leafless Indigo (*Indigofera efoliata*)
- Granite Zieria (*Zieria obcordata*).

Thirteen threatened flora species listed under the EPBC Act are predicted to have a moderate or high likelihood of occurrence within the project study area. One of these threatened flora species, Tarengo Leek Orchid (*Prasophyllum petilum*), has Bionet records in the project study area.

Threatened and migratory fauna

Fifty-two threatened fauna species listed under the BC Act are predicted to have a moderate or high likelihood of occurrence within the project study area. Twenty-one of these threatened fauna species have been recorded in the project study area during the preliminary targeted fauna surveys or have Bionet records within the project study area:

- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*)
- Diamond Firetail (*Stagonopleura guttata*)
- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*)
- Eastern Cave Bat (*Vespadelus troughtoni*)
- Giant Barred Frog (*Mixophyes iteratus*)
- Glossy Black-Cockatoo (*Calyptorhynchus lathami*)
- Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*)
- Hooded Robin (southeastern form) (*Melanodryas cucullata cucullata*)
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*)
- Large-eared Pied Bat (*Chalinolobus dwyeri*)
- Koala (*Phascolarctos cinereus*)
- Little Eagle (*Hieraaetus morphnoides*)
- Little Lorikeet (*Glossopsitta pusilla*)
- Painted Honeyeater (*Grantiella picta*)
- Powerful Owl (*Ninox strenua*)
- Scarlet Robin (*Petroica boodang*)
- Speckled Warbler (*Chthonicola sagittate*)
- Square-tailed Kite (*Lophoictinia isura*)
- Regent Honeyeater (*Anthochaera Phrygia*)
- Varied Sittella (*Daphoenositta chrysoptera*)
- Yellow-bellied Sheathtail-Bat (*Saccolaimus flaviventris*).

Although the Regent Honeyeater was not recorded in the project study area, the project study area crosses areas mapped as important habitat for this species, and therefore the Biodiversity Assessment Method (BAM) 2020 (DPIE, 2020b) requires that this species be assumed present.

Two species that have been recorded within the project study area are identified as SAII entities under the BC Act:

- Eastern Cave Bat (*Vespadelus troughtoni*)
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*).

An additional three threatened fauna species with a moderate or higher likelihood to occur within the project study area are identified as SAII entities under the BC Act:

- Regent Honeyeater (*Anthochaera phrygia*)
- Swift Parrot (*Lathamus discolor*)
- Little Bent-winged Bat (*Miniopterus australis*).

In addition, 19 threatened fauna species and nine migratory bird species listed under the EPBC Act are predicted to have a moderate or high likelihood of occurrence within the project study area. Five of the threatened fauna species have been recorded in the project study area during the preliminary field surveys or have Bionet records within the project study area:

- Giant Barred Frog (*Mixophyes iteratus*)
- Regent Honeyeater (*Anthochaera Phrygia*)
- Painted Honeyeater (*Grantiella picta*)
- Koala (*Phascolarctos cinereus*)
- Large-eared Pied Bat (*Chalinolobus dwyeri*).

Seven migratory bird species are predicted to have a moderate or higher likelihood of occurrence within the project study area. None of these species have been recorded within the project study area.

National Parks, State Forests and Conservation Areas

The project study are traverses the southwestern edge of the Goulburn River National Park at Ulan and Wilpinjong and small sections of the Durridgere State Conservation Area in Cassilis and Turill, as shown in Figure 6-5. However, the project will be designed to not be located within the Goulburn River National Park or Durridgere State Conservation Area.

Other National Park estates near the project study area include Dapper Nature Reserve, Munghorn Gap Nature Reserve, Yarrobil National Park, Goodiman State Conservation Area, Cobbora State Conservation Area, Goonoo State Conservation Area and Goulburn River State Conservation Area (refer to Figure 6-5).

The Tuckland State Forest (in Dunedoo) and Cope State Forest (in Cope) are located within and adjacent to the project study area (refer to Figure 6-5).

Regent Honeyeater important habitat areas are also mapped within and outside the southeastern section of the project study area between Ulan and Wollar.

Three conservation areas that form part of the offset strategy for the Peabody Wilpinjong Coal Mine and areas nominated for regeneration under their offset strategy are located within the southeastern section of the project study area. Other offset areas associated with the Peabody Wilpinjong Coal Mine have been transferred to national park estate and are located outside the project study area.

Two offset areas protected under Yancoal's Moolarben Coal Complex offset strategy are located within the southeastern section of the project study area. A further twelve offset areas that form part of this offset strategy are located within 10 kilometres of the southeastern section of the project study area.

Wetlands of national and international importance

No nationally important wetlands were identified within the project study area. The nearest nationally important wetlands are:

- Lake Goran (about 80 kilometres upstream from the project study area)
- Macquarie Marshes (about 225 kilometres downstream from the project study area)
- Lake Cowal/Wilbertroy Wetlands (about 177 kilometres upstream from the project study area).

The nearest Wetlands of International importance (RAMSAR wetlands) are Hunter Estuary, located 150–200 kilometres downstream from the project study area and Macquarie Marshes Nature Reserve, located about 150–200 kilometres downstream from the project study area.

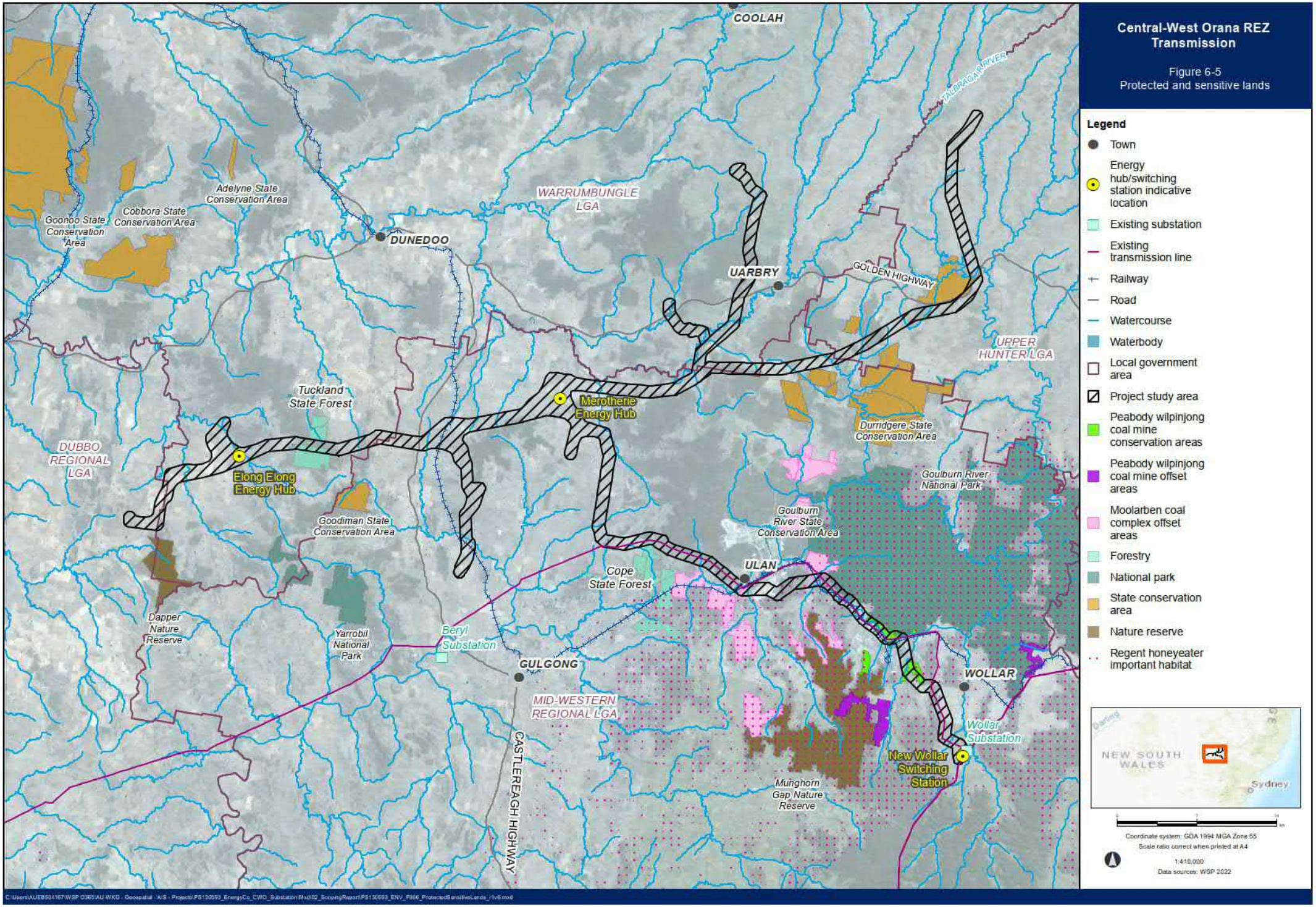
Threatened fish and key fish habitat

The project study area extends across the Macquarie-Bogan and Hunter catchments, and crosses the Talbragar River, as well as several creeks and minor streams.

Mapped key fish habitat is present throughout the project study area, which generally follows the named watercourses (watercourses are shown in Figure 6-5). The term ‘fish’ includes all aquatic invertebrates such as yabbies, shrimps, oysters, mussels and insect larvae.

No threatened fish species listed under the EPBC Act or BC Act have a moderate or high likelihood of occurrence within the project study area. A search of the NSW Department of Primary Industries (DPI) Fisheries Spatial Data Portal on 17 August 2022 found that habitat for Southern Purple Spotted Gudgeon (*Mogurnda adspersa*) and Eel-tailed Catfish (*Tandanus tandanus*) listed under the FM Act is present throughout all streams listed as key fish habitat within the project study area.

No EECs listed under the FM Act have the potential to occur within the project study area.


COOLAH
TALBRAGAR RIVER
Adelyne State Conservation Area
Goonoo State Conservation Area
Cobbora State Conservation Area
WARRUMBUNGLE LGA
DUNEDOO
UARBRY
GOLDEN HIGHWAY
UPPER HUNTER LGA
Tuckland State Forest
Merotherie Energy Hub
Durridgere State Conservation Area
DUBBO REGIONAL LGA
Elong Elong Energy Hub
Goulburn River National Park
Goodiman State Conservation Area
Goulburn River State Conservation Area
ULAN
Cope State Forest
Dapper Nature Reserve
Yarrobil National Park
Beryl Substation
GULGONG
WOLLAR
MID-WESTERN REGIONAL LGA
Wollar Substation
New Wollar Switching Station
CASTLEREAGH HIGHWAY
Munghorn Gap Nature Reserve
Central-West Orana REZ Transmission
Figure 6-5
Protected and sensitive lands
Legend
Town
Energy hub/switching station indicative location
Existing substation
Existing transmission line
Railway
Road
Watercourse
Waterbody
Local government area
Project study area
Peabody wilpinjong coal mine conservation areas
Peabody wilpinjong coal mine offset areas
Moolarben coal complex offset areas
Forestry
National park
State conservation area
Nature reserve
Regent honeyeater important habitat
NEW SOUTH WALES
Sydney
Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:410,000
Data sources: WSP 2022
C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\02_ScopingReport\PS130593_ENV_F006_ProtectedSensitiveLands_r1v6.mxd

Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDEs) are communities of plants, animals, and other organisms who rely on a supply of groundwater to support the species composition, structure and function of the ecosystem.

Two broad classes of GDEs that have the potential to be present within or near the project study area include:

- aquatic GDEs: ecosystems dependent on the surface expression of groundwater, such as base-flow rivers and watercourses, wetlands and some floodplains. Although plant roots are generally below ground, this class of GDE requires a surface expression of groundwater, which may, in many cases, then soak below the soil surface and thereby become available to plant roots
- terrestrial GDEs: ecosystems dependent on the subsurface presence of groundwater, often accessed via the capillary fringe (the subsurface layer in which groundwater seeps up from a water table by capillary action to fill pores).

A review of the Groundwater Dependent Ecosystem Atlas (Bureau of Meteorology, 2022a) identified several PCTs in the project study area that have a moderate to high potential to be GDEs (refer to Figure 6-9). High priority (high conservation value) groundwater dependent ecosystems are also identified in the groundwater sharing plans for the project study area (refer to Section 6.15.1).

A preliminary assessment of the possible relationships between PCTs and GDEs in the project study area indicates that the following PCTs in the project study area have a high or moderate potential to be GDEs:

- River Red Gum riparian tall woodland/open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion (high potential)
- River Oak – Rough-barked Apple – red gum – box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion (high potential)
- Western Hunter Flats Rough-barked Apple Forest (high potential)
- Western Grey Box – cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion (high potential)
- Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion (High potential)
- Tumbledown Gum woodland on hills in the northern NSW South Western Slopes Bioregion and southern Brigalow Belt South Bioregion (high potential)
- Narrow-leaved Ironbark – Black Pine – Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin (moderate potential)
- Scribbly Gum – Narrow-leaved Ironbark – Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin (moderate potential)
- White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion (moderate potential).

Weeds, pests and pathogens

A number of state and regional priority weeds occur in the project study area, including Weeds of National Significance such as Lantana (*Lantana camara*), Madeira Vine (*Anredera cordifolia*) and Serrated Tussock (*Nassella trichotoma*). Weeds of National Significance are weeds that have been prioritised by the Australian government based on their potential for spread, their invasiveness, and their social and economic impacts.

Within NSW there are also several pests and pathogens that have the potential to impact agricultural and forestry activities and biodiversity. Diseases and pest animals that commonly occur in the project study area and have the potential to impact biodiversity and are also listed as a key threatening process under either the EPBC Act and/or BC Act, include Root-rot fungus (*Phytophthora cinnamomi*), Amphibian chytrid fungus (chytridiomycosis), Psittacine circoviral disease, European red fox and feral cats, pigs and goats.

6.5.2 Potential impacts

As summarised in this section, and detailed in Appendix C, a number of threatened native flora and fauna species, TECs, migratory species, important habitat values and sensitive environments could potentially be impacted by construction and operation of the project.

The potential impacts of the project during construction and operation include:

- clearing of native vegetation resulting in loss of fauna habitat, habitat fragmentation and loss of connectivity
- impacts on listed threatened flora species and endangered terrestrial ecological populations and communities
- impacts on potential habitat for listed threatened fauna species
- impacts on biodiversity values of protected and sensitive lands, including wetlands, national parks and conservation areas
- increased native fauna mortality from risk of collision with construction vehicles and transmission lines
- impacts on native fauna due to EMF
- impacts on aquatic ecology and threatened species, including as a result of riparian vegetation removal or changes in geomorphology, water quality and/or fish passage
- impacts on native vegetation (including EECs) and threatened species due to the transport of weeds and pathogens
- impacts on fauna due to increased dust, sedimentation and erosion, noise and light
- impacts on groundwater dependent ecosystems.

The development and refinement of the project study area has sought to avoid impacts on important biodiversity values where possible. Further avoidance and minimisation strategies to be implemented as part of continued design development for the project will be informed by additional biodiversity surveys that will be carried out as part of the detailed biodiversity impact assessment to be included in the EIS (refer to Section 6.5.3 below for more information).

6.5.3 Proposed further assessments

A detailed biodiversity impact assessment will be carried out as part of the EIS that will include:

- a desktop review of existing vegetation maps, relevant reports, topographic maps, aerial photographs and database searches for records of vegetation communities and flora and fauna species within a 10 kilometre radius of the project study area
- a vegetation survey to provide broad vegetation mapping and habitat assessment within a 220 metre radius around the proposed transmission line and targeted seasonal species surveys carried out in biodiversity hotspots within the 220 metre radius
- preparation of a Biodiversity Development Assessment Report (BDAR) in accordance with Appendix 10 of the Biodiversity Assessment Method (BAM) (DPIE, 2020b) and under the framework of the BC Act and EPBC Act. The BDAR will identify the potential significance of biodiversity impacts of the project, including the potential for serious and irreversible impacts on identified threatened species and ecological communities and impacts on relevant MNES protected under the EPBC Act (refer to Section 4.3.5). The BDAR will demonstrate how the project has sought to avoid and/or minimise impacts on biodiversity (e.g. retaining native vegetation, moving the disturbance area to avoid impacts), propose measures that will be implemented to further minimise impacts on biodiversity and identify the residual impacts of the project that will need to be offset in accordance with the BC Act
- a Biodiversity Offset Strategy (BOS) will be prepared to satisfy State and Commonwealth requirements. The BOS will include the approach for quantification of offset requirements and options to meet obligations under the BC Act.

The assessment (and supporting field surveys) will be guided by the following government plans, policies and guidelines:

- NSW Threatened Species Survey and Assessment Guidelines (various)
- *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (Commonwealth of Australia, 2013)
- Commonwealth Department of the Environment – Nationally Threatened Ecological Communities and Threatened Species Guidelines (various)
- Commonwealth Department of the Environment – Survey Guidelines for Nationally Threatened Species (various)
- *Developments adjacent to National Parks and Wildlife Service lands – Guidelines for consent and planning authorities* (NSW National Parks and Wildlife Service, 2020)
- *NSW Groundwater Dependent Ecosystem Policy* (NSW Department of Land and Water Conservation, 2002)
- *Policy and guidelines for fish habitat conservation and management* (NSW DPI, 2013)
- *Aquatic Ecology in Environmental Impact Assessment* (NSW Department of Planning, 2003)
- *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003).

6.6 Aboriginal heritage

This section presents a summary of a preliminary heritage assessment that has been undertaken for the project (refer to Appendix D). The preliminary heritage assessment was primarily based on a desktop study and provides an analysis of known Aboriginal cultural heritage items and sites relevant to the project and gaps in data within the project study area.

6.6.1 Existing environment

The project study area is primarily associated with the Wiradjuri people, however, the area is located at the boundary of the Wiradjuri, Gamilaroi (also Kamilaroi, Gomeroi and Gamilaraay; Tindale (1974) recorded over 30 spellings), and Wailwan (also Weilwan Wayilwan) nations. The project study area falls within the boundaries of the Mudgee, Gilgandra, Dubbo, Walhallow and Wanaruah Local Aboriginal Land Councils (LALC).

A search of Aboriginal objects, sites, and places registered on the Aboriginal Heritage Information System (AHIMS) was carried out on 22 April 2022 and 16 August 2022. A total of 34 AHIMS searches were undertaken to cover the project study area and broader heritage study area. The searches identified a total of 2,847 Aboriginal sites, with the most common types registered being artefacts (about 81 per cent), followed by areas of Potential Archaeological Deposits (PADs) (about 11 per cent), modified trees (about five per cent) and grinding grooves (about two per cent). The eastern portion of the heritage study area contained a greater number of art sites, correlating with the greater availability of geological outcroppings within this area.

Of the 2,847 total AHIMS sites within the project study area and broader heritage study area, 295 Aboriginal sites are located within the project study area. The most common types are artefact sites (about 89 per cent), followed by comparable representation of PADs (about nine per cent) and culturally modified trees (about four per cent).

The previously recorded sites are concentrated in the vicinity of mining and linear projects where archaeological assessments have been completed. Areas where few or no Aboriginal sites were identified in the AHIMS database does not necessarily correlate with a low frequency of sites being present, but rather the number of archaeological surveys that have been done in these areas. This means that Aboriginal objects may be present in locations where there are no registered AHIMS sites.

Based on the distribution of sites and finds identified by the AHIMS searches, as well as previous investigations and features of the landscape (e.g. waterways, topography), artefact sites, PADs, culturally modified (scarred or carved) trees, grinding grooves, freshwater middens and burial sites have the potential to occur within the project study area (referred to as areas of archaeological sensitivity) (refer to Figure 6-6).

In the vicinity of Wollar, Wilpinjong and Moolarben and east of Uarbry, there is a high potential for rockshelters to occur in areas with a steep relief or where sandstone outcropping occurs.

To the west, in the vicinity of Merotherie, Elong Elong and Uarbry, stone artefacts are found on the surface or shallowly buried within a wide range of environments and landforms, although more extensive deposits are found near major tributaries such as Laheys Creek and Maryvale Creek. Within these environments, sites such as culturally modified trees and grinding grooves have also been documented where remnant vegetation and exposed sandstone in the vicinity of creek lines are present.

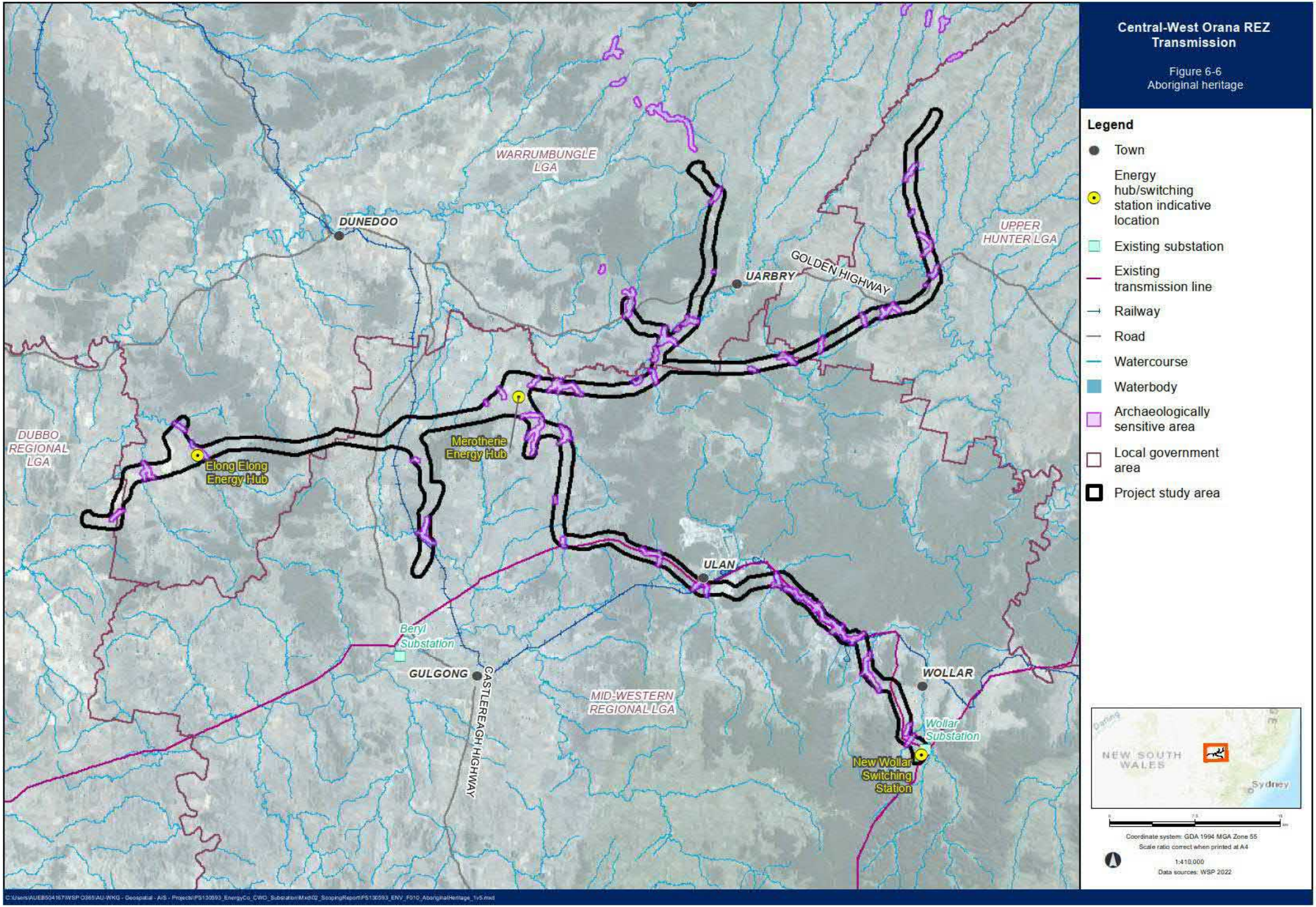
Cultural sites are also documented in the region, typically where visually dominant features in the landscape, such as hills and ranges, are present.

A search of the Native Title Register indicates that the project study area includes lands which are currently subject to the following active native title claims:

- Gomeroi People (NC2011/006)
- Warrabinga-Wiradjuri #7 (NC2018/002).

One native title claim that has not been determined (NC2016/005) includes three small areas near the project study area near the Peabody Wilpinjong coal mine in Wilpinjong, Wollar and Munghorn. One of these areas is directly adjacent to the project study area.

There are no Indigenous Land Use Agreements that apply to the project study area.



Central-West Orana REZ Transmission

Figure 6-6
Aboriginal heritage

Legend

- Town
- Energy hub/switching station indicative location
- Existing substation
- Existing transmission line
- Railway
- Road
- Watercourse
- Waterbody
- Archaeologically sensitive area
- Local government area
- Project study area

6.6.2 Potential impacts

The project has the potential to impact on known and previously unrecorded Aboriginal items. Impacts on known and previously unrecorded Aboriginal items can occur through the following processes:

- direct harm or disturbance to surface and/or subsurface features at an item. This could occur due to surface disturbance and excavations associated with ground disturbance activities, including vegetation removal
- indirect impacts including inadvertent direct impacts during vegetation clearance activities, disturbance from surface water drainage and workers driving over sites.

Field surveys and engagement with Aboriginal stakeholders is required to inform the cultural values of the project study area and presence of Aboriginal sites. The field surveys and engagement will inform the design of the project, with the aim to:

- protect, conserve and/or manage the heritage significance of Aboriginal objects and places
- avoid or minimise impacts on areas of archaeological potential and scientific significance, where feasible and reasonable.

During operation, there would be potential to impact Aboriginal heritage while carrying out access track and vegetation maintenance or tower and transmission line maintenance nearby. However, the potential for accidental impacts would be minimised through implementation of standard protocols (such as delineation of no-go zones near known Aboriginal heritage sites) during maintenance activities.

Any active Native Title Claim which affects the project will need to be considered during the EIS phase, with consultation undertaken with relevant Aboriginal representatives.

6.6.3 Proposed further assessments

A detailed Aboriginal Cultural Heritage Assessment (ACHA) will be carried out as part of the EIS that will include:

- consultation with Aboriginal stakeholders in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010.* The aims of the consultation process are to identify relevant stakeholders, provide a means of communication and information exchange, and identify areas and sites of known cultural significance to the Aboriginal community
- a desktop review of existing Aboriginal heritage datasets, relevant reports, topographic maps, aerial photographs and geological and soil landscape mapping within the project study area
- development of a landscape-based predictive model of the archaeological resource using relevant and comparable local and regional data, and map areas of relative predicted archaeological sensitivity across the study area. This will inform areas to target in subsequent survey and test excavation stages
- completion of archaeological field assessment of the study area with the participation of Aboriginal stakeholder representatives. Archaeological field assessment will include survey within a 200 metre radius of the proposed route alignment(s), in addition to test excavation of proposed impact areas (i.e. transmission line tower locations)
- provide input into the project design refinement process and assess the potential impacts of the project on Aboriginal heritage cultural values and sites
- identification of mitigation and management measures to further avoid or minimise impacts to Aboriginal heritage.

The assessment and supporting field surveys will be guided by the following government plans, policies and guidelines:

- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011)
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010a)
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (the Code of Practice) (DECCW, 2010b).

6.7 Non-Aboriginal heritage

This section presents a summary of a preliminary heritage assessment that has been undertaken for the project (refer to Appendix D). The preliminary heritage assessment was primarily based on a desktop study and provides an analysis of known historical heritage items and sites relevant to the project.

6.7.1 Existing environment

Searches were undertaken in August 2022 of the following heritage registers:

- World Heritage List
- The National Heritage List
- The Commonwealth Heritage List
- Register of National Estate
- The State Heritage Register
- Section 170 Heritage and Conservation Registers
- Heritage schedules from the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter LEPs.

These searches identified two heritage items within the project study area and 262 listed heritage items within 20 kilometres of the project study area. Sites within or in the immediate vicinity of the project study area are shown in Figure 6-7. These heritage items can be characterised by residential and rural activities that have occurred in the region over the last 250 years and generally include built heritage such as residential and commercial buildings (e.g. homesteads and warehouses), government administration buildings (e.g. police stations and court houses), ecclesiastical buildings (e.g. cemeteries and churches) and infrastructure (e.g. railway, water supply) and areas listed for their natural values (e.g. nature reserves and conservation areas).

The two listed heritage sites within the project study area are of local significance – one historical homestead at Wollar (Wandoona Homestead) and the Goulburn River National Park (refer to Table 6-1). However the Goulburn River National Park is also being considered for inclusion in the National Heritage List as part of an extension to the Greater Blue Mountains Area – Additional values nomination.

The Greater Blue Mountains World Heritage Area is located around 20 kilometres to the southeast of the project study area.

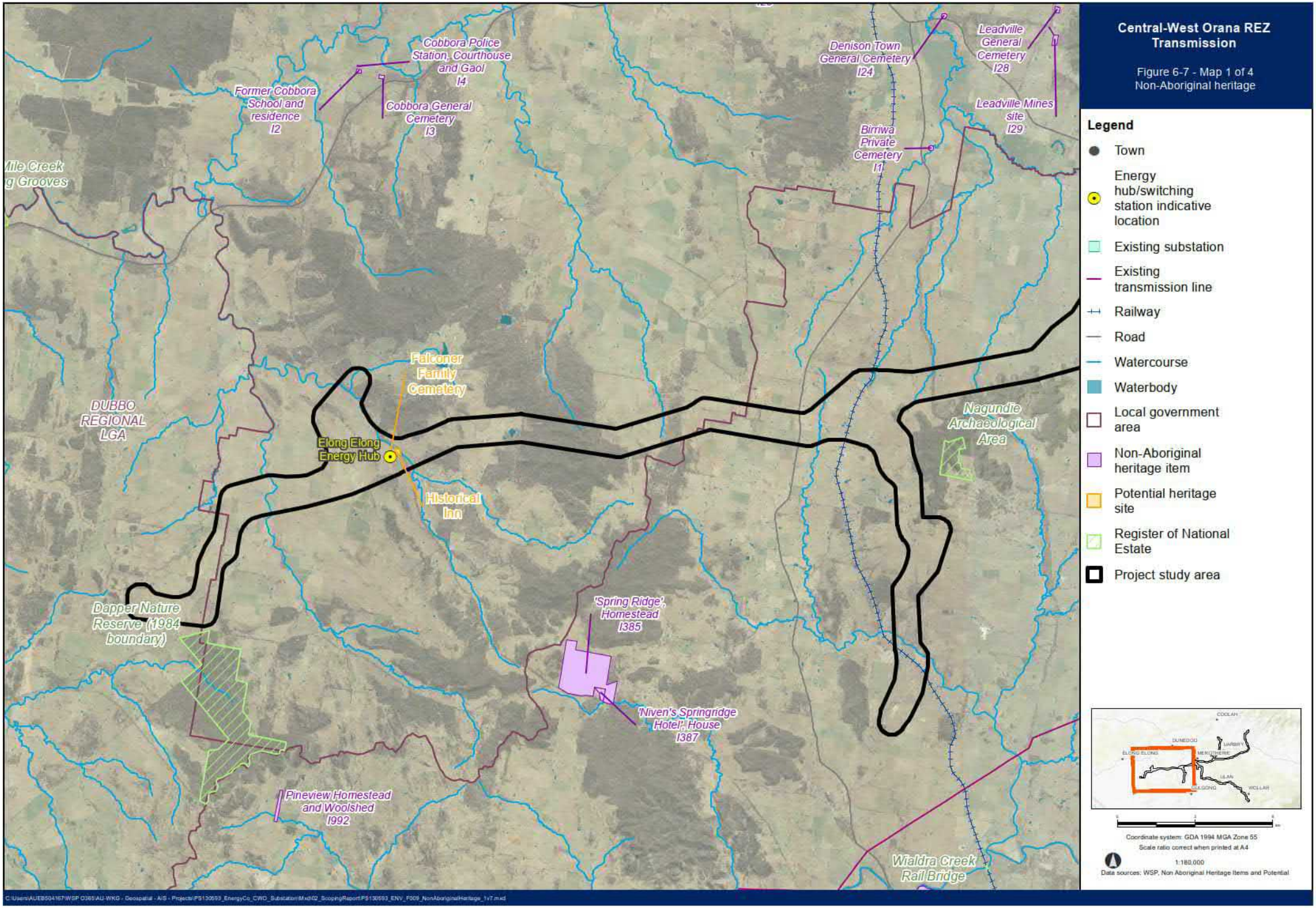
Table 6-1 Local heritage items within the project study area

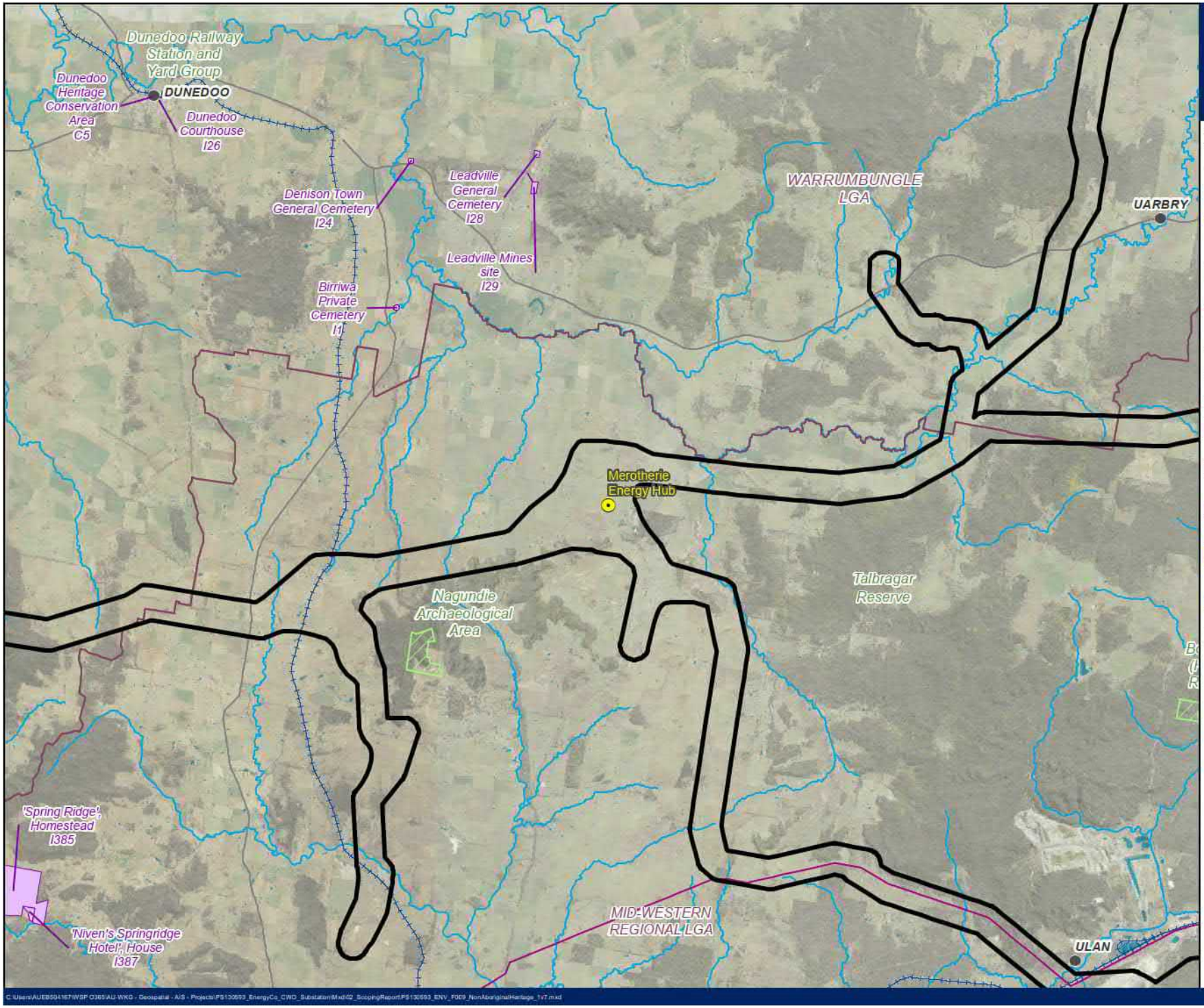
Item	Location	List	Reference
Goulburn River National Park	Ulan	Mid-Western Regional LEP 2012	I994
Wandoona Homestead	Wollar	Mid-Western Regional LEP 2012	I996

A preliminary field investigation of the project study area carried out in July 2021 identified two potential historical heritage items that have been previously documented (EMM Consulting Pty Limited, 2012), but not listed in any heritage registers (refer to Figure 6-7). Both of these sites are situated within the project study area in the vicinity of the Elong Elong Energy Hub:

- a family cemetery adjacent to Laheys Creek (known as Laheys Creek Cemetery), assessed as being of local significance
- a former inn (referred to as Cobb & Co in some literature), located about 240 metres southeast of the Laheys Creek Cemetery.

There is also the potential for unrecorded historic sites and features of heritage significance to occur within or near the project study area. This could include agricultural heritage (e.g. old fence lines, field systems), burials, archaeological sites (e.g. homesteads and huts), transport and access routes (e.g. stock routes, bridle paths), early infrastructure (e.g. roads, railways) and former timber mills and associated infrastructure.


Central-West Orana REZ Transmission
Figure 6-7 - Map 1 of 4
Non-Aboriginal heritage
Legend
Town
Energy hub/switching station indicative location
Existing substation
Existing transmission line
Railway
Road
Watercourse
Waterbody
Local government area
Non-Aboriginal heritage item
Potential heritage site
Register of National Estate
Project study area
Cobbora Police Station, Courthouse and Gaol I4
Former Cobbora School and residence I2
Cobbora General Cemetery I3
Denison Town General Cemetery I24
Leadville General Cemetery I28
Leadville Mines site I29
Birriwa Private Cemetery I1
Falconer Family Cemetery
DUBBO REGIONAL LGA
Elong Elong Energy Hub
Historical Inn
Nagundie Archaeological Area
Dapper Nature Reserve (1984 boundary)
'Spring Ridge', Homestead I385
'Niven's Springridge Hotel', House I387
Pineview Homestead and Woolshed I992
Wialdra Creek Rail Bridge
COOLAH
DUNEDOO
ELONG ELONG
MERRYTHERE
ULAN
GULGONG
WOLLAR
Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:180,000
Data sources: WSP, Non Aboriginal Heritage Items and Potential

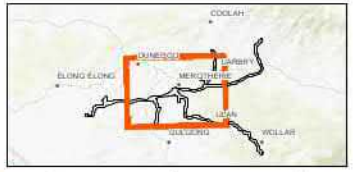


Central-West Orana REZ Transmission

Figure 6-7 - Map 2 of 4
Non-Aboriginal heritage

Legend

- Town
- Energy hub/switching station indicative location
- Existing substation
- Existing transmission line
- Railway
- Road
- Watercourse
- Waterbody
- Local government area
- Non-Aboriginal heritage item
- Potential heritage site
- Register of National Estate
- Project study area

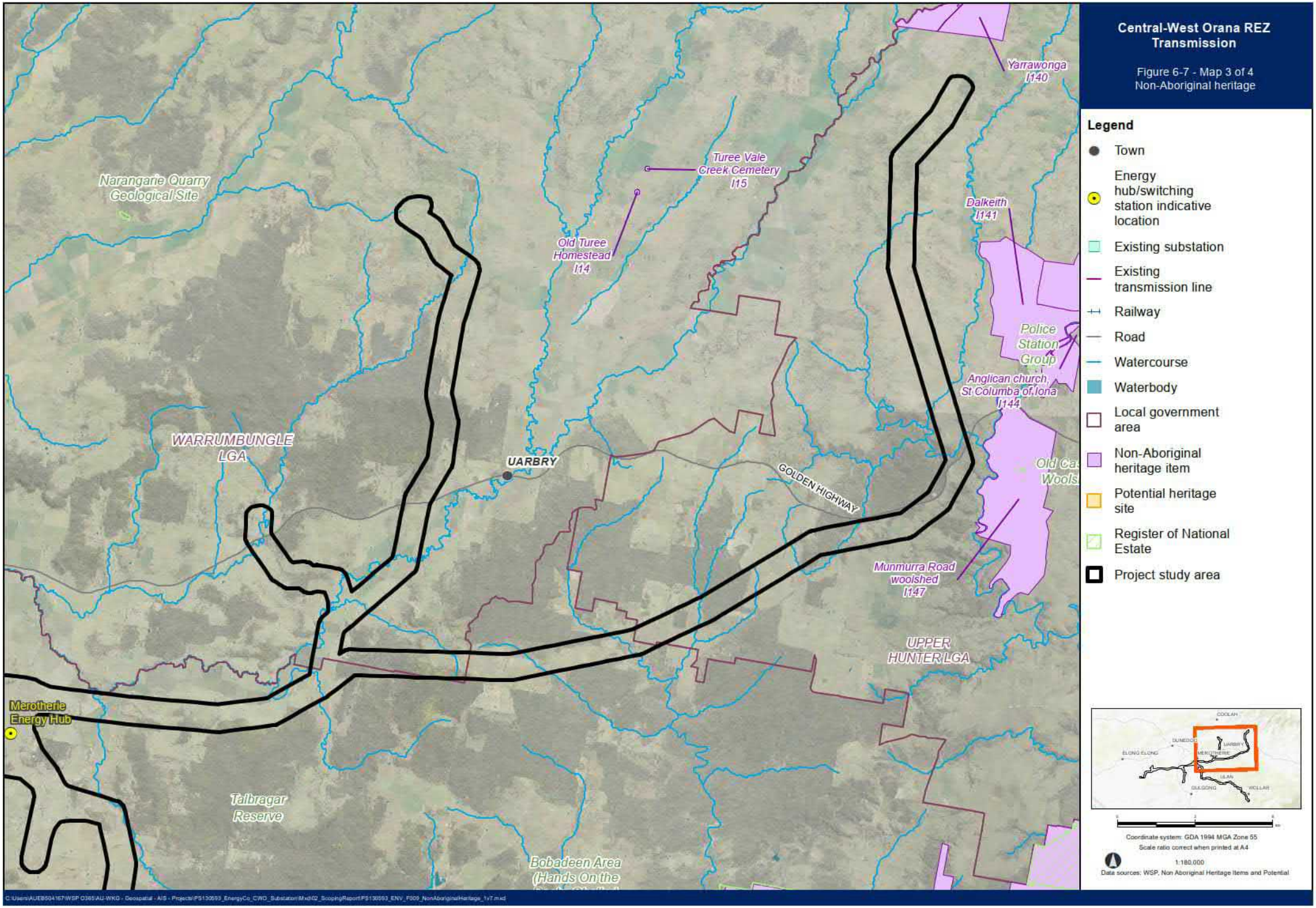


Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4

1:180,000

Data sources: WSP, Non Aboriginal Heritage Items and Potential

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\02_ScopingReport\PS130593_ENV_F009_NonAboriginalHeritage_1v7.mxd



Central-West Orana REZ Transmission

Figure 6-7 - Map 3 of 4
Non-Aboriginal heritage

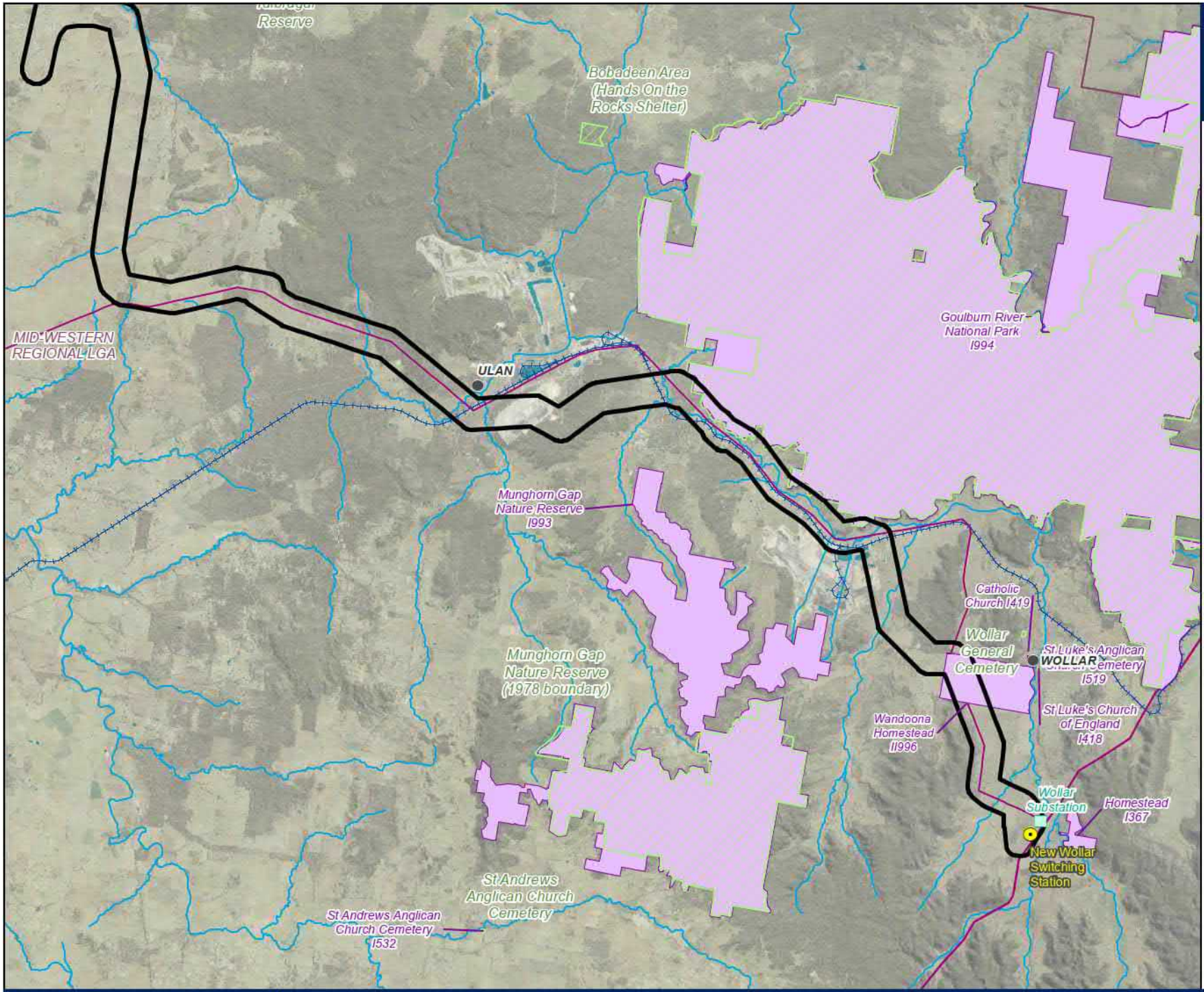
Legend

- Town
- Energy hub/switching station indicative location
- Existing substation
- Existing transmission line
- Railway
- Road
- Watercourse
- Waterbody
- Local government area
- Non-Aboriginal heritage item
- Potential heritage site
- Register of National Estate
- Project study area

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4

1:180,000

Data sources: WSP, Non Aboriginal Heritage Items and Potential



Central-West Orana REZ Transmission

Figure 6-7 - Map 4 of 4
Non-Aboriginal heritage

Legend

- Town
- Energy hub/switching station indicative location
- Existing substation
- Existing transmission line
- Railway
- Road
- Watercourse
- Waterbody
- Local government area
- Non-Aboriginal heritage item
- Potential heritage site
- Register of National Estate
- Project study area

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4

1:180,000

Data sources: WSP, Non Aboriginal Heritage Items and Potential

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\02_ScopingReport\PS130593_ENV_F009_NonAboriginalHeritage_1v7.mxd

6.7.2 Potential impacts

The project has the potential to directly and indirectly impact on known and previously unrecorded non-Aboriginal heritage items. Direct impacts generally result from changes to the site environment, including excavation, demolition of structures, vegetation removal or impacts from vibration caused by construction plant and equipment, which can result in a loss of heritage value. Indirect impacts may occur where views to and from heritage sites are altered, resulting in a loss of heritage value of the site.

The potential for direct and/or indirect impacts would depend on the proximity of the project or construction activities to these items or to contributory components of the heritage items (where the project would be located within the heritage curtilage). However, the potential for direct impacts to known (or registered) heritage sites would be limited to one locally significant heritage site as the project will be designed to not be located in the Goulburn River National Park. The potential for indirect impacts will be further considered and assessed in the EIS, and field surveys will inform if there is the potential for impacts to previously unrecorded non-Aboriginal heritage items.

6.7.3 Proposed further assessments

A detailed non-Aboriginal heritage impact assessment will be carried out as part of the EIS that will include:

- a desktop review of relevant historical information including regional and local histories, heritage studies and historical maps to understand the historical heritage context, and searches of relevant heritage registers and schedules
- development of a predictive model of the archaeological resource using relevant and comparable local and regional data, and map areas of relative predicted sensitivity to both assist in the identification of potential archaeological sites and surviving built structures or other previously unidentified features
- archaeological field survey within the project study areas to validate the predictive model. The proposed survey program and methodology will be presented and discussed with the DPE for endorsement before surveys are carried out
- assessment of the potential risk of direct or indirect impact of the project on identified historic heritage values
- Statement(s) of Heritage Impact for sites that have the potential to be impacted by the project
- mitigation and management measures required to reduce the impacts of the project.

The assessment (and supporting field surveys) would be guided by the following government plans, policies and guidelines:

- The *Burra Charter*: The Australia ICOMOS Charter for Places of Cultural Significance, 2013
- The NSW Heritage Manual, which includes:
  - *Statements of Heritage Impact Guidelines* (Heritage Office and Department of Urban Affairs and Planning, 2002)
  - *Investigating Heritage Significance* (Heritage Council of NSW, 2021)
  - *Assessing Heritage Significance* (Heritage Office, 2001)
  - *Assessing Significance for Historical Archaeological Sites and 'Relics'* (Heritage Branch Department of Planning, 2009).
  - *Archaeological Assessments: Archaeological Assessment Guidelines* (Heritage Office, Department of Urban Affairs and Planning, 1996).

6.8 Social

6.8.1 Existing environment

The regional social locality and local social locality (as described below) set the social locality for the project. This also provides an understanding of the social context without the project, including the existing social environment and socio-economic trends relevant to the scoped potential social impacts, the local area where direct and indirect impacts may occur and the broader region in which the project is located.

Regional social locality

The regional social locality refers to the area likely to experience indirect benefits or effects as a result of the project during construction and/or operation.

The regional social locality for the project comprises nine LGAs: Dubbo Regional, Narromine, Mid-Western Regional, Upper Hunter, Warrumbungle, Gilgandra, Liverpool Plains, Muswellbrook and Cabonne.

The regional social locality has a total population of 103,988. When compared with NSW, using the data available from the 2021 and 2016 Census (Australian Bureau of Statistics (ABS), 2016; ABS, 2021), the population of the regional social locality can broadly be characterised by:

- an older population, except for Muswellbrook and Dubbo Regional LGAs which presents a younger population
- a relatively high Indigenous population (the highest of which is 20.4 per cent in the Narromine LGA)
- significantly varying median weekly income (varying from $1,068 in the Warrumbungle LGA to $1,628 in the Muswellbrook LGA).

The Socio-Economic Indexes for Areas (SEIFA) Index of Relative Socio-economic Advantage and Disadvantage (IRSAD) provides an overview of the socio-economic conditions of residents and households within an area, including relative advantage and disadvantage. IRSAD scores demonstrate that the population of the regional social locality and local social locality are likely to experience heightened levels of socio-economic disadvantage.

The Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter LGAs, and service communities (localities with a concentration of residents and services) within these LGAs are likely to experience indirect positive and negative impacts as a result of the project, such as availability of and demand on accommodation and services, as well as employment opportunities and workforce competition. These impacts would be predominantly experienced during the construction phase of the project and would be influenced by the initiatives implemented by EnergyCo in response to these issues. Further details on these LGAs, which include the service communities of Dunedoo, Dubbo and Gulgong, is presented in the following sections.

Warrumbungle LGA

The Warrumbungle LGA encompasses the northern section of the project study area, covering a total area of 12,380 square kilometres with a population of 9,225. Almost half of the population live in rural and remote areas (Warrumbungle Shire Council, 2022) and the majority of residents (80 per cent) are Australian born.

The closest service community in the LGA to the project study area is Dunedoo, which is located about 16 kilometres to the north of the central section of the project study area. This town contains a number of services, recreational and education facilities for the local community as well as accommodation.

The Warrumbungle region also has a rich Aboriginal history and is home to the Gamilaraay people (also known as Kamilaroi), the Wailwan people and the Wiradjuri people. Aboriginal residents account for approximately 11 per cent of the population of the Warrumbungle LGA.

The economy of the LGA relies mainly on rural based industries, such as sheep and cattle farming and cropping, and to a lesser extent on tourism and coal mining in the south of the LGA (Warrumbungle Shire Council, 2019a). The most common industry of employment is beef cattle farming.

Dubbo Regional LGA

The Dubbo Regional LGA encompasses a small portion of the western section of the project study area and includes the service community of Dubbo, which is located about 55 kilometres west of the central section of the project study area. The LGA covers a total area of 7,536 square kilometres and has a total population of 54,922. About 79 per cent of the population live in the town of Dubbo and the majority of residents (82 per cent) are Australian born.

The Dubbo Regional LGA is located on the traditional land of the Tubbagah People of the Wiradjuri Nation. Indigenous residents represent over 16 per cent of the LGA's population.

The economy in the LGA relies largely on manufacturing, which represents the highest gross output by industry in the area, followed by rental, hiring and real estate services and construction (Dubbo Regional Council, 2016). The region is also known for its historical wheat and wool production. The most common employment sector is hospitals, followed by primary education, illustrating the notable presence of health and educational services in the LGA.

Mid-Western Regional LGA

The Mid-Western Regional LGA encompasses the eastern section of the project study area. The LGA covers a total area of 8,737 square kilometres and has a total population of 25,713. The majority of residents (84 per cent) are Australian born.

The main service communities in the LGA are Mudgee, Gulgong and Bombira, with Mudgee containing the largest concentration of businesses and services in the LGA. The closest service communities within the LGA to the project study area are Gulgong, located about nine kilometres southeast of the southern arm of the central section of the project study area.

The Mid-Western Regional LGA is home to the Wiradjuri people who are recognised as the traditional owners of the land. Aboriginal residents account for approximately seven per cent of the LGA's population.

The economy in the LGA relies on major industries including mining, agriculture (including viticulture or winegrowing), construction, retail and tourism (Mid-Western Regional Council, 2022). The most common industry of employment is coal mining, which employs 13.7 per cent of the LGA's population, followed by beef cattle farming.

Upper Hunter LGA

The Upper Hunter LGA encompasses the northeastern section of the project study area. Cassilis is the closest community within the LGA to the project study area and is located about 3.2 kilometres northeast of the eastern arm of the northeastern section of the project study area. The LGA covers a total area of 8,096 square kilometres, with a significant portion of the LGA located within national parks and nature reserves. The LGA has a total population of 14,229. The majority of residents (84 per cent) are Australian born.

The Upper Hunter LGA is home to the Wonnarua people who are recognised as the traditional owners of the land. The region is home to several sites of significance including the Finchley Trig and Biaime Caves (Welcome to Country, 2019). Aboriginal residents account for approximately seven per cent of the LGA's population.

The economy in the LGA relies on rural based industries such as grazing, dairy farming, horse studs and general farming (Upper Hunter Shire Council, 2022). Coal mining is also a major source of employment and economic stimulus in the LGA.

Local social locality

The local social locality is the area expected to experience the most social change as a result of the project during construction and/or operation. It includes the people living and/or accessing the services within or near the project study area. Townships located within the local social locality include:

- Barneys Reef
- Beryl
- Birriwa
- Bungaba
- Cassilis
- Cobbora
- Coolah
- Cope
- Cumbo
- Dunedoo
- Goolma
- Leadville
- Merotherie
- Stubbo
- Tallawang
- Tichular
- Turill
- Uarbry
- Ulan
- Wilpinjong
- Wollar.

6.8.2 Potential impacts

A preliminary social scoping assessment (the scoping tool) has identified the potential for positive and negative social impacts to occur during construction and operation, prior to mitigation (refer to Table 6-2). The identification of these impacts has been informed by a review of stakeholder engagement outcomes and the existing environment as well as the opportunities for social and economic development created by the project. The potential impacts identified are those that will require further investigation in the EIS and subject to mitigation strategies that will be developed by EnergyCo as part of the ongoing design development. This will be documented in the EIS.

Table 6-2 Potential key social impacts of the project (prior to mitigation)

Social impact category	Potential impacts
Way of life	• amenity impacts during construction may temporarily affect sense of place and alter the way neighbouring landowners and residents use and enjoy space • changes to way of life as a result of delays to mobility during construction due to increase traffic and transport of construction workforce, equipment and construction materials (in particular at energy hubs and switching stations). These potential impacts may be increased by cumulative impacts of other local and regional projects.
Community	• the perceived unfair distribution of impacts and benefits resulting in community division affecting residents' social networks, sense of community and wellbeing. These impacts may be increased by cumulative impacts of the project with other nearby projects.
Culture	• cumulative impacts on cultural identity in the region as a result of the increased presence of the renewable energy industry within the landscape • impacts on Aboriginal cultural values and wellbeing due to changes to the environment and sites of cultural heritage significance that are not acceptable to Aboriginal people, affecting sense of place and cultural connection to Country.
Accessibility	• increased demand on health/social services due to an increase in the temporary construction workforce, which may be increased by cumulative impacts from other major projects • potential disruption to telecommunications in the vicinity of transmission infrastructure, including radio, internet and television • impacts on wellbeing – annoyance amongst residents and impacts to general way of life as a result of potential interruptions to utilities, such as water, electricity, gas, telecommunications, during the construction phase of the project (if realignment of services required).

Social impact category	Potential impacts
Health and wellbeing	• detrimental effects on health and wellbeing due to the combined effects of dust and noise during construction, that are likely to impact neighbouring landowners and residents, especially those with pre-existing respiratory conditions such as asthma and emphysema • impacts to sense of safety due to an increase in traffic movements associated with the transport of construction equipment and materials, and the potential degradation of local roads • mental health issues in the construction workforce due to feelings of isolation • detrimental physical and mental health outcomes on landowners subject to the acquisition process, physical changes to their properties and the way landowners use and manage their land. This may be exacerbated by cumulative impacts of the project with other nearby projects • stress due to perceived health and safety risks associated with the construction of transmission line towers within resident's properties, including concern about the potential health impacts of increases in electromagnetic fields (EMFs) with the introduction of new HV transmission lines and energy hubs in the area • stress due to perceived bushfire risk associated with the construction and operation of power lines, particularly given the agricultural and residential land use in the area • stress due to perceived uncertainty in the local property market associated with cumulative impacts of the project with other nearby projects and land acquisition.
Surroundings	• a permanent change in community character due to the loss of aesthetic values as a result of visual impacts caused during construction and operation, that is likely to impact neighbouring landowners and residents within the local social locality • perceived or actual loss of biodiversity values resulting in impacts to the community's sense of belonging and aesthetic values, which may be exacerbated by cumulative impacts • diminished sense of safety during construction due to the increased presence of construction workers in service communities, which affects local perceptions of safety and wellbeing.
Livelihoods	• the easement and associated transmission line may restrict or alter how some landowners manage their property, potentially decreasing productivity on some portions of land or perceived property value impacts, which could have an effect on livelihoods • improvement to landowners' livelihoods due to receiving compensation/leasing payments for transmission line towers • improved livelihoods of local business owners as result of economic stimulus resulting from the project's procurement opportunities • employment opportunities would improve the livelihoods of those employed, improve mental wellbeing, the way they interact with their communities and their ability to access goods and services • impacts on local livelihoods due to an increased demand in the local workforce market, resulting in an increased cost of labour to small businesses (agriculture) and causing labour shortages for other non-project industries • cumulative impacts on livelihood due to the cumulative impacts of loss of agricultural land and reduced productivity and cumulative impacts on local livelihood and the local agricultural industry due to combined land acquisition • improvement in local employment opportunities due to the encouragement of investment into renewable projects and associated industries within the region as a result of the project • perceived unequitable distribution of benefits, as the project is supplying energy consumers on the east coast of NSW, therefore not benefiting the communities where the infrastructure is located.
Decision making systems	• landowners may perceive negative impacts in relation to their property and access to remedy rights, regardless of the standards of procedural fairness being met and just compensation terms being in place. This would include adjoining landowners that are in proximity to new transmission infrastructure • impacts on procedural fairness and people's capacity to influence changes that may affect their lives.

6.8.3 Proposed further assessments

A detailed social impact assessment will be included in the EIS that will include:

- a description of the existing social characteristics and features of the local and regional social locality (a social baseline). This will be informed by published literature and engagement carried out for the project
- an assessment of the potential social impacts of the project, building upon the social scoping assessment tool (provided in Appendix E) and the outcomes of the desktop assessment, engagement and other impact assessments completed for the project (e.g. construction noise, EMF impacts, economic impacts). This assessment will consider the potential social impacts during construction and operation on the way of life, community, accessibility, culture, health and wellbeing, surroundings, livelihoods and decision-making systems
- mitigation measures to avoid, minimise and manage any identified potential impacts of the project. This will be supported by a Social Management Plan Framework.

The following government plans, policies and guidelines will be considered in the social impact assessment:

- *Social Impact Assessment Guideline for State Significant Projects* (DPIE, 2021c)
- *Technical Supplement: Social Impact Assessment Guideline for State Significant Projects* (DPIE, 2021d)
- *Undertaking Engagement Guidelines for State Significant Projects* (DPIE, 2021e)
- *Central West and Orana Regional Plan 2036* (DPE, 2017) and the *Draft Central West and Orana Regional Plan 2041* (DPE, 2021b)
- *Dubbo 2040 Community Regional Council Strategic Plan* (Dubbo Regional Council, 2022)
- *Towards 2030 – Mid-Western Region 2030 Community Plan* (Mid-Western Regional Council, 2017b)
- *Warrumbungle Shire Community Strategic Plan (Reviewed) 2017-2032* (Warrumbungle Shire Council, 2019c).

6.9 Economic

This section describes the potential benefits and impacts to other industries and/or businesses due to the project, such as impacts to the economic productivity due to land use changes or conflicts, employment opportunities and expenditure within the immediate region by the workforce. The physical impacts to land use or property is addressed in Section 6.2. Section 6.8 addresses the social impacts arising from the economic benefits and impacts of the project.

6.9.1 Existing environment

In 2016, the Central West and Orana region had an economic output of $44 billion (DPIE, 2021b), of which around 50 per cent was created by the agriculture, mining, manufacturing and construction industries (DPIE, 2021a). Service industries (health care, retail and education) are also significant employers in the region.

As discussed in Section 2.2, the draft Central West and Orana Regional Plan 2041 (DPIE, 2021b) identifies the region's role in supporting NSW's transition to net zero carbon emissions by 2050 through a broad range of actions, including through enabling the establishment of the Central-West Orana REZ. The establishment of the REZ would facilitate growth in local and regional economies and create new employment opportunities for local communities.

6.9.2 Potential impacts

The project would generate expenditure of over $2 billion within the local, regional and NSW economies during the construction phase over a relatively short period of time. The construction phase would also generate opportunities for local employment and suppliers, which would benefit the economy of nearby towns. The project would generate over 650 direct jobs at the peak of construction.

Other economic impacts during construction and/or operation include:

- impacts on agriculture, forestry and other industries arising from productivity impacts due to the displacement of and/or conflicts with existing land uses (temporary and permanent)
- impacts due to increased expenditure in local communities and/or increased competition for resources (including workforce).

Several workforce accommodation camps would be established for the project given the distance to towns of sufficient size to support the required construction workforce and support staff. The camps would limit the pressure on local accommodation in nearby smaller towns. However, the provision of workforce accommodation camps may have positive and negative impacts on local businesses, due to increased expenditure in local communities and increased competition for resources (including workforce).

When fully completed, the project would facilitate enhanced security and reliability of energy supply with associated economic benefits to consumers across the NEM including:

- improvement of security and continuity of energy supply to NSW and the NEM during periods of maximum hourly and daily demand
- unlock renewable generation development and allow greater market access
- greater access to lower-cost energy generation
- create at least three gigawatts of additional network capacity to support energy security objectives for NSW and Australia
- create opportunities for local employment and support for local and regional economic growth.

6.9.3 Proposed further assessments

The detailed economic impact assessment for the project will focus on the impacts of the project in the immediate region and will include:

- characterisation of the economy within the economic impact study area, with a particular focus on industries and businesses that could be beneficially or adversely impacted by the project
- an assessment of the economic effects of the project during construction and/or operation due to:
  - employment – being direct employment in local communities and indirect employment due to increased expenditure by local and non-local workers
  - non-labour project expenditure in the regional economy (e.g. expenditure due to demand for plant/equipment, accommodation, and services)
  - economic impacts on other industries – including the displacement or restriction on key land use (e.g. agriculture, forestry), impacts on tourism/accommodation providers, impacts due to increased demands on housing/temporary accommodation and/or other cost of living factors (e.g. food)
- mitigation measures to avoid, minimise and manage any identified potential impacts of the project.

The assessment will be supported by an Input-Output Analysis, which will include an assessment of regional impacts of the project in terms of direct and indirect output, value added, income and employment, and any impacts on the economic activity of other industries.

6.10 Noise and vibration

6.10.1 Existing environment

The existing noise environment of the project study area is anticipated to generally experience low background noise levels consistent with the rural character of the area. Existing noise conditions in the project study area are expected to be influenced by natural noise sources (e.g. wildlife calls, wind-blown vegetation), human activity, domestic animals, agricultural machinery, mining, forestry, wind farms and transport noise on road and rail networks. The existing substation at Wollar is also considered to be a local noise source.

Individual residential dwellings on agricultural land and within the rural village of Ulan make up the majority of the nearest sensitive receivers within the project study area. The nearest regional population centres to the project study area are Gulgong, located about nine kilometres southeast of the southern arm of the central section of the project study area; and Dunedoo, located about 16 kilometres to the north of the central section of the project study area. The nearest towns and villages to the project study area are Ulan, located about 200 metres northeast of the southeastern section of the project study area; Wollar, located about 1.9 kilometres northeast of the southeastern section of the study area and Uarbry, located about 2.2 kilometres southeast of the central arm of the northeastern section of the project study area.

6.10.2 Potential impacts

Construction of the project has the potential to result in the following noise and vibration impacts:

- airborne noise impacts from:
  - the operation of construction plant and equipment such as excavators, piling rigs, chainsaws, mulchers, graders, dozers during construction activities such as vegetation clearance, earthworks, piling and road upgrades (if required)
  - airborne noise impacts from the use of helicopters and/or drones for the delivery of equipment and materials or stringing of the transmission lines (if required)
  - implosive jointing of conductors (joining two HV conductors through an implosion that results in a permanent connection of sheath over the conductor)
  - use of construction compounds and workforce accommodation camps
- potential minor vibration impacts on nearby vibration sensitive receivers, depending on the construction plant and equipment used during construction, which may include blasting for rock breaking during earthworks (subject to further ground condition investigations and identified as part of the EIS)
- increased road traffic noise along haulage routes and near workforce accommodation due to heavy vehicle and light vehicle movements transporting construction staff, equipment and materials to and from the construction areas.

For most of the project study area, construction activities are not expected to cause significant noise and vibration impacts due to the relatively short duration of work at each location and the distance of works from noise sensitive receivers, with the exception of construction of the energy hubs and switching stations, where construction noise impacts on nearby sensitive receivers may be experienced for a longer period of time.

Operation of the project is not anticipated to cause a significant noise impact on surrounding noise sensitive receivers as the project will be designed to comply with the relevant Australian and international standards, or to incorporate consideration of mitigation, where required. During operation, the project would have the potential to introduce some additional noise sources. Potential operational impacts include:

- noise from operation of noise generating equipment within the energy hubs, such as transformers, generators, and mechanical heating, ventilation and cooling systems
- noise from live transmission lines, which is typically associated with corona discharge noise that is highest during certain weather conditions such as light rain, mist or fog.

Potential vibration impacts from operation of the project are anticipated to be minimal. There may also be occasional minor noise impacts from maintenance activities at energy hubs and switching stations and along the transmission easements associated with vehicle movements, plant and equipment. However, these maintenance activities are expected to be infrequent, short in duration and localised.

6.10.3 Proposed further assessments

A detailed construction and operational noise and vibration assessment will be included in the EIS. Monitoring will be carried out near proposed permanent energy hubs, large proposed ancillary facilities and existing HV transmission lines.

The noise and vibration assessment methodology for the EIS will include:

- characterising the existing noise environment (including noise monitoring) and establishing noise and vibration criteria/goals
- identifying representative construction scenarios, locations and working times
- estimating potential increases to road traffic noise on haulage routes and near workforce accommodation camp sites
- predicting construction and operational noise at noise sensitive receivers
- analysing noise impacts in accordance with the relevant policies and guidelines
- identifying potential vibration impacts, safe working distances from construction plant and equipment and potentially impacted receivers within those distances
- identify any management and mitigation measures required to reduce the noise and vibration impacts of construction and operation of the project.

Operational noise modelling will be carried out where operational noise sources have been identified (e.g. corona noise from HV transmission lines, operation of energy hubs). Noise levels will be predicted for neutral and worst case meteorological conditions.

The following government plans, policies and guidelines are relevant to the noise and vibration assessment in the EIS:

- *Noise Policy for Industry* (NSW Environment Protection Authority (EPA), 2017b)
- *Interim Construction Noise Guideline* (DECC, 2009)
- *Draft Construction Noise Guideline* (EPA, 2020b)
- *Environmental Noise Management – Assessing Vibration: A Technical Guideline* (DECC, 2006)
- *German Standard DIN 4150–3:1999 Vibration in Buildings – Part 3: Effects on Structures* (German Institute for Standardisation, 1999)
- *NSW Road Noise Policy* (DECCW, 2011).

6.11 Hazard and risk

6.11.1 Existing environment

Bushfire risk

Bushfires pose an ever-present risk to life, property and the environment and can be caused by a variety of factors, including lightning strikes, sparks from farm machinery, sparks from hot works and heavy plant, escaped burn offs/campfires and electrical incidents such as fallen power lines. The bushfire risk across the project study area varies depending on the vegetation, topography and climatic conditions, with areas of rural grazing land, cropping, grassland, open woodland and forest each presenting a distinct bushfire risk.

Land within the western, northeastern and southeastern sections of the project study area containing areas of forest, open woodland and grassland is mapped as Category 1 bushfire prone land (highest bushfire risk), Category 3 bushfire prone land (medium bushfire risk) and Category 2 (lower bushfire risk than Category 1 and Category 3) bushfire prone land in the NSW Planning Portal (DPE, 2022e), as shown in Figure 6-8. High temperatures combined with thunderstorm activity in these areas can initiate major fire events. Prolonged drought conditions can also exacerbate bushfire impacts. However, the Department of Primary Industries (DPI) Combined Drought Indicator indicates that there are no areas currently suffering from drought in the Central-West Orana region.

Electric and magnetic fields

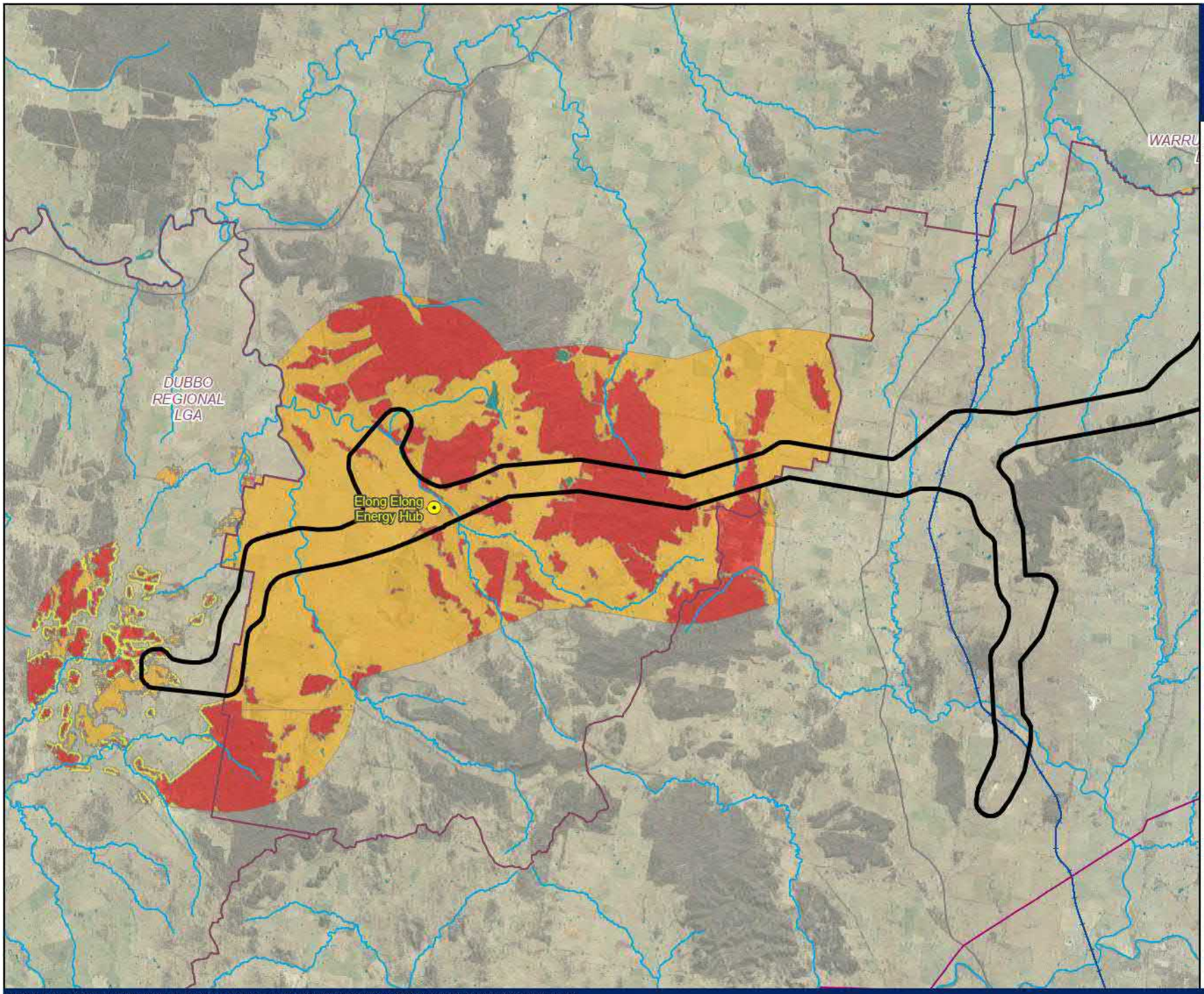
Electric and magnetic fields (EMF) are part of the natural environment with electric fields present in the atmosphere in ionospheric currents, thunderstorms and lightning while static magnetic fields are created by the earth's core. EMF is also produced wherever electricity or electrical equipment is in use. Transmission lines, electrical wiring, household appliances and electrical equipment generally produce extremely low frequency (ELF) EMF that occupy the lower part of the electromagnetic spectrum in the frequency range 0 – 3000 Hertz (ARPANSA, 2022).

For a transmission line, the strength of the electric field varies generally with the operating voltage of the line (measured in volts), while the magnetic field strength is related to the current flowing in the line (measured in amps). The current flowing in the transmission line is dependent upon the load or power flow and would vary with consumer demand (which varies on a daily and seasonal basis). The EMF strengths at ground level, below the conductors, are also dependent on the height of the wires above the ground and their geometric arrangements as supported by the transmission structures. Typically, EMF are strongest closest to the transmission lines, with their levels quicky reducing with distance from the wire.

Parts of the project study area contain existing HV transmission lines (up to 330 kV), low voltage distribution lines and a substation, which are all current sources of EMF.

Dangerous goods and hazardous materials

Dangerous goods and hazardous material may currently be stored and transported within the project study area for use in farming and forestry practices and mining processes. Businesses are required to store, handle and use these dangerous goods and hazardous materials in accordance with the *NSW Work Health and Safety Act 2011* and relevant Australian Standards. Road users are required to transport dangerous goods and hazardous materials within the surrounding road network in accordance with the *Dangerous Goods (Road and Rail Transport) Act 2008* and the Dangerous Goods (Road and Rail Transport) Regulation 2014.



Central-West Orana REZ Transmission

Figure 6-8 - Map 1 of 4
Bushfire risk and mine subsidence

Legend

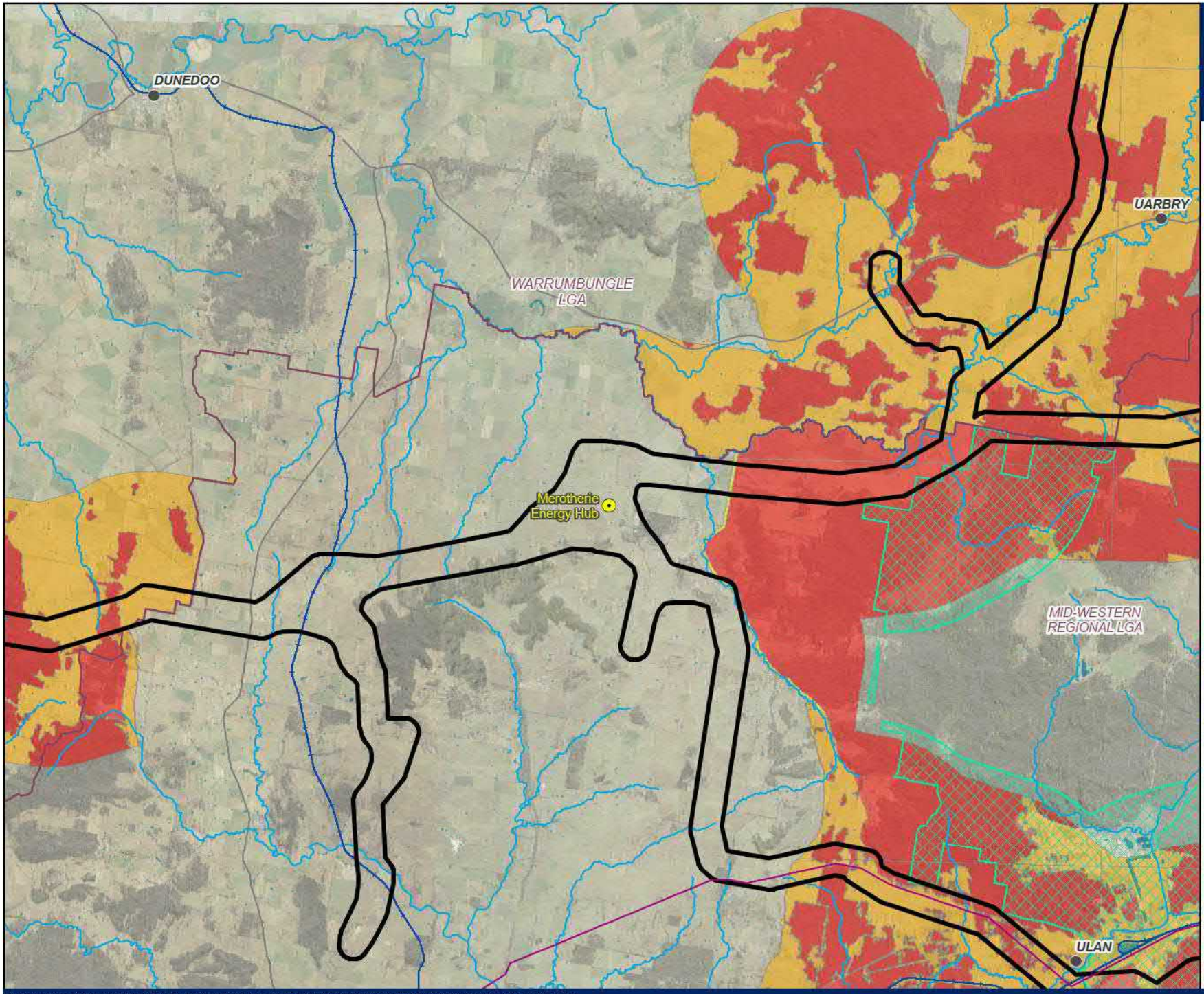
- Town
- Energy hub/switching station indicative location
- Existing substation
- Existing transmission line
- Railway
- Road
- Watercourse
- Waterbody
- Mudgee mine subsidence district
- Local government area
- Project study area

Bushfire prone land

- Vegetation category 1
- Vegetation category 2
- Vegetation buffer

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:180,000
Data sources: WSP 2022

C:\Users\Angela.Sun\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\02_ScopingReport\PS130593_ENV_F008_BushfireMineSubsidenceRisk_r1v5.mxd



Central-West Orana REZ Transmission

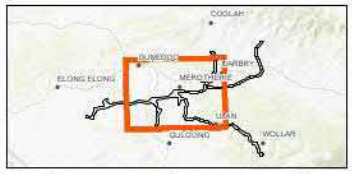
Figure 6-8 - Map 2 of 4
Bushfire risk and mine subsidence

Legend

- Town
- Energy hub/switching station indicative location
- Existing substation
- Existing transmission line
- Railway
- Road
- Watercourse
- Waterbody
- Mudgee mine subsidence district
- Local government area
- Project study area

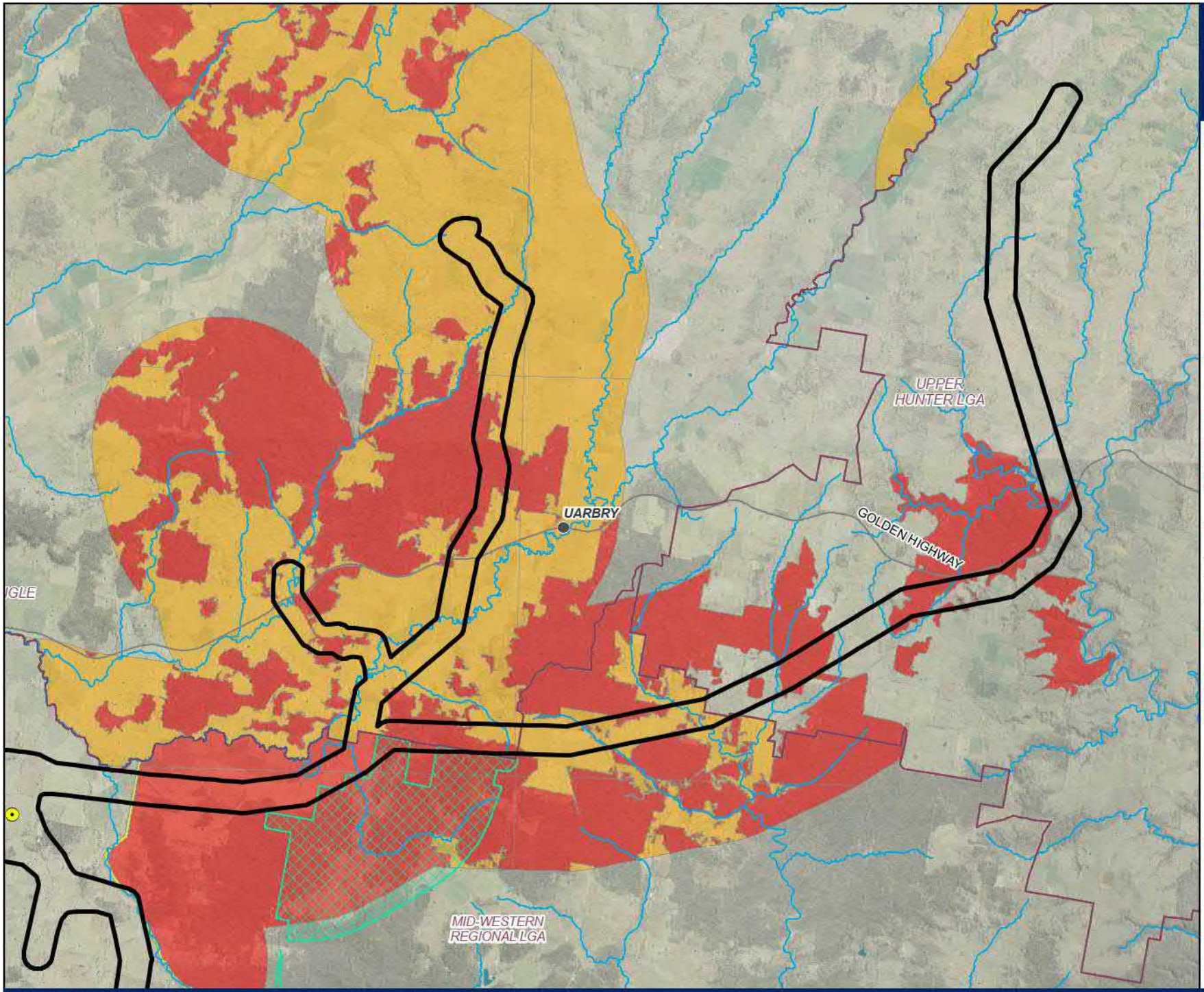
Bushfire prone land

- Vegetation category 1
- Vegetation category 2
- Vegetation buffer



Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:180,000
Data sources: WSP 2022

C:\Users\Angela.Sun\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_SubstationMod\02_ScopingReport\PS130593_ENV_F008_BushfireMineSubsidenceRisk_r1v5.mxd



Central-West Orana REZ Transmission

Figure 6-8 - Map 3 of 4
Bushfire risk and mine subsidence

Legend

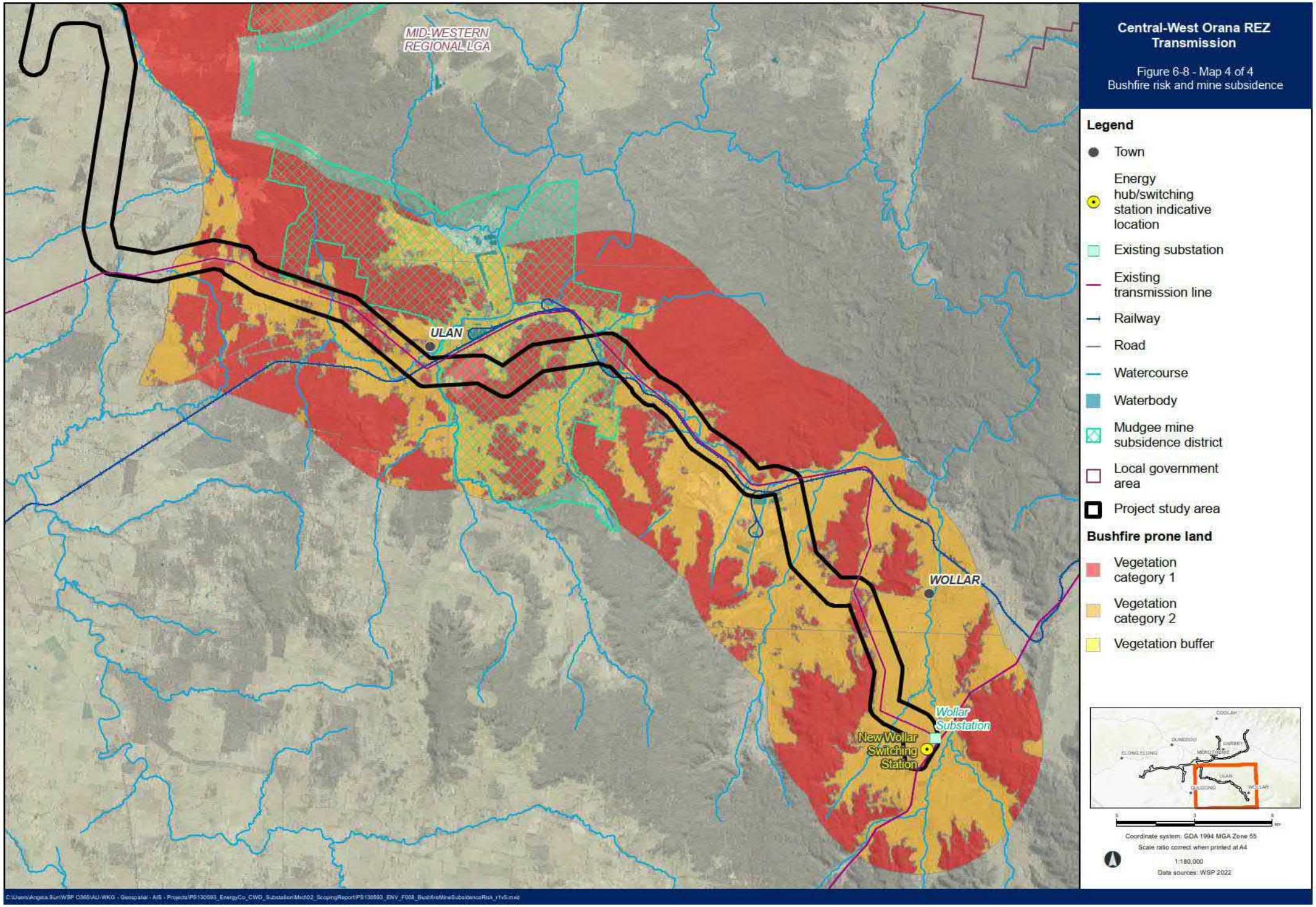
- Town
- Energy hub/switching station indicative location
- Existing substation
- Existing transmission line
- Railway
- Road
- Watercourse
- Waterbody
- Mudgee mine subsidence district
- Local government area
- Project study area

Bushfire prone land

- Vegetation category 1
- Vegetation category 2
- Vegetation buffer

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:180,000
Data sources: WSP 2022

C:\Users\Angela.Sun\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\02_ScopingReport\PS130593_ENV_F008_BushfireMineSubsidenceRisk_r1v5.mxd



Central-West Orana REZ Transmission

Figure 6-8 - Map 4 of 4
Bushfire risk and mine subsidence

Legend

- Town
- Energy hub/switching station indicative location
- Existing substation
- Existing transmission line
- Railway
- Road
- Watercourse
- Waterbody
- Mudgee mine subsidence district
- Local government area
- Project study area

Bushfire prone land

- Vegetation category 1
- Vegetation category 2
- Vegetation buffer

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:180,000
Data sources: WSP 2022

C:\Users\Angela.Sun\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\02_ScopingReport\PS130593_ENV_F008_BushfireMineSubsidenceRisk_r1v5.mxd

Mine subsidence risk

Mine subsidence is the propensity for upward, lateral (sideways), or downward ground movement due to former or current mine operations, which can result in structures moving, sinking in one area or across the entire foundation footprint.

A search of the NSW Planning Portal ePlanning Spatial Viewer (DPE, 2022e) on 4 May 2022 indicates that parts of the central-eastern and southeastern sections of the project study area in Bungaba and Ulan are located within the Mudgee subsidence district (refer to Figure 6-8).

Utilities

Several transmission lines and substations occur within the project study area or in the surrounding area. There is also the potential for other utilities, such as telecommunications cables and gas, water and sewer mains to occur in the project study area.

6.11.2 Potential impacts

Bushfire risk

There is a risk that construction activities, plant, equipment and infrastructure could be impacted by bushfire as well as a risk that construction activities could initiate bushfires. Should a fire start in the project study area during construction, there would be a potential threat to construction personnel, especially where the bushfire event is fast moving.

During operation, the occurrence and/or spread of a bushfire within the project study area has the potential to impact on project infrastructure. Ongoing vegetation management would occur within the transmission line easement and an Asset Protection Zone (APZ) would likely be maintained around the energy hub and switching station sites to minimise bushfire risk.

Vegetation within the transmission line easement will need to be managed on an ongoing basis due to annual plant growth increasing fuel hazard and the potential for growing tips to contact with live lines and initiate a fire, which would present a risk to life, property and the environment. Controlling fires along live transmission line breaks is constrained by the potential for electrical arcing to impact ground crews and limited aerial firefighting options.

Electric and magnetic fields

The scientific literature on EMF exposure is extensive, complex and inconclusive. In addressing the question of adverse health effects, expert advice on EMF from competent health authorities in Australia and from around the world is relied upon. This includes the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), which is the Australian Government agency responsible for providing health assessments and recommendations to the Government on matters relating to EMF. ARPANSA has adopted the International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines for limiting exposure to EMF (ICNIRP, 2010).

The project would introduce new HV transmission lines, energy hubs and switching stations within the project study area, which would result in additional increases to electric and magnetic fields in the local area. The proposed transmission lines, energy hubs and switching stations would be designed and built to ensure that exposure levels are within the limits recommended by the ICNIRP guidelines. The proposed transmission lines would also be located as far away as possible from residential dwellings to further minimise this risk. There are currently no recognised international guidelines to specifically protect animals and plants from EMF.

Dangerous goods and hazardous materials

There is the potential that the onsite storage, use and transport of dangerous goods and hazardous materials required for construction of the project may result in the accidental release of chemicals, fuel and materials to occur, which could potentially impact construction workers, nearby residential receivers and/or the surrounding environment. To manage this risk, all dangerous goods and hazardous materials that may be required would be stored and managed in accordance with the *Work Health and Safety Act 2011* and the *Storage and Handling of Dangerous Goods Code of Practice* (WorkCover NSW, 2005).

It is not anticipated that substantial volumes of dangerous goods or hazardous materials would be used during operation of the project. However, the storage, use and transport of dangerous goods and potentially hazardous materials would present a potential operational risk for the project, which could result in the accidental release of these goods and materials which may impact the local environment and/or human health.

Mine subsidence risk

Mine subsidence may pose a risk to proposed structures during construction and operation that will need to be considered during design, specifically:

- soil slippage during construction, which often requires stabilisation prior to conducting excavation for proposed structures
- ground instability and surface strains and tilts, leading to structural damage to transmissions infrastructure, such as cracks, separation of joints, buckling of pipes and sunken floors.

Subsidence Advisory NSW is the NSW Government agency responsible for regulating and administering the mine subsidence compensation system in NSW. Subsidence Advisory NSW has developed and applied surface development guidelines in accordance with the *Coal Mine Subsidence Compensation Act 2017*, to mitigate or eliminate the damage to surface structures from mine subsidence within mine subsidence districts. Design information will be provided to Subsidence Advisory NSW to determine subsidence related design parameters to be addressed by the detailed design.

Utilities

Damage, rupture and/or failure to shut down, isolate or otherwise appropriately manage utilities during construction activities has the potential to result in environmental hazards or disruption to services. The potential risk associated with utility related hazards will be minimised by carrying out utility checks and consulting with the relevant utility providers.

At this stage of project development, interfaces with other utilities are expected to be limited to existing transmission lines and the existing Wollar Substation. This will be reviewed as design of the project is further developed.

6.11.3 Proposed further assessments

Bushfire risk

A detailed bushfire hazard assessment will be completed to consider the potential impact of the project on bushfire risk and potential impacts to public safety, property and the environment. The assessment will identify bushfire risks within and adjacent to the project study area due to the construction and operation of the project. The assessment will identify suitable management approaches, including emergency planning, infrastructure protection and APZs, with reference to relevant Australian guidelines, standards and building codes.

The following government guidelines are relevant to the project:

- *Planning for Bush Fire Protection* (NSW Rural Fire Service, 2019)
- *AS3959:2018 – Construction of buildings in bushfire-prone areas* (Standards Australia, 2018).

Electric and magnetic fields

A detailed assessment will be completed to assess the potential impacts of EMF from the project, using the ICNIRP Guideline. This will include consideration of potential health risks for adjacent residents resulting from EMF associated with the development of new HV transmission lines, energy hubs and switching stations.

The ICNIRP Guideline sets 'Basic Restrictions' derived from the levels at which interactions with the central nervous system are established, with a safety factor applied. The Basic Restrictions are expressed in terms of electric field levels within the human body but, as these levels can only be assessed by sophisticated computer modelling of the body, ICNIRP also sets 'Reference Levels' for EMF. These levels are conservatively set such that, provided they are met, the Basic Restrictions will also be met without the need for more comprehensive analysis. The ICNIRP 'Basic Restrictions' and 'Reference Levels' for the general public will be used as compliance criteria in the EIS assessment of EMF.

Given the inconclusive nature of the science regarding EMF at levels commonly associated with electrical equipment and human health, the 'prudent avoidance' approach will be applied. The following government guidelines and standards are relevant to the project:

- *Guidelines for Limiting Exposure to Time-varying Electric and Magnetic Fields (1 Hz to 100 kHz)* (ICNIRP, 2010)
- *C95.6-2002 – IEEE Standard for Safety Levels With Respect to Human Exposure to Electromagnetic Fields, 0-3 kHz* (Institute of Electrical and Electronics Engineers (IEEE), 2002).

Dangerous goods and hazardous material

A standard assessment will be completed that considers the general risks associated with the storage and/or transport of dangerous goods or hazardous materials. The following government guidelines are relevant to the project:

- *Australian Code for the Transport of Dangerous Goods by Road and Rail* (National Transport Commission, 2020)
- *Hazardous and Offensive Development Application Guidelines: Applying SEPP 33* (NSW Department of Planning, 2011).

Mine subsidence risk

A standard assessment of mine subsidence risk within the project study area will be undertaken as part of further geotechnical assessment carried out for the project. Further consultation will be undertaken with Subsidence Advisory NSW during refinement of the design. Those aspects of the project located within the Mudgee subsidence district will be designed in accordance with any requirements provided by Subsidence Advisory NSW.

Utilities

A standard assessment of risks to utilities will be included in the EIS. This will be informed by further engagement with relevant utility owners and development of the construction methodology.

6.12 Traffic and transport

6.12.1 Existing environment

The road network within the project study area includes several major roads, including:

- Golden Highway (B84), which crosses the project study area at Uarbry, Leadville and Cassilis
- Castlereagh Highway (B55), which crosses the project study area at Tallawang.

The project study area is also traversed by several regional roads, including Wollar Road, Ulan Road, Cope Road and Spring Ridge Road, as well as a large number of local and private rural roads with varying speed limits and conditions.

Two existing railway lines traverse the project study area:

- Wallerawang Gwabegar line, which crosses the central section of the project study area in a north-south direction and the southern arm of the central section in a north-west to south-east direction, east of the Castlereagh Highway. This line runs from Wallerawang on the Main Western Line to Gwabegar. Primary traffic on this line is coal trains and cement traffic from Kandos to Wallerawang and seasonal wheat traffic from Binnaway to Coonabarabran.
- Sandy Hollow Gulgong line, which crosses the southeastern section of the project study area from Ulan to Wilpinjong. This line runs from the Ulan Coal Loader to Sandy Hollow and forms a cross-country link between the Main North Line and the Wallerawang Gwabegar Line. Primary traffic on this line is coal trains from the Ulan colliery.

The proposed Gulgong Mary Vale line crosses the southwestern section of the project study area in an east-west direction at Goolma. This project is at an early stage of development.

6.12.2 Potential impacts

Construction of the project would require the use of heavy vehicles to deliver construction plant, equipment and materials, as well as the removal of waste. Light vehicle movements would also be required for construction, mostly associated with the movement of construction workers.

Potential construction traffic and transport impacts associated with these heavy and light vehicle movements include:

- impacts on intersection and traffic performance on the surrounding road network, particularly near construction compounds and accommodation camp sites
- temporary disruptions to traffic movements along roads within the project study area during the transmission line stringing works above or near the road, and during the delivery of large project components
- impacts on the condition of roads due to increased construction traffic
- potential disruptions to rail movements along the Wallerawang Gwabegar and Sandy Hollow Gulgong railway lines when construction works are being completed above this rail infrastructure in the project study area.

Helicopters may also be used for the delivery of some equipment and materials, while drones could be used for stringing of the transmission lines in certain areas. The coordination of aerial activities would be completed in consultation with local landowners, Airservices Australia and CASA to minimise any potential air traffic conflicts, as required.

During operation of the project, traffic and transport impacts are expected to be minimal and would typically be limited to occasional vehicle travel by staff to energy hub and switching station sites and/or to the transmission line via the surrounding road network. Annual fly overs for seasonal bushfire prevention surveys, or on as needs basis in response to operational situations (for example, unplanned outages) would also occur.

6.12.3 Proposed further assessments

A detailed traffic and transport assessment will be completed for the EIS. Potential traffic and transport impacts from construction of the project will be identified and assessed in the EIS, and will propose management measures to avoid, minimise and manage the potential impacts.

The assessment will be informed by traffic monitoring data carried out to understand existing traffic on key vehicle routes to be used for construction of the project, supplemented by relevant publicly available traffic data.

The assessment of construction traffic and transport impacts will include:

- a description of the existing traffic and transport environment of the project study area, including traffic volumes, road regulations (speed limits, heavy vehicle restrictions), crash history, as well as active and public transport provisions
- identification of key vehicle routes, and access and egress points of construction compound, laydown and accommodation camp sites
- identification of daily and peak traffic movements likely to be generated from construction of the project
- a qualitative assessment of construction vehicle movements to identify the potential impacts of the project's construction traffic on the performance of key roads within the surrounding road network
- consideration of potential impacts of the project on active and public transport infrastructure and services, where relevant
- consideration of the potential impacts on property access by the project during construction, such as access adjustments and/or temporary disruptions
- consideration of the potential impacts on road condition due to increased vehicular movements during construction
- mitigation measures to avoid, minimise and manage any identified potential impacts of the project.

A qualitative assessment of the potential operational traffic impacts of the project will be undertaken which will consider the potential impacts of maintenance vehicles along the public road network in the project study area on the road network, public and active transport infrastructure and property access. As aerial operations will be annual or on an ad-hoc basis, no further assessment is proposed.

The following government plans, policies and guidelines will be relevant to the project:

- *NSW Heavy Vehicle Access Policy Framework* (Transport for NSW, 2018)
- *2026 Road Safety Action Plan* (Transport for NSW, 2022a)
- *Traffic control at work sites – Technical Manual* (Transport for NSW, 2022b)
- *Guide to Pavement Technology Part 6: Unsealed Pavements* (Austroads, 2009)
- *Austroads Guide to Traffic Management* (Austroads, 2020)
- *Transport Management Plans for oversize and/or overmass movements in NSW* (Transport for NSW, 2013)
- *Additional Access Conditions, Oversize and Overmass Heavy Vehicles and Loads* (Transport for NSW, 2020a).

6.13 Waste management and resource use

6.13.1 Existing environment

Waste management and waste transfer facilities within and near the project study area are located at Birriwa, Dunedoo, Dubbo, Goolma, Gulgong, Ulan, Wollar, Cassilis and Coolah.

6.13.2 Potential impacts

Waste management

The construction of the project would generate a range of typical solid and liquid waste materials including:

- vegetation waste from clearing of easements, access roads and energy hub and switching station sites
- excess spoil from excavations and access track works that cannot be reused onsite
- surplus construction materials such as steel, concrete, construction off-cuts and packaging
- general domestic waste from construction and maintenance personnel
- waste and wastewater produced at construction compounds and workforce accommodation camp/s
- small quantities of waste oils, greases, chemicals and lubricants from operation of construction plant and equipment.

During operation, maintenance activities would be the main source of waste material, and is expected to consist of mostly green waste from vegetation maintenance in the transmission line easement, as well as small quantities of other waste materials (such as the replacement of fittings and equipment) and general domestic waste from operation and maintenance personnel.

Construction and operational waste would be managed and handled in accordance with the *Waste Classification Guidelines* (EPA, 2014).

Construction waste would be segregated and stockpiled on site, with materials such as clean excavated soil, concrete, timber, plastic and metals separated for reuse or recycling. Any potentially contaminated or hazardous materials would need to be handled carefully and segregated to minimise the risk of cross-contamination.

Waste requiring disposal during construction and operation would be directed to a waste management facility that is lawfully permitted to accept that type of waste.

The disposal of waste generated during construction and operation of the project is not anticipated to result in significant adverse environmental impacts as removal of waste generated would be managed through the application of standard environmental management measures which would be identified as part of the EIS.

Resource use

Resources used during the construction and operation of the project would include:

- fill material (construction phase)
- water (construction phase)
- electricity (construction and operational phases)
- fuel (construction phase)
- concrete (construction phase)
- steel (primarily construction phase).

While the project would result in some increased demand on local and regional resources, it would be unlikely that the project alone would result in any resource becoming scarce or in short supply, with the exception of construction water.

At this stage, it is expected that water would be sourced via existing licences or from treated wastewater if available in the nearby region (primarily for dust suppression). However, all potential sources of water will be identified and water usage will be assessed as part of the EIS.

6.13.3 Proposed further assessments

A standard assessment of waste management and resource use will be included in the EIS to identify:

- potential waste streams that would be generated during construction and operation of the project
- the resources expected to be required for construction and operation of the project
- standard management practices compliant with the *Waste Avoidance and Resource Recovery Act 2001* and other relevant policies and guidelines to avoid or minimise waste from the project. This will include spoil management and disposal practices.

Should the project need to construct and operate new water supply points during construction, a detailed assessment will be included in the EIS relevant to the water source (being surface water or groundwater) and water sharing plan.

The following legislation and government guidelines are relevant to the project:

- *Waste Classification Guidelines* (EPA, 2014)
- *Waste Avoidance and Resource Recovery Act 2001*
- *NSW Waste avoidance and resource recovery strategy 2003* (Resource NSW, 2003)
- *NSW Waste and Sustainable Materials Strategy – Stage 1: 2021-2027* (DPIE, 2021h).

6.14 Hydrology, flooding and water quality

6.14.1 Existing environment

Surface water and hydrology

The project study area extends across the Macquarie-Bogan and Hunter surface water catchments (refer to Figure 6-9). These catchments are subject to the provisions of the *Water Sharing Plan for the Macquarie Bogan Unregulated and Alluvial Water Sources 2012* and *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009*.

The Talbragar River and other permanent and ephemeral watercourses are present within the project study area.

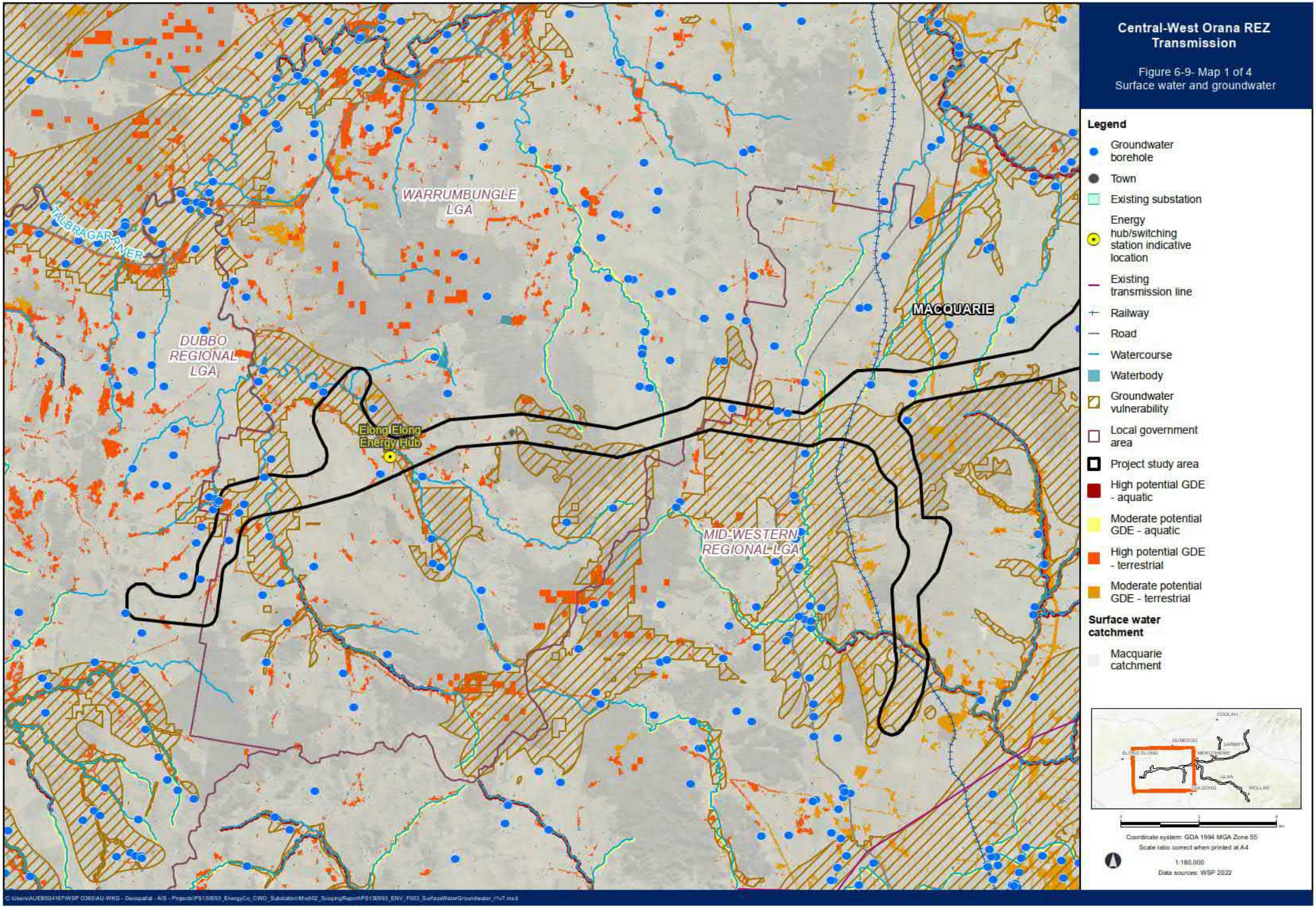
As stated in Section 6.5.1, key fish habitat is present within the project study area within named watercourses.

Water quality

Existing water quality within the project study area is expected to be influenced by surrounding land uses, such as existing agricultural operations that may have resulted in increased pollutants from pesticides, herbicides, fertilisers and sedimentation within nearby watercourses.

Flooding

Limited flooding information is available for the project study area and there are no flood studies relevant to the project study area. Local environmental plans identify flood planning areas, where developments may be subject to flood related controls. LEPs relevant to the project do not identify any flood planning areas within the project study area.



Central-West Orana REZ Transmission

Figure 6-9- Map 1 of 4
Surface water and groundwater

Legend

- Groundwater borehole
- Town
- Existing substation
- Energy hub/switching station indicative location
- Existing transmission line
- Railway
- Road
- Watercourse
- Waterbody
- Groundwater vulnerability
- Local government area
- Project study area
- High potential GDE - aquatic
- Moderate potential GDE - aquatic
- High potential GDE - terrestrial
- Moderate potential GDE - terrestrial

Surface water catchment

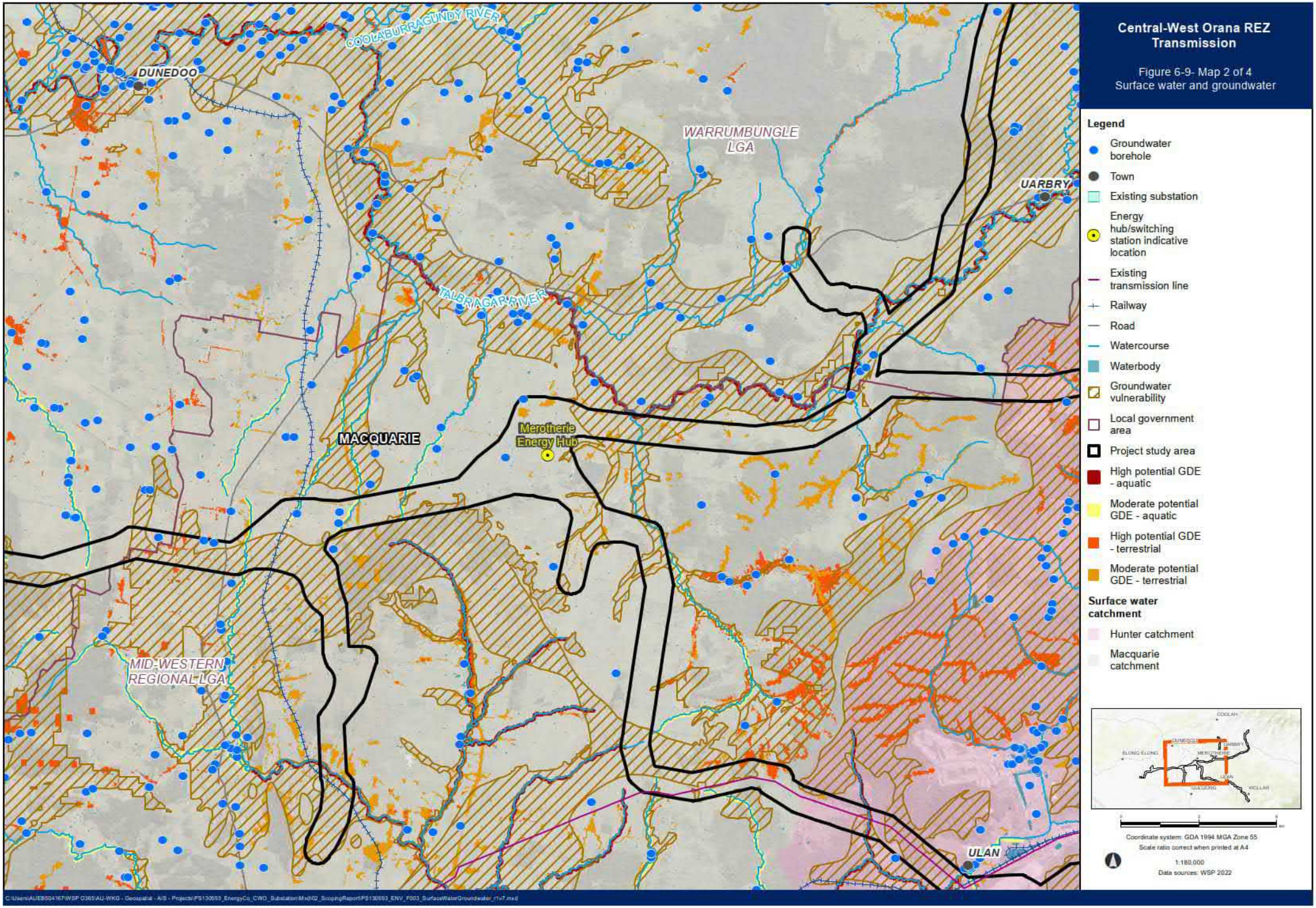
- Macquarie catchment

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4

1:180,000

Data sources: WSP 2022

C:\Users\AUEB504157\WSP O365\AU-WKG - Geospatial - A/S - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\02_Scoping\Report\PS130593_ENV_F003_SurfaceWaterGroundwater_r1v7.mxd



Central-West Orana REZ Transmission

Figure 6-9- Map 2 of 4
Surface water and groundwater

Legend

- Groundwater borehole
- Town
- Existing substation
- Energy hub/switching station indicative location
- Existing transmission line
- Railway
- Road
- Watercourse
- Waterbody
- Groundwater vulnerability
- Local government area
- Project study area
- High potential GDE - aquatic
- Moderate potential GDE - aquatic
- High potential GDE - terrestrial
- Moderate potential GDE - terrestrial

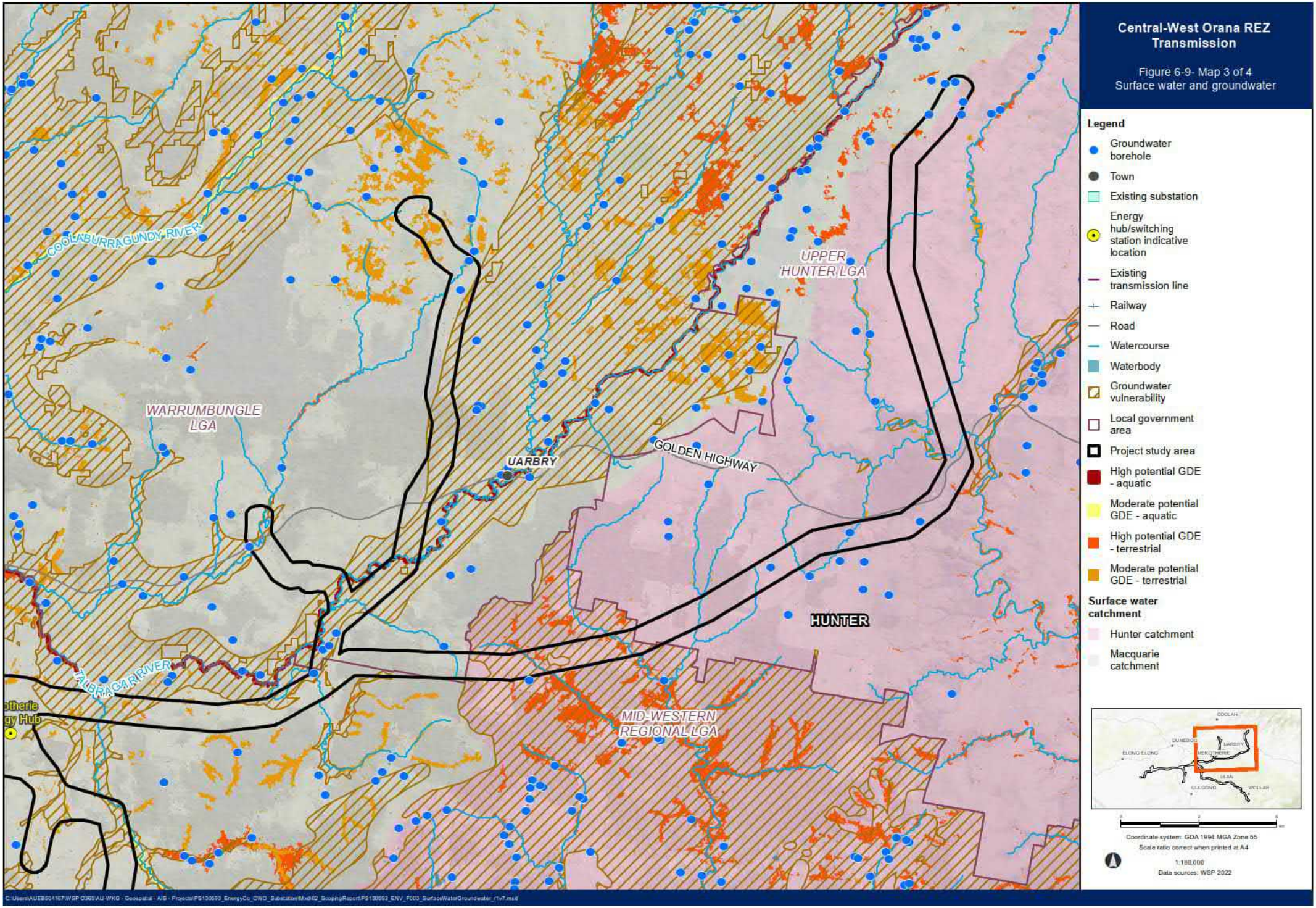
Surface water catchment

- Hunter catchment
- Macquarie catchment

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4

1:180,000

Data sources: WSP 2022



Central-West Orana REZ Transmission

Figure 6-9- Map 3 of 4
Surface water and groundwater

Legend

- Groundwater borehole
- Town
- Existing substation
- Energy hub/switching station indicative location
- Existing transmission line
- Railway
- Road
- Watercourse
- Waterbody
- Groundwater vulnerability
- Local government area
- Project study area
- High potential GDE - aquatic
- Moderate potential GDE - aquatic
- High potential GDE - terrestrial
- Moderate potential GDE - terrestrial

Surface water catchment

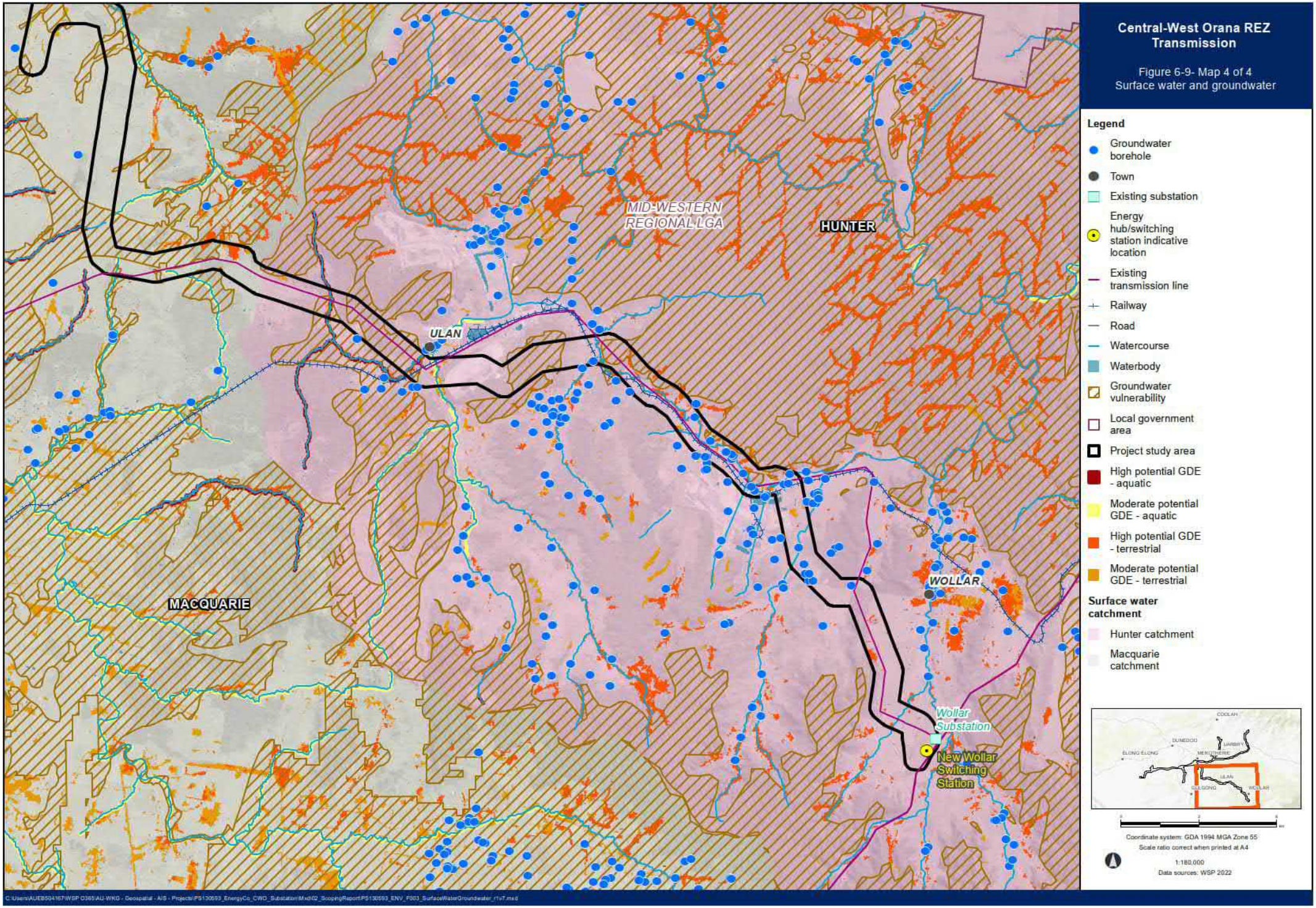
- Hunter catchment
- Macquarie catchment

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4

1:180,000

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\02_ScopingReport\PS130593_ENV_F003_SurfaceWaterGroundwater_r1v7.mxd



Central-West Orana REZ Transmission

Figure 6-9- Map 4 of 4
Surface water and groundwater

Legend

- Groundwater borehole
- Town
- Existing substation
- Energy hub/switching station indicative location
- Existing transmission line
- Railway
- Road
- Watercourse
- Waterbody
- Groundwater vulnerability
- Local government area
- Project study area
- High potential GDE - aquatic
- Moderate potential GDE - aquatic
- High potential GDE - terrestrial
- Moderate potential GDE - terrestrial

Surface water catchment

- Hunter catchment
- Macquarie catchment

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4

1:180,000

Data sources: WSP 2022

C:\Users\AUE8504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\02_ScopingReport\PS130593_ENV_F003_SurfaceWaterGroundwater_r1v7.mxd

6.14.2 Potential impacts

Water quality

Construction and operation of the project has the potential to impact surface water quality through:

- pollution of stormwater runoff with sediments, fuel and other hazardous materials from construction sites or oils and other hazardous material from energy hub and switching station sites
- offsite discharge of water from concrete batching plants
- potential exposure of saline and/or acid sulfate soils resulting in off-site discharge of saline and/or acidic water during construction.

If not managed appropriately, these impacts could result in changes to the pH, electrical conductivity, dissolved oxygen and temperature of nearby watercourses, reduced light penetration due to increased turbidity and the introduction of gross pollutants and toxic pollutants, such as construction fuels, oils and grease and chemicals, into nearby watercourses.

Surface water and hydrology

Construction of the project has the potential to impact on surface water and hydrology by altering the characteristics of surface water flows (for example volume, rate, timing and velocity) and/or drainage patterns, resulting in watercourses becoming geomorphologically less stable. Construction activities that may generate these potential impacts could include:

- the location of earthworks, flow diversions, bunding, material stockpiles and temporary drainage infrastructure during construction
- attenuated or delayed discharge or reuse of stormwater captured in temporary construction sediment basins
- discharge of groundwater inflows from construction excavations into watercourses
- extraction of groundwater for use during construction, that may impact surface water baseflows
- works in natural watercourses for construction access tracks, that may alter surface water flows and water levels.

The introduction of additional areas of hardstand associated with energy hub and switching station sites may also result in minor localised impacts to surface water and hydrology by altering the characteristics of surface water flows and/or drainage patterns during operation of the project.

Flooding

Construction works would have the potential to impact flooding due to potential impacts on local overland flow paths and existing drainage paths as a result of:

- interruption of overland flow paths by temporary structures (ancillary facilities), materials, plant and equipment
- altered stream flows due to the establishment of temporary access tracks.

Potential impacts on flooding during operation relate to structures and infrastructure such as at the energy hub and switching station sites creating obstructions. No structures will be located within major watercourses, however they may be located within floodplains. Structures will be designed to not impede flood flows.

6.14.3 Proposed further assessments

A standard hydrology, flooding and water quality assessment will be included in the EIS. The assessment will be informed by a review of available climatic data, topographic and aerial photography information, the NSW River Styles database, environmental values in the area and available flood and overland flow study reports, plans and available mapping.

The project study area will be characterised in terms of the existing hydrologic and flood environments across a range of flood events, existing flood emergency management procedures, existing flood hazard, current and future rainfall and key water sensitive environments as well as existing water quality conditions and water quality objectives of key watercourses.

The assessment will include a qualitative assessment of potential impacts of the project on key hydrologic receiving environments. Key flood related risks, including flood levels, flood hazard and flood debris, to the project and the potential change to flood behaviour as a result of the project will be identified. Where the proposed works may have a significant impact on flooding and hydrology, high level hydrology and hydraulic models will be developed at selective watercourses.

For all aspects of the hydrology, flooding and water quality assessment, impacts will be assessed, and mitigation and management measures will be developed. Impacts are anticipated to be manageable through appropriate design of permanent drainage and water quality treatment systems for the new energy hub and switching station sites, siting new infrastructure away from floodplains or watercourses where possible, and implementation of standard management measures for construction and operation.

The following government plans, policies and guidelines are relevant to the project:

- *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom, 2004)
- *Managing Urban Stormwater: Soils and Construction Volume 2* (DECC, 2008)
- *Approved methods for the sampling and analysis of water pollutants in NSW* (EPA, 2022)
- *Policy and guidelines for fish habitat conservation and management* (NSW DPI, 2013)
- *Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions* (OEH, 2017)
- *National Water Quality Management Strategy* (Department of Agriculture and Water Resources, 2018)
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ, 2000)
- *NSW Water Quality and River Flow Objectives* (DECCW, 2006)
- *Erosion and Sediment Control on Unsealed Roads – A field guide for erosion and sediment control maintenance practices* (OEH, 2012b)
- *Australian Rainfall and Runoff: A Guide to Flood Estimation* (Ball et al., 2019)
- *The NSW Floodplain Development Manual 2005* (NSW Government, 2005)
- *Flood risk management guidelines - Practical Consideration of Climate Change* (DECC, 2007).

6.15 Groundwater

6.15.1 Existing environment

A search of the Bureau of Meteorology's Australia Groundwater Explorer on 11 August 2022 indicated the groundwater level across the project study area is variable from approximately three to 70 metres below ground level (Bureau of Meteorology, 2022b).

Existing boreholes and areas that have been mapped as having vulnerable groundwater resources are shown in Figure 6-9 (NSW DPIE, 2014a). Areas that have been mapped as having vulnerable groundwater resources show the vulnerability (or level of risk) of aquifers to contamination relating to the geological and hydrogeological characteristics of the location that affect and control groundwater movement, such as the depth to the water table, topography, hydraulic conductivity, geology and soil type. High vulnerability ranked groundwater resources are predominantly found in the unconfined, shallow, highly permeable aquifers or highly fractured locally recharged basaltic and granite terrains, whereas low vulnerability ranked groundwater resources are generally characterised by a deep watertable, very steep slopes and meta-sedimentary geology (sedimentary rock that has been subject to metamorphism).

Groundwater sharing plans that are in place within the project study area include:

- NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020
- NSW Murray Darling Basin Porous Rock Groundwater Sources 2020
- Macquarie-Castlereagh Groundwater Sources 2020
- North Coast Fractured and Porous Rock Groundwater Sources 2016.

As discussed in Section 6.5.1, there are a number of moderate and high potential aquatic and terrestrial GDEs (shown in Figure 6-9) and high priory GDEs within the project study area.

6.15.2 Potential impacts

During construction, potential impacts to groundwater may include:

- changes to groundwater connectivity, flow direction, levels and/or recharge rates due to the extraction of groundwater for use during construction and/or should groundwater be intercepted and temporary dewatering be required during excavation for the installation of new project infrastructure (e.g. transmission towers, energy hub sites or switching station sites)
- impacts on groundwater quality, associated with the generation of turbid or saline water, and/or pollution, with construction of the project having a minor potential for spills or leaks to allow fuels, chemicals or wastewater to enter shallow aquifers
- impacts on groundwater users due to a decrease or change in groundwater levels as a result of interference to aquifers or the extraction of groundwater for use during construction
- impacts on GDEs and riparian areas, due to the extraction of groundwater for use during construction and/or impacts on groundwater quality and flows (stated above).

The potential for impacts on groundwater and groundwater users during construction would depend on the proximity of the project to groundwater users (e.g. water supply bores and GDEs), the depth of excavation, the amount of groundwater extracted for construction use and whether blasting is required. These impacts will be considered as part of the EIS based on the proposed construction methodology.

The project is not expected to interact with groundwater during operation and therefore is not expected to impact on groundwater levels, flow or connectivity as a result of project operation. The installation of the energy hub and switching station sites would result in minor reduced local recharge into the groundwater at these locations, as precipitation that would normally fall on the recharge surface would be drained away. However, these impacts are expected to be minimal. as the surface water runoff is expected to infiltrate into the regional groundwater system regardless of the slightly increased impervious area.

There is not likely to be an operational impact on groundwater chemistry given the unlikely occurrence of accidental spills as well as the proposed operational control of runoff.

6.15.3 Proposed further assessments

A standard groundwater assessment will be included in the EIS. Publicly available geological and hydrogeological information and data from completed geotechnical investigations in the project study area will be reviewed to determine the existing groundwater environment (including groundwater levels, hydraulic conductivity, groundwater flow directions and groundwater quality) and identify existing boreholes, groundwater users and GDEs that could potentially be impacted by the project.

Potential groundwater impacts on groundwater resources, quality, users and receiving environments will be assessed for construction and operation of the project, and groundwater inflow to excavations will be estimated based on the identified characteristics of the existing groundwater environment, and project construction methodology.

The following government policies and guidelines are relevant to the assessment of potential groundwater impact of the project:

- *NSW Aquifer Interference Policy* (NSW DPI, 2012)
- relevant groundwater sharing plans, including the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020, NSW Murray Darling Basin Porous Rock Groundwater Sources 2020, Macquarie-Castlereagh Groundwater Sources 2020 and North Coast Fractured and Porous Rock Groundwater Sources 2016
- NSW DPE Groundwater Assessment Toolbox for major projects in NSW, including:
  - *Groundwater assessment toolbox for major projects in NSW – Overview document* (DPE, 2022b)
  - *Guidelines for Groundwater Documentation for SSD/SSI Projects – Technical guideline* (DPE, 2022c)
  - *Minimum Groundwater Modelling Requirements for SSD/SSI Projects – Technical guideline* (DPE, 2022d)
  - *Cumulative Groundwater Impact Assessment Approaches – Information paper* (DPE, 2022a)
- *Guidelines for groundwater quality protection in Australia National Water Quality Management Strategy* (Australian Government, 2013)
- *Guidelines for the Assessment and Management of Groundwater Contamination* (NSW Department of Environment and Conservation, 2007).

6.16 Soils and contamination

6.16.1 Existing environment

Geology, soils and topography

The project study area passes through a wide variety of terrains, ranging between 370 metres elevation near Wilpinjong in the southeastern section of the project study area and 690 metres elevation north of Cassilis in the northeastern section of the study area.

The project study area lies within the Brigalow Belt South and NSW South Western Slopes and Sydney Basin bioregions (NSW DPE, 2003). Due to the complex geology, varying topography and climate influences within these bioregions, a diverse range of landforms and soil types occur across the project study area, as described in Table 6-3. Subregions of the bioregions within the project study area are shown in Figure 6-10. Landslide risks have not been identified in the project study area (DPIE, 2014b).

Table 6-3 Geology, landforms and soils

IBRA region	Geology	Characteristic landform	Typical soils	Location in project study area
Brigalow Belt South				
Liverpool Range	Tertiary basalt flows with intervening sediments and ash fall material overlying Jurassic quartz black earths on lower sandstones and shale.	Undulating plateaus with steep gradients to long footslopes.	Soils typically consist of stony red brown loams on ridges, shallow stony clay soils on steep slopes and deep black earths on lower slopes.	Central and eastern arms of the northeastern section
Pilliga	Horizontal Jurassic quartz sandstones, limited shales, Tertiary basalt plugs and caps and the sediments derived from these rocks.	Stepped sandstone ridges with low cliff faces and a high proportion of rock outcrops. Long gentle slopes are intersected by sandy stream beds and former stream channels.	Soils consist mainly of shallow black earths and red loams on basalts.	Central and eastern arms of the northeastern section
Talbragar Valley	Mesozoic quartz sandstone, conglomerates and shales with minor Tertiary basalt caps and extensive alluvial wash plains.	Characterised by rocky hills, undulating long slopes and plains and wide valley floors with sandy streams.	Thin stony loams and texture contrast soils cover most of the landscape with deeper sands and brown earths typically found on valley floors.	Western section
NSW South Western Slopes				
Inland (Upper) Slopes	Ordovician to Devonian folded and faulted sedimentary sequences with inter-bedded volcanic rocks and large areas of intrusive granites.	Steep, hilly and undulating ranges and granite basins, with occasional basalt caps and confined river valleys with terrace remnants.	Soils typically consists of alluvial sands, loams and clays.	Central section
Sydney Basin				
Kerrabee	Triassic Narrabeen Group quartz and lithic sandstones and shales, with coal measures exposed in valley floors and volcanic necks of Jurassic age and small areas of ridge top Tertiary basalt flows occurring in some areas.	Sandstone plateaus, wide valleys and circular depressions or low domes depending on the relative erodibility of adjacent rock types.	Soils consist mainly of sandy texture contrast soils on slopes, harsh texture contrast soils on coal measures and deep sands and loams in alluvium.	Eastern and southeastern sections

Land contamination

The project study area encompasses many different land uses, however the majority of the project study area is anticipated to have minimal existing on-site contamination risks.

A search of the NSW Environment Protection Authority (EPA) Contaminated Land Record of Notices and list of notified sites on 11 August 2022 for the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter LGAs identified no known contaminated sites or contaminated sites notified to the EPA within the project study area (EPA, 2022). Contaminated sites outside the project study area are shown in Figure 6-10. The nearest sites notified to the EPA as being potentially contaminated are:

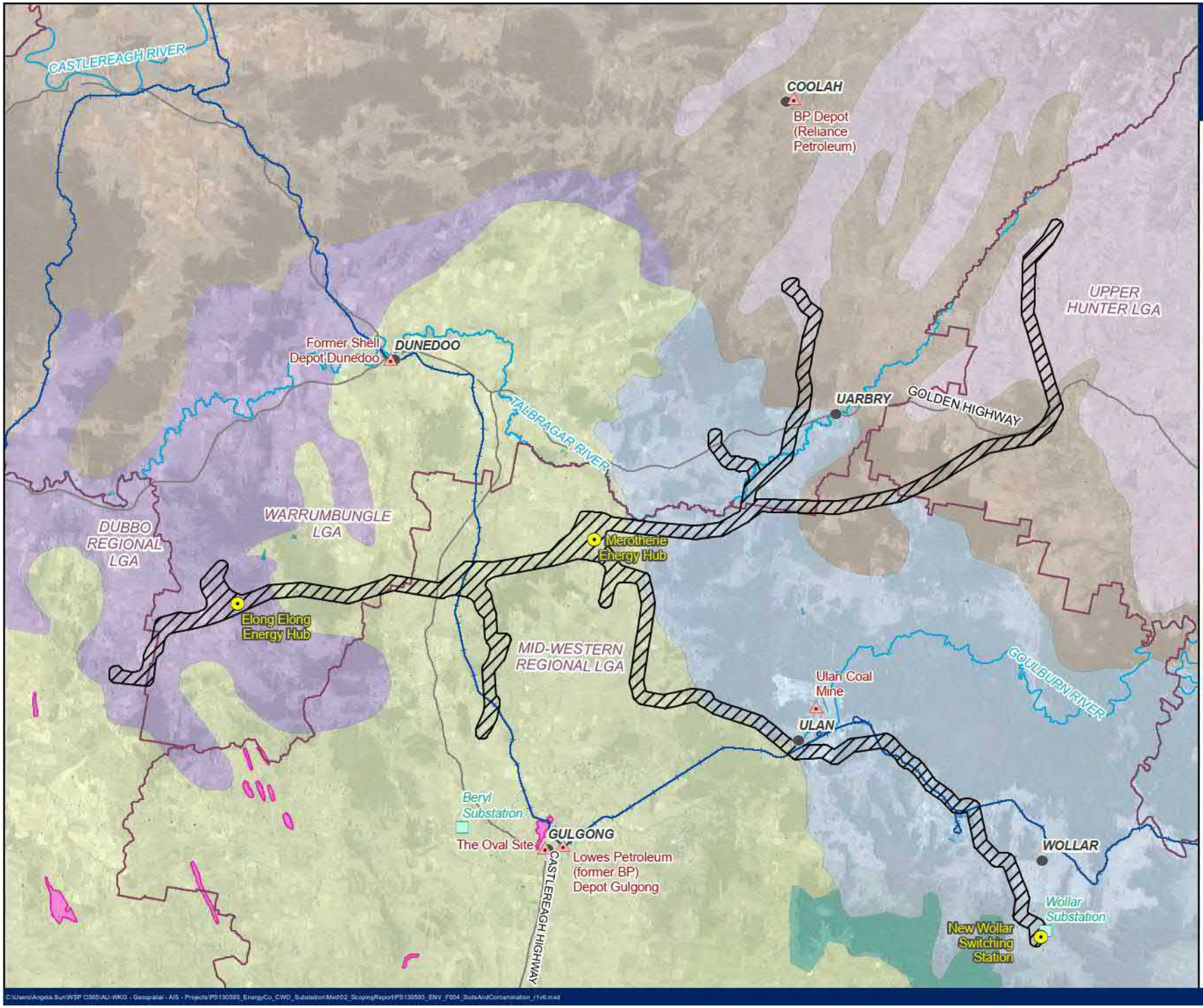
- a section of the rail corridor of the Wallerawang Gwabegar line in Tallawang, about two kilometres west of the southern arm of the central section of the project study area (location for this site has not been made publicly available and is therefore not shown in Figure 6-10). The site is currently being assessed by the EPA
- an open cut coal mine in Ulan, about 3.2 kilometres northwest of the southeastern section of the project study area. Regulation under the *Contaminated Land Management Act 1997* is not required for this site.

Only one other contaminated site notified to the EPA is located within 10 kilometres of the project study area, an oval located in Gulgong (about 9.9 kilometres from the project study area) (refer to Figure 6-10). Regulation under the *Contaminated Land Management Act 1997* is not required for this site.

The EPA is currently investigating potential Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) contamination at two locations near the project study area:

- groundwater bores in Dubbo City, located about 50 kilometres west of the western section of the project study area
- Fire and Rescue NSW in Wellington, located about 40 kilometres southwest of the western section of the project study area.

There is also the potential for localised contamination which is not currently identified on the register, including localised soil contamination from unregistered landfill and waste storage, agricultural chemicals storage, active or disused livestock dip sites which are potential sources of arsenic and pesticide contamination and localised pesticide use.



Central-West Orana REZ Transmission

Figure 6-10
Soils and contamination

Legend

- EPA contaminated site
- Existing substation
- Energy hub/switching station indicative location
- Town
- Railway
- Road
- Watercourse
- Waterbody
- Local government area
- Project study area
- Potential naturally ocurring asbestos (NOA)

IBRA subregions

- Inland slopes
- Kerrabee
- Liverpool range
- Pilliga
- Talbragar valley
- Wollemi

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:410,000
Data sources: WSP 2022

C:\Users\Angela.Sun\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\02_ScopingReport\PS130593_ENV_F004_SoilsAndContamination_r1v6.mxd

Acid sulfate soils

Acid sulfate soils are naturally occurring soils that contain high concentrations of micro-crystalline iron sulfide (pyrite), which on contact with oxygen and water combines to become sulfuric acid, potentially making the soil highly acidic. Acid sulfate soils are typically formed in regions that are subjected to long term waterlogged conditions, as are found in coastal estuarine environments and wetlands. Localised inland acid sulfate soils can occur within drainage lines, wetlands and billabongs where sulfate is present in the landscape. There is a low probability of encountering inland acid sulfate soils where salinity as a source is not present in the landscape. The project study area is mapped as having an extremely low probability or low probability of acid sulfate soils as per the CSIRO Australian Soil Resource Information System (ASRIS) (CSIRO, 2011).

Naturally occurring asbestos

Asbestos is a naturally occurring mineral comprised of fibrous silicate crystals found in rock, sediment or soil. When disturbed, the microscopic fibres of asbestos can be released into the air. The term Naturally Occurring Asbestos (NOA) distinguishes natural occurrences of asbestos from manufactured products that contain asbestos. The probability of encountering NOA within the top 10 metres of the ground surface in the project study area and surrounds is shown in Figure 6-10. This shows that NOA is not likely to be encountered within the project study area.

Salinity

Salinity occurs in many areas of NSW, and includes dryland salinity, irrigation and river salinity, and urban salinity. Hydrogeological mapping on the eSpade (DPE, 2022f) tool indicates a high likelihood of salinity near Wilpinjong and along Wollar Road, and a lower occurrence north and south of Wilpinjong. The remainder of the project study area has a low likelihood of salinity occurring.

6.16.2 Potential impacts

Soils

Potential impacts to soils as a result of construction of the project may include:

- construction would result in the exposure of the natural ground surface and subsurface through the removal of vegetation and excavation which may lead to soil erosion. This may lead to offsite erosion and sediment transfer offsite, which may result in potential sedimentation of surrounding land and drainage lines
- physical changes to soil quality, including compaction from movement of vehicles and machinery.

The suitability of soils and underlying geology will be considered during design development when siting permanent infrastructure (e.g. transmission line structures, energy hubs, switching stations and access tracks).

Land contamination

There is the potential for contamination of soils during construction and/or operation of the project as a result of:

- leaks or spills from the use or refuelling of plant, equipment, vehicles
- firefighting chemicals and water used during fire events
- a spill or leak occurring during the transportation and storage of fuels, oils and chemicals
- accidental release of sewerage and wastewater from worker facilities within ancillary facilities and workforce accommodation camps
- mobilisation and spread of pre-existing contamination in the surrounding soil, surface water or groundwater if disturbed.

The final design will include spill containment systems and bunds in accordance with relevant legislation and standards.

The potential impacts of registered contaminated sites within and near the project study area on the construction and operation of the project will be investigated as part of the EIS. While it is anticipated that existing on-site contamination risks would be minimal, there is the potential that former land uses, such as mining, sheep and cattle dips or buried asbestos materials, or other existing contamination may be encountered.

Acid sulfate soils

During construction, there is the potential for acid sulfate soils to be exposed to air during excavations if not properly handled, which could lead to the formation of sulfuric acid, and subsequent mobilisation of iron, aluminium and sometimes heavy metals that can have detrimental impacts on the surrounding environment and infrastructure (e.g. the contamination of groundwater, soil degradation, vegetation dieback and the damage of underground infrastructure through corrosion).

Salinity

Potential impacts from salinity can occur due to disruption of the water table (i.e. when saline groundwater rises and deposits salts in upper soil layers). Disruption can result from vegetation removal, physical barriers, or the reuse of saline soils generated by the project.

Soil disruption associated with excavations, footings, construction compounds or levelling purposes are potential activities that could lead to increased salinity risk. Vegetation removal (leading to disruption to the water table) or the reuse of saline soils generated by the project could also lead to an increased salinity risk. Disturbance of saline soils may also lead to impacts to downstream receiving environments.

High salinity soil can produce aggressive soil conditions, which may be detrimental to concrete and steel and damage foundations of infrastructure. This risk will be managed through design or construction methodology in areas that have a high likelihood of salinity.

6.16.3 Proposed further assessments

A standard assessment of soils and contamination will be presented in the EIS. The assessment will be desktop based and will consider published documentation as well as results from any geotechnical and contamination investigations completed for the project as part of design development. Data from the site investigations will be used to validate regional soil and geological mapping.

This assessment of soils and contamination to be included in the EIS will include:

- an assessment of the potential of the project to impact on the existing soil characteristics of the project study area, including:
  - a review of the existing information on the soil characteristics in the project study area, including the potential for acid sulfate soils and salinity to be present
  - identification of potential impacts of the project to identified soil characteristics in the project study area during construction and operation, including a salinity assessment
  - mitigation measures to avoid, minimise and manage any potential impacts of the project on soils

- a preliminary contamination assessment, consisting of:
  - a review of publicly available desktop information relating to site contamination within the project study area
  - identification of the potential to encounter existing contamination during construction and operation of the project (including potential areas and contaminants of concern)
  - identification of project activities that have the potential to generate contamination during construction and operation
  - assessment of potential contamination risks associated with construction and operation of the project including consideration of impacts to human health and environmental receptors
  - identification of any additional investigations and/or remediation activities required and mitigation measures to avoid, minimise and manage any potential impacts of the project on contamination.

The following government plans, policies and guidelines are relevant to the project:

- *National Environment Protection (Assessment of Site Contamination) Measure* (National Environment Protection Council, 2013)
- *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land* (DUAP and EPA, 1998)
- *Consultants reporting on contaminated land – Contaminated Land Guidelines* (EPA, 2020a)
- *Contaminated Land Management – Guidelines for the NSW Site Auditor Scheme* (EPA, 2017a)
- *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997* (EPA, 2015)
- Urban and regional salinity – guidance given in the Local Government Salinity Initiative booklets (http://www.environment.nsw.gov.au/salinity/solutions/urban.htm) which includes Site Investigations for Urban Salinity (DLWC, 2002)
- *Guidelines for managing salinity in rural areas* (OEH, 2015)
- *Naturally Occurring Asbestos – Asbestos Management Plan Guide* (Asbestos Awareness & the Asbestos Education Committee, 2021)
- *How to manage and control asbestos in the workplace – Code of Practice* (Safe Work Australia, 2020)
- *Managing asbestos in or on soil* (WorkCover NSW, 2014)
- *Soil and Landscape Issues in Environmental Impact Assessment* (DLWC, 2000)
- *Managing Urban Stormwater: Soils and construction – Volume 1* (Landcom, 2004).

6.17 Air quality

6.17.1 Existing environment

The project study area and surrounding region is sparsely populated, with most of the land within which the project study area is located, consisting of rural properties and agricultural land. Sensitive air quality receivers are generally located at isolated rural properties within or adjacent to the project study area.

Ambient air quality within the project study area is characteristic of a rural area and is affected by a number of factors including topography, prevailing meteorological conditions and local and regional sources of potential air pollution.

Sources of air pollutants within and near the project study area that are listed on the National Pollutant Inventory include quarries, open cut and underground mining, mineral, metal and chemical wholesalers and feedlots (DCCEEW, 2022). Other air pollution sources would include vehicle and dust emissions from roads, agricultural activities and forestry practices.

6.17.2 Potential impacts

During construction, local air quality within the project study area may be temporarily affected by particulate (dust) emissions during activities such as vegetation clearance, earthworks, stockpile management, concrete batching plants, access track construction, and the movement of plant, equipment and vehicles along unsealed areas and roads/tracks. There is also the potential for localised gaseous emissions generated by the combustion of fuel in construction plant, machinery and emissions. The main sensitive receivers for air quality impacts during construction would be residences within 100 metres of construction works. Air quality impacts from construction are expected to be minor and short term due to the relatively small scale of construction works required at each transmission line structure location, distance from sensitive receivers, and the progressive nature of the construction works, except for the construction of the energy hub and switching station sites or at construction compound sites. At these locations, there would be the potential for localised air quality impacts for a longer duration of time.

During operation, the project is anticipated to have a negligible impact on local air quality. Operational air quality will be manageable through the application of standard environmental management measures.

6.17.3 Proposed further assessments

A standard construction air quality assessment will be included in the EIS which will consider the risk of dust effects from construction activities based on the scale and nature of the works and the sensitivity of the area surrounding the activity. The construction air quality impact assessment will include:

- identification and description of the background air quality environment based on a desktop assessment and review of existing information
- identification of sensitive receivers for air quality, and weather conditions and activities that have the potential to impact air quality conditions
- identification of the main types and sources of air emissions during construction
- a semi-quantitative risk based assessment for particulate matter, based on guidance provided by the *Guidance on the assessment of dust from demolition and construction* (Institute of Air Quality Management (IAQM), 2014). The risk assessment will consider the area of disturbance, materials and equipment, vehicle movements, scheduling, and distance to sensitive receiving environments to potential emission sources such as the new construction areas, compounds, stockpile areas and concrete batching plants. Site-specific mitigation measures will be identified to manage and minimise adverse impacts
- a qualitative dust amenity impact assessment of construction haulage routes. This will consider the risk for amenity impacts considering the distance of the sensitive receiver to the road, whether the road is sealed or not, and the proposed use of the road
- a quantitative air quality impact assessment of crushing and screening activities at the earthwork material sites and/or construction compounds. This would consider the processing capacity for the crushing and screening plant and associated activities that could generate air emissions (e.g. handling, stockpiling, etc)
- mitigation measures to minimise the potential impacts to air quality during construction.

The following government plans, policies and guidelines are relevant to the project:

- *Guidance on the assessment of dust from demolition and construction* (IAQM, 2014).

6.18 Climate change and greenhouse gas

6.18.1 Existing environment

Climate change

Climate change projections relevant to the project include:

- potential increases in absolute maximum temperature
- potential increases in average temperatures and the frequency of heatwaves
- potential changes in annual rainfall, with an increase in rainfall during summer, autumn and winter and decreases in spring.

As a consequence of these projections, there could be potential increases in the number of days where the Forest Fire Danger Index will be greater than 50 (severe), primarily during summer and spring.

Greenhouse gas

The majority of emissions in NSW (as reported in 2017) are derived from electricity generation (51 metric tonnes of carbon dioxide equivalent ($MtCO_2$-e)), followed by transport (28 $MtCO_2$-e) (DPIE, 2020a). As outlined in Chapter 2, the Australian and NSW Governments have various policies and strategies to reduce greenhouse gas emissions to achieve the net-zero target by 2050. This includes the delivery of new transmission, generation and storage infrastructure to support low carbon renewable energy and the replacement of coal-fired power station capacity.

6.18.2 Potential impacts

Greenhouse gas

Construction of the project would result in the generation of greenhouse gas emissions. Greenhouse gas emissions are likely to be generated due to vegetation removal, combustion of fuels by plant and vehicles, consumption of electricity and from waste. The use of construction equipment and manufacture of materials for use in the project would also consume resources associated with greenhouse gas emissions. The volume of greenhouse gas emissions during construction would depend on the design of the project, the type and quantity of construction materials used, construction methods and equipment. To reduce the volume of greenhouse gas emissions during construction, opportunities to reduce greenhouse gas emissions will be explored as part of the project. This will be documented in the EIS.

The project is a key piece of strategic transmission infrastructure that would enable the transition to a lower emissions economy and would contribute towards achieving the target of net-zero carbon emissions by 2050. During operation, a minor amount of greenhouse gases would be anticipated due to the operation of project itself, through fuel or electricity consumed by operational systems, plant or vehicles as well as the consumption of materials or removal of vegetation during maintenance activities.

The carbon emissions from the project are low compared to the significant reductions in emissions that cannot be achieved without the project.

Climate change risk

During construction, climate change risks would be associated with severe weather events, such as extreme temperature, flooding, changes in rainfall patterns and fire risk, placing increased pressure on control measures to prevent flooding, erosion and sedimentation and bushfire ignition. Extreme weather could delay construction of the project, damage materials and cause adverse health impacts for workers.

Operational vulnerability to climate change could potentially include:

- an increase in the number and severity of weather-related electricity outages
- higher temperatures causing increased demand for electricity, while at the same time causing thermal expansion of power lines (resulting in line sag), increased resistance of transmission, and decreased amount of power that can be securely transmitted, and accelerated aging of transformers
- flooding of energy hubs, switching stations and other infrastructure causing damage to equipment with effort and time required to clean up and repair equipment, and weakening of the transmission line towers due to erosion or debris impact
- damage from bushfires, often coinciding with the increased demand for electricity from high temperatures.

6.18.3 Proposed further assessments

Greenhouse gas

A standard greenhouse gas assessment for the project will be included in the EIS. The assessment will:

- identify the likely sources of greenhouse gas emissions associated with construction of this proposal
- quantify the greenhouse gas emissions associated with each greenhouse gas source
- identify opportunities (mitigation measures) to reduce greenhouse gas emissions.

The following government and industry guidelines will be considered as relevant during the preparation of the climate change risk assessment for the project:

- *ISO 14064-1:2018 Specification with guidance at the organisation level for quantification and reporting of greenhouse gas emissions and removal* (ISO, 2018a)
- *National Greenhouse Accounts Factors* (Australian Government Department of Industry, Science Energy and Resources, 2021).

Climate change risk

The EIS will include a standard climate change risk assessment for the project.

- identify possible climate related impacts with an emphasis on any that are projected to undergo a substantial change
- identify project components that may be vulnerable to the climate change impacts
- identify possible current and future controls that may increase the resilience of particular project components to climate impacts
- recommend what should be considered or investigated further as part of the project design.

The following government and industry guidelines will be considered as relevant during the preparation of the climate change risk assessment for the project:

- *Climate Change in Australia Technical Report* 2015 (CSIRO, 2015)
- *Climate change impact and risk management – A guide for business and government* (Australian Greenhouse Office, 2006)
- *ISO 31000-2018; Risk Management – Principles and Guidelines* (ISO, 2018b)
- *AS 5334:2013 – Climate Change Adaptation for Settlements and Infrastructure – A risk based approach* (Standards Australia, 2013).

6.19 Cumulative impacts

6.19.1 Overview

The *Cumulative Impact Assessment Guidelines for State Significant Projects* (NSW DPIE, 2021g) (Cumulative Impact Assessment Guidelines) sets the requirements for the assessment of project-level cumulative impacts related to State significant projects. The guideline defines cumulative impacts as those arising as a result of incremental, sustained and combined effects of human action and natural variations over time that can be both positive and negative. They can be caused by the compounding effects of a single project or multiple projects in an area, and by the accumulation of effects from past, current and future activities as they arise.

The guideline requires the assessment to focus on key matters that could be materially affected by the cumulative impact of the project and other relevant future projects as a result of the impacts the overlap in timeframes and study areas. Relevant future projects (as outlined in Section 3.4 of the Cumulative Impact Assessment Guidelines) are:

- State Significant Development (SSD) or SSI projects
- projects that are classified as designated development and requires an EIS
- projects that require assessment under Division 5.1 of the EP&A Act and are likely to significantly affect the environment and require an EIS
- projects that have been declared to be a controlled action under the EPBC Act
- any major greenfield and urban renewal developments that are scheduled for the area (such as new areas zoned for urban development).

The guideline also sets out two types of cumulative impact assessments:

- issue-specific cumulative impact assessment. This involves an assessment of the project together with the impacts of other relevant future projects on specific issues (e.g. traffic) within an identified area, including the additional impacts that may occur over time as a result of changes to existing projects (e.g. closures and expansions, increases or decreases to the intensity of operations) or the commencement of new projects
- combined cumulative impact assessment. This involves an assessment of the combined effect of the different cumulative impacts of the project (e.g. noise, dust and traffic) with other relevant future projects on key matters in an identified area.

6.19.2 Relevant future projects

A number of renewable energy projects are proposed, approved or under construction within the Central-West Orana REZ. In addition to renewable energy projects, a number of mining projects in and around Ulan and Wilpinjong are operational and subject to proposed or approved expansions. A search of DPE's online major projects database (in August 2022) identified the following SSD and SSI projects.

Table 6-4 Relevant SSD and SSI projects

Project	Status
Valley of the Winds wind farm	proposed
Wollar Substation upgrade	proposed
Sandy Creek solar farm	proposed
Coborra solar farm	proposed
Barneys Reef wind farm	proposed

Project	Status
Tallawang solar farm	proposed
Birriwa solar farm	proposed
Spicers Creek wind farm	proposed
Bellambi Heights solar farm	proposed
Wellington south battery energy storage system	proposed
Burrendong wind farm	proposed
Inland Rail (Narromine to Narrabri)	proposed
Liverpool Range wind farm	approved, with proposed modifications
Dunedoo solar farm	approved
Stubbo solar farm	approved
Uungula wind farm	approved
Wellington north solar farm	approved
Wollar solar farm	under construction
Maryvale solar farm	under construction
Wellington solar farm	under construction

There are no major greenfield and urban renewal developments scheduled in the area, the nearest mapped are in Dubbo.

EnergyCo is coordinating whole of REZ studies including workforce accommodation, transport and waste management, among others. These studies will identify measures to manage REZ-wide cumulative impacts, with further details to be provided in the EIS.

6.19.3 Potential impacts

The potential for cumulative impacts will depend on the scale and nature of the potential impacts of the project in combination with relevant future projects, and the sensitivity of the receiving environment. Cumulative impacts that have the potential to arise for the project based on known proposed or approved projects are:

- land use and property
- agriculture
- landscape character and visual amenity
- biodiversity
- aboriginal heritage
- social and economic
- traffic and transport
- noise and vibration
- resource use.

6.19.4 Proposed further assessment

A detailed cumulative impact assessment will be presented in the EIS, which will:

- confirm relevant projects that could be included in the cumulative impact assessment. This will consider:
  - spatial relevance to the project and/or impacts of the project
  - timing (e.g. if works are to occur concurrently)
  - scale and nature of the potential impacts of the relevant State or regional projects
- assessment of the potential cumulative impacts, including identification of relevant issues likely to have material cumulative impacts during construction and/or operation of the project. This may include quantitative assessments for certain matters
- identification of suitable mitigation measures to manage potential cumulative impacts.

The environmental risk analysis will be supported and is informed by the cumulative impact assessment.

The assessment will only consider relevant projects that have publicly accessible information that is sufficient to inform a cumulative impact assessment at the time of preparing the EIS.

The matters that are likely to require a cumulative assessment for the project include land use and property, agriculture, landscape character and visual amenity, biodiversity, heritage, social, economic, traffic and transport, and noise and vibration impacts. The matters requiring an issue-specific or a combined cumulative impact assessment will be informed by the further development of the project and construction methodology, and progression of the EIS.

7 Conclusion

EnergyCo is seeking approval for the construction and operation of new HV electricity transmission infrastructure to connect energy generation and storage projects within the Central-West Orana REZ to the NEM.

Key features of the project include:

- a new switching station at Wollar, to connect the project to Transgrid's existing Wollar Substation and onto the NEM
- new twin double circuit 500 kV transmission lines and associated infrastructure to connect to the NEM and single and double circuit 330 kV single lines to connect energy generation and storage projects within the Central-West Orana REZ to the energy hubs
- energy hubs at Merotherie and Elong Elong, to connect energy generation and storage projects within the Central-West Orana REZ to the new 500 kV network infrastructure
- switching stations along the 330 kV network infrastructure to transfer the energy generated from the energy generation projects onto the 330 kV network infrastructure
- establishment and upgrade of access tracks and public roads, and other ancillary works such as laydown and staging areas, earthwork material sites with crushing and screening plants, concrete batching plants, brake/winch sites, site offices and workforce accommodation camps
- utility adjustments required for construction of the new network infrastructure.

It is expected that construction of the project would commence in the second half of 2024 and take approximately three years to complete, with initial operations commencing as early as mid-2027.

The project has been developed to avoid impacts on important environmental, land use and social values, as described in Chapter 2. This approach will continue throughout further design development and will be detailed in the EIS.

The project includes a southern extension of the transmission network between Elong Elong and Mumbil with a connection to the NSW transmission network. This section is under investigation and will be subject to a separate planning approval.

The project is CSSI and is subject to approval by the NSW Minister for Planning under Division 5.2, Part 5 of the EP&A Act. If the project is determined to be a controlled action, the approval of the Australian Minister for the Environment under the EPBC Act will be required in addition to the State CSSI approval under the EPBC Act. EnergyCo anticipates that, if Commonwealth approval is required, the impacts would be assessed via the EIS process in accordance with the NSW Assessment Bilateral Agreement. The key environmental issues identified for the project, which will be assessed in detail during the preparation of the EIS are:

- land use and property
- agriculture
- landscape character and visual amenity
- biodiversity
- Aboriginal heritage
- non-Aboriginal heritage
- social
- economic
- noise and vibration
- waste management and resource use
- hazard and risk
- traffic and transport
- cumulative impacts.

Other issues requiring assessment but considered to have low potential impacts are hydrology, flooding and water quality, groundwater, soils and contamination, air quality and climate change and greenhouse gas.

Following the receipt of the SEARs for the project, an EIS will be prepared that will be publicly exhibited by DPE, in accordance with the provisions of Division 5.2 of the EP&A Act. During the public exhibition of the EIS, the community, stakeholder, organisations and government agencies will be encouraged to provide feedback via a formal submission. The EIS is likely to be publicly exhibited in mid-2023.

8 References

AEMO (Australian Energy Market Operator) (2019), *2019 Electricity Statement of Opportunities – A report for the National Electricity Market*.

AEMO (2020), *Integrated System Plan*.

AEMO (2022), *2022 Integrated System Plan – June 2022*.

AEMO Services Limited (2021), *2021 Infrastructure Investment Objectives Report – December 2021*.

ANZECC/ARMCANZ (Australian and New Zealand Environment and Conservation Council / Agriculture and Resource Management Council of Australia and New Zealand) (2000), *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, Australian and New Zealand Environment and Conservation Council / Agriculture and Resource Management Council of Australia and New Zealand, Australia.

ARPANSA (Australian Radiation Protection and Nuclear Safety Agency) (2022), Extremely low frequency electric and magnetic fields. Accessed from www.arpansa.gov.au/understanding-radiation/what-is-radiation/non-ionising-radiation/low-frequency-electric-magnetic-fields.

Australia ICOMOS (International Council on Monuments and Sites) (2013), *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance*, Australia International Council on Monuments and Sites, Burwood, Victoria.

Australian Bureau of Statistics (2016), *Census of Population and Housing*. Accessed from www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/2008.0~2016~Main%20Features~Topic%20release%20schedule~140.

Australian Bureau of Statistics (2021), *Census of Population and Housing*. Accessed from www.abs.gov.au/census/find-census-data/search-by-area.

Australian Energy Council (2017), *Capacity factors: Understanding the misunderstood*. Retrieved 27 May 2022 from www.energycouncil.com.au/analysis/capacity-factors-understanding-the-misunderstood/.

Australian Government (2013), *Guidelines for groundwater quality protection in Australia National Water Quality Management Strategy*, Department of Agriculture and Water Resources, Canberra.

Australian Greenhouse Office (2006), *Climate change impact and risk management – A guide for business and government*.

Australian Institute of Landscape Architects (2018), *Guidance Note for Landscape and Visual Assessment*.\

Austroads (2009), *Guide to Pavement Technology Part 6: Unsealed Pavements*.

Austroads (2020), *Austroads Guide to Traffic Management*.

Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I (2019), *Australian Rainfall and Runoff: A Guide to Flood Estimation*, Commonwealth of Australia, Canberra, ACT.

Bureau of Meteorology (2022a), Groundwater Dependent Ecosystems Atlas. Accessed from: bom.gov.au/water/groundwater/gde/.

Bureau of Meteorology (2022b), Australia Groundwater Explorer.

CEC (Clean Energy Council) (2018), *Community Engagement Guidelines For Building Powerlines For Renewable Energy Developments – A guide for proponents, landholders and communities*.

CEC (2022), *Energy security in Australia*. Accessed from: www.cleanenergycouncil.org.au/advocacy-initiatives/energy-transformation/energy-security.

Climate Change Authority (2020), *Fact sheet on Australia's electricity sector*. Accessed from: www.climatechangeauthority.gov.au/sites/default/files/2021-03/2021Fact%20sheet%20-%20Electricity.pdf.

Commonwealth of Australia (2013), *Matters of National Environmental Significance Significant Impact Guidelines 1.1.*

CSIRO (Commonwealth Scientific and Industrial Research Organisation) (2011), CSIRO Australian Soil Resource Information System.

CSIRO (2015), *Climate Change in Australia Technical Report 2015*.

DECC (Department of Environment and Climate Change) (2006), *Environmental Noise Management – Assessing Vibration: a technical guideline*, Department of Environment and Climate Change, Sydney.

DECC (2007), *Flood Risk Management Guideline – Practical Consideration of Climate Change*.

DECC (2008), *Managing Urban Stormwater: Soils and Construction Volume 2 (A. Installation of Services; B. Waste Landfills; C. Unsealed Roads; D. Main Roads; E. Mines and Quarries)*, Department of Environment and Climate Change, Sydney.

DECC (2009*), Interim Construction Noise Guideline*, Department of Environment and Climate Change, Sydney.

DECCW (Department of Environment, Climate Change and Water) (2006), *NSW Water Quality and River Flow Objectives*, Department of Environment, Climate Change and Water, Sydney.

DECCW (2010a), *Aboriginal Cultural Heritage Consultation Requirements for Proponents, Department of Environment*, Climate Change and Water, Sydney.

DECCW (2010b), *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales*, Department of Environment, Climate Change and Water, Sydney.

DECCW (2010c), *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW*, Department of Environment, Climate Change and Water, Sydney.

DECCW (2011), *NSW Road Noise Policy*, Department of Environment, Climate Change and Water, Sydney.

Department of Agriculture and Water Resources (2018), *National Water Quality Management Strategy*, Department of Agriculture and Water Resources, Canberra.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2022), National Pollutant Inventory, Accessed from: www.npi.gov.au/.

DISER (Australian Government Department of Industry, Science, Energy and Resources) (2020), *Australia's Long-Term Emissions Reduction Plan – A whole-of-economy Plan to achieve net zero emissions by 2050*.

DISER (2021), *National Greenhouse Accounts Factors.*

DISER (2022), *Australia's Nationally Determined Contribution – Communication 2022*.

DLWC (Department of Land and Water Conservation) (2000), *Soil and Landscape Issues in Environmental Impact Assessment*, Technical Report No. 34, 2nd edition, NSW Department of Land and Water Conservation, Sydney.

DLWC (Department of Land and Water Conservation) (2002), *Site Investigations for Urban Salinity*, Sydney.

DUAP and NSW EPA (Department of Urban Affairs and Planning and the NSW Environmental Protection Agency) (1998), *Managing Land Contamination: Planning Guidelines SEPP 55 –Remediation of Land*.

Dubbo Regional Council (2016), *Dubbo Regional Council Local Government area economic profile*, Accessed from: www.dubbo.nsw.gov.au/ArticleDocuments/358/Dubbo%20Region%20Economic%20Profile%20September%202016.pdf.

Dubbo Regional Council (2020), *Dubbo Local Strategic Planning Statement*.

Dubbo Regional Council (2022), *Dubbo 2040 Community Regional Council Strategic Plan*.

EnergyCo (2022), *Community Feedback Report – Central-West Orana Renewable Energy Zone Revised study corridor consultation (June 2022)*.

Energy NSW (2022), First Nations Guidelines. Accessed from: https://www.energy.nsw.gov.au/government-and-regulation/electricity-infrastructure-roadmap/first-nations-guidelines.

Fairfull, S and Witheridge, G (2003), *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings*. NSW Fisheries, Cronulla.

German Institute for Standardisation (1999), *DIN 4150–3:1999 Vibration in Buildings – Part 3: Effects on Structures*.

Heritage Branch Department of Planning (2009), *Assessing Significance for Historical Archaeological Sites and 'Relics'*.

Heritage Council of NSW (2021), *Investigating Heritage Significance*.

Heritage Office (2001), *Assessing Heritage Significance*.

Heritage Office and Department of Urban Affairs and Planning (2002), *Statements of Heritage Impact Guidelines*.

Heritage Office and Department of Urban Affairs and Planning (1996), *Archaeological Assessments: Archaeological Assessment Guidelines*.

IAP2 (International Association for Public Participation) (2015), *Quality Assurance Standard for Community and Stakeholder Engagement*.

IAQM (Institute of Air Quality Management) (2014), *Guidance on the assessment of dust from demolition and construction*, Institute of Air Quality Management.

ICNIRP (International Commission on Non-Ionising Radiation Protection) (2010), *Guidelines for Limiting Exposure to Time-varying Electric and Magnetic Fields (1Hz to 100 kHz)*, Health Physics 99(6):818-836; 2010.

IEEE (Institute of Electrical and Electronics Engineers) (2002), *C95.6-2002 – IEEE Standard for Safety Levels With Respect to Human Exposure to Electromagnetic Fields, 0-3 kHz.*

Infrastructure NSW (2018), *State Infrastructure Strategy 2018-2038*.

International Organisation for Standardisation (ISO) (2018a), *ISO 14064-1:2018 Specification with guidance at the organisation level for quantification and reporting of greenhouse gas emissions and removal.*

International Organisation for Standardisation (ISO) (2018b), *ISO 31000-2018; Risk Management – Principles and Guidelines.*

Landcom (2004), *Managing Urban Stormwater: Soils and construction – Volume 1*, New South Wales Government.

LIIEMA (Landscape Institute and Institute of Environmental Management and Assessment) (2013), *Guidelines for Landscape and Visual Impact Assessment (GLVIA3)*, Third Edition.

Mid-Western Regional Council (2017a), *Mid-Western Regional Draft Comprehensive Land Use Strategy (Revision E)*. Prepared by Parsons Brinckerhoff for Mid-Western Regional Council.

Mid-Western Regional Council (2017b), *Towards 2030 – Mid-Western Region 2030 Community Plan*.

Mid-Western Regional Council (2022), About Warrumbungle Shire, Available at www.warrumbungle.nsw.gov.au/our council/community-and-economic-profile/about-the-shire/about-warrumbungle-shire.

National Environment Protection Council (2013), *National Environment Protection (Assessment of Site Contamination) Measure*.

National Transport Commission (2020), *Australian Code for the Transport of Dangerous Goods by Road and Rail*.

NSW Department of Environment and Conservation (2007), *Guidelines for the Assessment and Management of Groundwater Contamination.*

NSW Department of Land and Water Conservation (2002), *NSW State Groundwater Dependent Ecosystems Policy*.

NSW Department of Planning (2003), *Aquatic Ecology in Environmental Impact Assessment – EIA Guideline Series*, Prepared by Marcus Lincoln Smith, Brookvale, NSW.

NSW Department of Planning (2011), *Hazardous and Offensive Development Application Guidelines: Applying SEPP 33*.

NSW DPE (Department of Planning and Environment) (2003), *The Bioregions of New South Wales*, Published by the National Parks and Wildlife Service.

NSW DPE (2017), *Central West and Orana Regional Plan 2036*.

NSW DPE (2018a), *Transmission Infrastructure Strategy 2018*.

NSW DPE (2018b), *NSW Renewable Energy Action Plan*.

NSW DPE (2020), *Electricity Infrastructure Roadmap*.

NSW DPE (2022a), *Cumulative groundwater impact assessment approaches*. Information paper prepared for the Water Division, NSW Department of Planning and Environment as part of the Groundwater Assessment Toolbox Project.

NSW DPE (2022b), *Groundwater assessment toolbox for major projects in NSW - Overview document*. Technical guideline prepared for the Water Division, NSW Department of Planning and Environment as part of the Groundwater Assessment Toolbox Project.

NSW DPE (2022c), *Guidelines for Groundwater Documentation for SSD/SSI Projects*. Technical guideline prepared for the Water Division, NSW Department of Planning and Environment as part of the Groundwater Assessment Toolbox Project.

NSW DPE (2022d), *Minimum groundwater modelling requirements for Major Projects in NSW*. Technical guideline prepared for the Water Division, NSW Department of Planning and Environment as part of the Groundwater Assessment Toolbox Project.

NSW DPE (2022e), NSW Planning Portal. Accessed from: www.planningportal.nsw.gov.au/spatialviewer/#/find-a-property/address.

NSW DPE (2022f), eSpade Version 2.2. Accessed from: www.environment.nsw.gov.au/eSpade2Webapp.

NSW DPI (Department of Primary Industries) (Office of Water) (2012), *NSW Aquifer Interference Policy: NSW Government policy for the licensing and assessment of aquifer interference activities*, NSW Department of Primary Industries, a division of NSW Department of Trade and Investment, Regional Infrastructure and Services.

NSW DPI (Department of Primary Industries) (2013), *Policy and guidelines for fish habitat conservation and management*, NSW Department of Primary Industries, a part of the Department of Trade and Investment, Regional Infrastructure and Services.

NSW DPIE (Department of Planning, Industry and Environment) (2014a), Environmental Planning Instrument - Groundwater Vulnerability Dataset.

NSW DPIE (2014b), Environmental Planning Instrument – Landslide risk Dataset.

NSW DPIE (2019a), *Electricity Strategy*.

NSW DPIE (2019b), *Community Participation Plan*.

NSW DPIE (2020a), *Net Zero Plan Stage 1: 2020–2030.*

NSW DPIE (2020b), *Biodiversity Assessment Method*.

NSW DPIE (2021a), *State Significant Infrastructure Guidelines*.

NSW DPIE (2021b), *Draft Central West and Orana Regional Plan 2041*.

NSW DPIE (2021c), *State significant infrastructure guidelines – preparing a scoping report – Appendix A to the state significant infrastructure guidelines*.

NSW DPIE (2021d), *Social Impact Assessment Guideline for State Significant Projects*.

NSW DPIE (2021e), *Technical Supplement: Social Impact Assessment Guideline for State Significant Projects*.

NSW DPIE (2021f), *Undertaking Engagement Guidelines for State Significant Projects.*

NSW DPIE (2021g), *Cumulative Impact Assessment Guidelines for State Significant Projects*.

NSW DPIE (2021h), *NSW Waste and Sustainable Materials Strategy – Stage 1: 2021-2027*.

NSW EPA (Environment Protection Authority) (2014), *Waste Classification Guidelines*, NSW Environment Protection Authority, Sydney South.

NSW EPA (2015), *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*.

NSW EPA (2017a*), Contaminated Land Management – Guidelines for the NSW Site Auditor Scheme*, Third Edition.

NSW EPA (2017b), *Noise Policy for Industry*, Environment Protection Authority, Sydney.

NSW EPA (2020a), *Consultants reporting on contaminated land – Contaminated Land Guidelines*, NSW Environment Protection Authority, Parramatta, NSW.

NSW EPA (2020b), *Draft Construction Noise Guideline*, NSW Environment Protection Authority, NSW Environment Protection Authority, Parramatta, NSW.

NSW EPA (2022), *Approved methods for the sampling and analysis of water pollutants in NSW*, NSW Environment Protection Authority, Parramatta, NSW.

NSW Government (2005), *NSW Floodplain Development Manual 2005*, Department of Infrastructure, Planning and Natural Resources, Sydney.

NSW Government (2019), *Property Acquisition Standards*. Accessed from: https://www.nsw.gov.au/housing-and-construction/property-acquisition/about-us/standards-and-principles/standards.

NSW Government (2020), Renewable Energy Zones. Accessed from: www.energy.nsw.gov.au/renewables/renewable-energy-zones.

NSW Heritage Office and Department of Urban Affairs and Planning (1996), *NSW Heritage Manual*.

NSW National Parks and Wildlife Service (2020), *Developments adjacent to National Parks and Wildlife Service lands - Guidelines for consent and planning authorities*.

NSW Rural Fire Service (2019), *Planning for Bush Fire Protection*, NSW Rural Fire Service, Granville, SNW.

OEH (Office of Environment and Heritage) (2011), *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW*, Office of Environment and Heritage, Sydney South.

OEH (2012a), The Land and Soil Capability Scheme.

OEH (2012b), *Erosion and Sediment Control on Unsealed Roads – A field guide for erosion and sediment control maintenance practices*.

OEH (2015), *Guidelines for managing salinity in rural areas*, NSW Office of Environment and Heritage, Sydney, NSW.

OEH (2016), *NSW Climate Change Policy Framework*, NSW Office of Environment and Heritage, Sydney, NSW.

OEH (2017), *Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions*.

OEH (2019), *BioNet Atlas user manual.*

Resource NSW (2003), *NSW Waste avoidance and resource recovery strategy 2003.*

Safe Work Australia (2020), *How to manage and control asbestos in the workplace – Code of Practice*.

Standards Australia (2013), *AS 5334:2013 – Climate Change Adaptation for Settlements and Infrastructure – A risk based approach*.

Standards Australia (2018), *AS3959:2018 – Construction of buildings in bushfire-prone areas*.

Transgrid (2021a), *Study Corridor Identification Report*.

Transgrid (2021b), *Central-West Orana REZ Transmission Community Engagement Feedback Report December 2020 – September 2021*.

Transport for NSW (2013), *Transport Management Plans for oversize and/or overmass movements in NSW*.

Transport for NSW (2018), *NSW Heavy Vehicle Access Policy Framework*.

Transport for NSW (2020a), *Additional Access Conditions – Oversize and overmass heavy vehicles and loads*.

Transport for NSW (2020b), *Guideline for Landscape Character and Visual Impact Assessment - Environmental impact assessment practice note EIA-N04*, Transport for NSW, Centre for Urban Design, Rozelle, NSW.

Transport for NSW (2022a), *2026 Road Safety Action Plan*.

Transport for NSW (2022b), *Traffic control at work sites – Technical Manual (Version 6.1)*.

Upper Hunter Shire Council (2017), *Upper Hunter Land Use Strategy (Upper Hunter Shire Council*.

Upper Hunter Shire Council (2020), *Draft Upper Hunter Shire Council Local Strategic Planning Statement*.

Warrumbungle Shire Council (2013), *Warrumbungle Shire Council Land Use Strategy*.

Warrumbungle Shire Council (2019a), *Warrumbungle Shire Local Strategic Planning Statement*.

Warrumbungle Shire Council (2019b), *Cobbora Land Use Planning Strategy*.

Warrumbungle Shire Council (2019c), *Warrumbungle Shire Economic Development and Tourism Strategy 2019–2023.*

Warrumbungle Shire Council (2019d), *Warrumbungle Shire Community Strategic Plan (Reviewed) 2017-2032*.

Warrumbungle Shire Council (2022), *About Warrumbungle Shire*, Accessed from: www.warrumbungle.nsw.gov.au/our council/community-and-economic-profile/about-the-shire/about-warrumbungle-shire.

Welcome to Country (2019), Hunter Valley, Accessed from: https://upperhunter.nsw.gov.au/our-shire.aspx.

Wildlife Health Australia (2018), *National Wildlife Biosecurity Guidelines September 2018 – Version 1.0*, Sydney, NSW.

WorkCover NSW (2005), *Storage and Handling of Dangerous Goods Code of Practice*, Gosford, NSW.

WorkCover NSW (2014), *Managing asbestos in or on soil*, Gosford, NSW.

Appendix A
Scoping summary table

A1 Scoping summary table

Table A-1 Scoping summary table

Matter	Key issue	Level of assessment	CIA	Engagement	Relevant government plans, policies and guidelines	Scoping report reference
Land use and property	Yes	Detailed	Yes	Government agencies LALCs Landowners Business owners Airservices Australia CASA	• Central West and Orana Regional Plan 2036 (DPE, 2017) and the Draft Central West and Orana Regional Plan 2041 (DPIE, 2021b) • Mid-Western Regional Draft Comprehensive Land Use Strategy (Mid-Western Regional Council, 2017a) • Warrumbungle Shire Council Land Use Strategy (Warrumbungle Shire Council, 2013) • Warrumbungle Shire Local Strategic Planning Statement (Warrumbungle Shire Council, 2019a) • Cobbora Land Use Planning Strategy (Warrumbungle Shire Council, 2019b) • Dubbo Local Strategic Planning Statement (Dubbo Regional Council, 2020) • Upper Hunter Land Use Strategy (Upper Hunter Shire Council, 2017) • Draft Upper Hunter Shire Council Local Strategic Planning Statement (Upper Hunter Shire Council, 2020).	Section 6.2
Agriculture	Yes	Detailed	Yes	Landowners	N/A	Section 6.3
Landscape character and visual amenity	Yes	Detailed	Yes	Landowners	• Guideline for Landscape Character and Visual Impact Assessment - Environmental impact assessment practice note EIA-N04 (Transport for NSW (TfNSW), 2020b) • Guidelines for Landscape and Visual Impact Assessment (GLVIA3) Third Edition (Landscape Institute and Institute of Environmental Management and Assessment (LIIEMA), 2013) • Guidance Note for Landscape and Visual Assessment (Australian Institute of Landscape Architects, 2018).	Section 6.4

Matter	Key issue	Level of assessment	CIA	Engagement	Relevant government plans, policies and guidelines	Scoping report reference
Biodiversity	Yes	Detailed	Yes	Landowners Government agencies	• NSW Threatened Species Survey and Assessment Guidelines (various) • Matters of National Environmental Significance Significant Impact Guidelines 1.1 (Commonwealth of Australia, 2013) • Commonwealth Department of the Environment – Nationally Threatened Ecological Communities and Threatened Species Guidelines (various) • Commonwealth Department of the Environment – Survey Guidelines for Nationally Threatened Species (various) • Developments adjacent to National Parks and Wildlife Service lands – Guidelines for consent and planning authorities (NSW National Parks and Wildlife Service, 2020) • NSW Groundwater Dependent Ecosystem Policy (NSW Department of Land and Water Conservation, 2002) • Policy and guidelines for fish habitat conservation and management (NSW DPI, 2013) • Aquatic Ecology in Environmental Impact Assessment (NSW Department of Planning, 2003) • Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (Fairfull and Witheridge, 2003).	Section 6.5
Heritage – Aboriginal cultural heritage	Yes	Detailed	Yes	LALCs RAPs Government agencies	• Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH, 2011) • Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW, 2010a) • Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW (DECCW, 2010b).	Section 6.6
Heritage - Non-Aboriginal cultural heritage	Yes	Detailed	No	Government agencies	• The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance (Australia ICOMOS (International Council on Monuments and Sites), 2013) • Statements of Heritage Impact Guidelines (Heritage Office and Department of Urban Affairs and Planning, 2002) • Investigating Heritage Significance (Heritage Council of NSW, 2021) • Assessing Heritage Significance (Heritage Office, 2001) • Assessing Significance for Historical Archaeological Sites and 'Relics' (Heritage Branch Department of Planning, 2009) • Archaeological Assessments: Archaeological Assessment Guidelines (Heritage Office, Department of Urban Affairs and Planning, 1996).	Section 6.7

Matter	Key issue	Level of assessment	CIA	Engagement	Relevant government plans, policies and guidelines	Scoping report reference
Social	Yes	Detailed	Yes	Councils Landowners Aboriginal stakeholders Chamber of Commerce and key associations Social service providers Community via Community Engagement Plan	• Social Impact Assessment Guideline for State Significant Projects (DPIE, 2021d) • Technical Supplement: Social Impact Assessment Guideline for State Significant Projects (DPIE, 2021e) • Undertaking Engagement Guidelines for State Significant Projects (DPIE, 2021f) • Central West and Orana Regional Plan 2036 (DPE, 2017) and the Draft Central West and Orana Regional Plan 2041 (DPIE, 2021b) • Dubbo 2040 Community Regional Council Strategic Plan (Dubbo Regional Council, 2022) • Towards 2030 – Mid-Western Region 2030 Community Plan (Mid-Western Regional Council, 2017b) • Warrumbungle Shire Community Strategic Plan (Reviewed) 2017-2032 (Warrumbungle Shire Council, 2019c).	Section 6.8
Economic	Yes	Detailed	Yes	Business owners Business chambers Councils	N/A	Section 6.9
Noise and vibration	Yes	Detailed	Yes	Residents	• Noise Policy for Industry (NSW Environment Protection Authority (EPA), 2017b) • Interim Construction Noise Guideline (DECC, 2009) • Draft Construction Noise Guideline (EPA, 2020b) • Environmental Noise Management – Assessing Vibration: A Technical Guideline (DECC, 2006) • German Standard DIN 4150–3:1999 Vibration in Buildings – Part 3: Effects on Structures (German Institute for Standardisation, 1999) • NSW Road Noise Policy (DECCW, 2011).	Section 6.10
Hazard and risk – Bushfire	Yes	Detailed	No	NSW Rural Fire Service	• Planning for Bush Fire Protection (NSW Rural Fire Service, 2019) • AS3959:2018 – Construction of buildings in bushfire-prone areas (Standards Australia, 2018).	Section 6.11

Matter	Key issue	Level of assessment	CIA	Engagement	Relevant government plans, policies and guidelines	Scoping report reference
Hazard and risk – EMF	Yes	Detailed	No	–	• Guidelines for Limiting Exposure to Time-varying Electric and Magnetic Fields (1Hz to 100 kHz) (ICNIRP, 2010) • C95.6-2002 – IEEE Standard for Safety Levels With Respect to Human Exposure to Electromagnetic Fields, 0-3 kHz (Institute of Electrical and Electronics Engineers (IEEE), 2002)	Section 6.11
Hazard and risk – Other	Yes	Standard	No	DPE Subsidence Advisory NSW Transport for NSW	• Hazardous and Offensive Development Application Guidelines: Applying SEPP 33 (NSW Department of Planning, 2011) • Australian Code for the Transport of Dangerous Goods by Road and Rail (National Transport Commission, 2020).	Section 6.11
Traffic and transport	Yes	Detailed	Yes	Councils Landowners Transport for NSW	• NSW Heavy Vehicle Access Policy Framework (Transport for NSW, 2018) • 2026 Road Safety Action Plan (Transport for NSW, 2022a) • Traffic control at work sites – Technical Manual (Transport for NSW, 2022b) • Guide to Pavement Technology Part 6: Unsealed Pavements (Austroads, 2009) • Austroads Guide to Traffic Management (Austroads, 2020) • Transport Management Plans for oversize and/or overmass movements in NSW (Transport for NSW, 2013) • Additional Access Conditions, Oversize and Overmass Heavy Vehicles and Loads (Transport for NSW, 2020a).	Section 6.12
Waste management and resource use	Yes	Standard	Yes	EPA	• Waste Classification Guidelines (EPA, 2014) • Waste Avoidance and Resource Recovery Act 2001 • NSW Waste avoidance and resource recovery strategy 2003 (Resource NSW, 2003) • NSW Waste and Sustainable Materials Strategy – Stage 1: 2021-2027 (DPIE, 2021h).	Section 6.13

Matter	Key issue	Level of assessment	CIA	Engagement	Relevant government plans, policies and guidelines	Scoping report reference
Hydrology, flooding and water quality – Flooding	No	Standard	No	DPE	• Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom, 2004) • Managing Urban Stormwater: Soils and Construction Volume 2 (DECC, 2008) • Approved methods for the sampling and analysis of water pollutants in NSW (EPA, 2022) • Policy and guidelines for fish habitat conservation and management (NSW DPI, 2013) • Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions (OEH, 2017) • National Water Quality Management Strategy (Department of Agriculture and Water Resources, 2018) • Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ, 2000) • NSW Water Quality and River Flow Objectives (DECCW, 2006) • Erosion and Sediment Control on Unsealed Roads – A field guide for erosion and sediment control maintenance practices (OEH, 2012b) • Australian Rainfall and Runoff: A Guide to Flood Estimation (Ball et al., 2019) • The NSW Floodplain Development Manual 2005 (NSW Government, 2005) • Flood risk management guidelines - Practical Consideration of Climate Change (DECC, 2007).	Section 6.14
Hydrology, flooding and water quality - Other	No	Standard	No	DPE WaterNSW	• Water Sharing Plan for the Macquarie Bogan Unregulated and Alluvial Water Sources 2012 • Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009.	Section 6.14

Matter	Key issue	Level of assessment	CIA	Engagement	Relevant government plans, policies and guidelines	Scoping report reference
Groundwater	No	Standard	No	DPE WaterNSW	• NSW Aquifer Interference Policy (NSW DPI, 2012) • Relevant groundwater sharing plans, including the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020, NSW Murray Darling Basin Porous Rock Groundwater Sources 2020, Macquarie-Castlereagh Groundwater Sources 2020 and North Coast Fractured and Porous Rock Groundwater Sources 2016. • NSW DPE Groundwater Assessment Toolbox for major projects in NSW, including: — Groundwater assessment toolbox for major projects in NSW – Overview document (DPE, 2022b) — Guidelines for Groundwater Documentation for SSD/SSI Projects – Technical guideline (DPE, 2022c) — Minimum Groundwater Modelling Requirements for SSD/SSI Projects – Technical guideline (DPE, 2022d) — Cumulative Groundwater Impact Assessment Approaches – Information paper (DPE, 2022a) — Guidelines for groundwater quality protection in Australia National Water Quality Management Strategy (Australian Government, 2013) — Guidelines for the Assessment and Management of Groundwater Contamination (NSW Department of Environment and Conservation, 2007).	Section 6.15

Matter	Key issue	Level of assessment	CIA	Engagement	Relevant government plans, policies and guidelines	Scoping report reference
Soils and contamination	No	Standard	No	Councils EPA	• National Environment Protection (Assessment of Site Contamination) Measure (National Environment Protection Council, 2013) • Managing Land Contamination: Planning Guidelines SEPP 55 –Remediation of Land (DUAP and EPA, 1998) • Consultants reporting on contaminated land – Contaminated Land Guidelines (EPA, 2020a) • Contaminated Land Management – Guidelines for the NSW Site Auditor Scheme (EPA, 2017a) • Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997 (EPA, 2015) • Urban and regional salinity – guidance given in the Local Government Salinity Initiative booklets (http://www.environment.nsw.gov.au/salinity/solutions/urban.htm) which includes Site Investigations for Urban Salinity (DLWC, 2002) • Guidelines for managing salinity in rural areas (OEH, 2015) • Naturally Occurring Asbestos – Asbestos Management Plan Guide (Asbestos Awareness and the Asbestos Education Committee, 2021) • How to manage and control asbestos in the workplace – Code of Practice (Safe Work Australia, 2020) • Managing asbestos in or on soil (WorkCover NSW, 2014) • Soil and Landscape Issues in Environmental Impact Assessment (DLWC, 2000) • Managing Urban Stormwater: Soils and construction – Volume 1 (Landcom, 2004).	Section 6.16
Air quality	No	Standard	No	NSW Environment and Heritage	• Guidance on the assessment of dust from demolition and construction (Institute of Air Quality Management (IAQM), 2014).	Section 6.17
Climate change and greenhouse gas	No	Standard	No	–	• ISO 14064-1:2018 Specification with guidance at the organisation level for quantification and reporting of greenhouse gas emissions and removal (ISO, 2018a) • National Greenhouse Accounts Factors (DISER, 2021). • Climate Change in Australia Technical Report 2015 (CSIRO, 2015) • Climate change impact and risk management – A guide for business and government (Australian Greenhouse Office, 2006) • ISO 31000-2018; Risk Management – Principles and Guidelines (ISO, 2018b) • AS 5334:2013 – Climate Change Adaptation for Settlements and Infrastructure – A risk based approach (Standards Australia, 2013).	Section 6.18

Matter	Key issue	Level of assessment	CIA	Engagement	Relevant government plans, policies and guidelines	Scoping report reference
Cumulative impacts	Yes	Detailed	N/A	Community Government agencies Local Aboriginal Land Councils Landowners Business owners	• Cumulative Impact Assessment Guidelines for State Significant Projects (DPIE, 2021g).	Section 6.19

Appendix B

Preliminary environmental risk assessment

B1 Preliminary environmental risk assessment

This appendix provides a preliminary environmental risk analysis undertaken for the project to identify the potential key issues associated with the project, and the matters that require further consideration and assessment in the EIS. In line with *State significant infrastructure guidelines – preparing a scoping report* (DPIE, 2021) (Scoping report guideline), the analysis has considered:

- Nature of potential impacts (positive and negative) – being direct, indirect and cumulative impacts. The perceptions of key stakeholders or groups (where known) and where relevant, the sentiment of landowners towards the project have also been considered when identifying potential impacts as these matters may not necessarily align with the technical analysis of environmental impacts.
- Scale of the impact (severity, geographical extent, and duration) and sensitivity of the receiving environment (including environmental, social and economic values held by stakeholders and community).

A key issue identified by the preliminary environmental risk analysis should require a 'detailed' level of assessment in most instances as defined in the Scoping Report guideline, whereas 'other' issues would require a 'standard' level of assessment. However, the complexity of the technical assessment would also inform whether or not an issue is categorised as requiring a 'detailed' or a 'standard' assessment in the EIS for the project. As such, there may be 'other' issue that requires a detailed assessment in the EIS.

The process of key issue identification and analysis will continue as the EIS progresses to ensure that the detailed information gathered for the project is used to identify and review potential environmental issues. The outcomes of the risk analysis included in this Scoping report will be re-examined during the environmental assessment that will be included in the EIS for the project.

B1.1 Methodology

B1.1.1 Likelihood and consequence analysis

To determine the residual impacts for each potential issue, a risk analysis involving a likelihood and consequence analysis was carried out in accordance with the principles of the Australian and New Zealand standard *AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines*.

This involved:

- rating the risk of each identified potential impact by identifying the consequences of the impact and the likelihood of each impact occurring
- considering the probable effectiveness of the proposed management and mitigation measures to determine the likely residual risk of each impact.

The definitions of the likelihood are provided in Table B-1 and the definitions of consequences are provided in Table B-2. In determining the consequence, the scale of the impact (severity, geographical extent, and duration) and sensitivity of the receiving environment is considered (including values held by stakeholders and vulnerability to change).

The risk rating for each potential issue was then determined by combining the consequence and likelihood to identify the level of risk as shown in the matrix provided in Table B-3.

Table B-1 Risk analysis likelihood definitions

Likelihood	Definition
Certain	Expected to happen routinely during the project life.
Likely	Could easily happen and has occurred on a previous similar project.
Unlikely	Possible, but not anticipated.

Table B-2 Risk analysis consequence definitions

Consequence level	Definition
Minor	• Minor effects on biological, social, economic or physical environment/values, both built and natural (actual or perceived). • Minor short to medium term damage to small area of limited significance, easily rectified and/or effectively mitigated.
Moderate	• Moderate effects on biological, social, economic or physical environment/values, both built and natural (actual or perceived). • Moderate short to medium term widespread impacts. More difficult to rectify and/or effectively mitigate.
Major	• Serious effects on biological, social, economic or environment/values, both built or natural (actual or perceived). • Relatively widespread medium to long term impacts. Rectification or effective mitigation difficult or impossible. Offsets may be required.

Table B-3 Risk rating matrix

Likelihood	Consequence		
	Minor	Moderate	Major
Certain	Medium	High	High
Likely	Low	Medium	High
Unlikely	Low	Low	Medium

B1.1.2 Identification of environmental risk categories

The likelihood and consequence analysis for each of the identified potential issues that may be associated with the project were identified and categorised as a 'key issue' or 'other' (see Table B-4 for the definition of these categories). Where the risk analysis identifies an environmental aspect with risks that have a range of ratings, the highest risk rating would determine the final risk category for that environmental aspect.

Table B-4 Environmental risk categories

Risk category	Definition
Key issue	Potential for high or medium impacts (actual or perceived) requiring further investigation to identify specific management and mitigation measures.
Other	Potential for low impacts that can be managed effectively with standard and/or best practice management and mitigation measures.

B1.2 Environmental risk analysis

Using the framework described above, the environmental risk analysis results for the project are presented in Table B-5.

Table B-5 Environmental risk analysis

Risk descriptor	Nature of impact	Project phase	Environmental risk screening			Environmental risk category
			Consequence	Likelihood	Risk rating	
Land use and property						
Creation of an easement or acquisition of land for permanent infrastructure resulting in changes or limitations on land use (including private/public land, offset areas).	Direct	Operation	Major	Certain	High	**Key issue**
Temporary changes to land use due to the leasing and use of land for the disturbance area, access, ancillary facilities and workforce accommodation camps.	Direct	Construction	Moderate	Certain	High	
Impacts on forestry production due to access requirements for the project, limitations on the height of vegetation permitted in the easement and interference with telecommunications navigation or surveillance equipment.	Direct/Indirect	Construction	Moderate	Likely	Medium	
Conflicts with aviation activities (such as landing strips, aerodromes and regional airports).	Indirect	Construction/Operation	Moderate	Likely	Medium	
Impacts on mining leases and licences such that mine operations are affected.	Indirect	Construction/Operation	Minor	Unlikely	Low	
Effects on access to properties and adjustments to infrastructure (fences/gates) as a result of changes to private access roads and internal access arrangements.	Direct	Construction/Operation	Minor	Likely	Low	
Impacts on services and utilities.	Direct	Construction	Moderate	Unlikely	Low	
Effects to access to Travelling Stock Reserves and other stock movements.	Direct	Construction	Minor	Unlikely	Low	
Agriculture						
Impacts on agricultural productivity and/or farming operations due to restrictions during operation (such as disruption to cropping and irrigation practices (including limitations on equipment or activities (ground and aerial)), interference with telecommunications navigation or surveillance equipment, limitations on stock movements and impacts to resources (water, etc)).	Direct/Indirect	Operation	Major	Likely	High	**Key issue**

Risk descriptor	Nature of impact	Project phase	Environmental risk screening			Environmental risk category
			Consequence	Likelihood	Risk rating	
Impacts on agricultural productivity and/or farming operations due to restrictions during construction (such as disruption to cropping and irrigation practices (including limitations on equipment or activities (ground and aerial)), limitations on stock movements, biosecurity risks, impacts to resources (water, etc), impacts to livestock (due to construction noise and lighting)).	Direct/Indirect	Construction	Moderate	Likely	Medium	
Impacts to biophysical strategic agricultural land.	Direct	Construction/Operation	Moderate	Likely	Medium	
Introduction of biosecurity risks due to the movement and storage of machinery and materials, including the spread of weeds and pathogens.	Indirect	Construction	Moderate	Unlikely	Low	
Landscape character and visual amenity						
Adverse impacts on landscape character and visual amenity from private/public places due to construction activities (e.g. vegetation clearing and earthworks), construction traffic, ancillary infrastructure and workforce accommodation camps.	Indirect	Construction	Moderate	Likely	Medium	**Key issue**
Light spill from construction sites or at energy hubs.	Indirect	Construction/Operation	Minor	Likely	Low	
Adverse impacts on landscape character and visual amenity from private/public places due to permanent infrastructure.	Indirect	Operation	Major	Certain	High	
Biodiversity						
Clearing of native vegetation resulting in loss of fauna habitat, habitat fragmentation and loss of connectivity.	Direct/Indirect	Construction	Major	Certain	High	**Key issue**
Impacts on listed threatened flora species and endangered terrestrial ecological populations and communities.	Direct/Indirect	Construction	Major	Certain	High	
Impacts on potential habitat for listed threatened fauna species.	Direct/Indirect	Construction	Major	Certain	High	
Increased native fauna mortality from risk of collision with construction vehicles.	Direct	Construction	Minor	Likely	Low	

Risk descriptor	Nature of impact	Project phase	Environmental risk screening			Environmental risk category
			Consequence	Likelihood	Risk rating	
Impacts to native vegetation (including EECs) and threatened species due to the transport of weeds and pathogens.	Indirect	Construction	Moderate	Unlikely	Low	
Increased native fauna mortality from risk of collision with transmission lines.	Indirect	Operation	Moderate	Likely	Medium	
Impacts to native fauna due to EMF.	Indirect	Operation	Moderate	Likely	Medium	
Impacts on aquatic ecology and threatened species, including as a result of riparian vegetation removal or changes in geomorphology, water quality and/or fish passage.	Direct/Indirect	Construction	Minor	Likely	Low	
Impacts on groundwater dependent ecosystems.	Indirect	Construction	Moderate	Unlikely	Low	
Impacts on fauna due to increased dust, sedimentation and erosion, noise and light.	Indirect	Construction/Operation	Minor	Likely	Low	
Impacts on the biodiversity values of protected and sensitive lands, including wetlands, National Parks and ecological conservation areas.	Indirect	Construction/Operation	Moderate	Certain	High	
Impacts on aquatic ecology and threatened species, including as a result of riparian vegetation removal or changes in geomorphology, water quality and/or fish passage.	Direct/Indirect	Operation	Moderate	Unlikely	Low	
Aboriginal heritage						
Impacts on registered Aboriginal heritage items/sites.	Direct/Indirect	Construction	Major	Certain	High	**Key issue**
Impacts on areas of known Aboriginal cultural sensitivity.	Direct/Indirect	Construction/Operation	Major	Certain	High	
Impacts on unidentified Aboriginal heritage items or areas of archaeological sensitivity of cultural value.	Direct/Indirect	Construction	Major	Certain	High	
Non-Aboriginal heritage						
Impacts on listed heritage items and known areas of archaeological potential.	Indirect	Construction/Operation	Moderate	Unlikely	Low	**Key issue**
Impacts on unknown heritage items (e.g. archaeological items).	Direct/Indirect	Construction	Moderate	Likely	Medium	

Risk descriptor	Nature of impact	Project phase	Environmental risk screening			Environmental risk category
			Consequence	Likelihood	Risk rating	
Social						
Refer to separate SIA Scoping Tool in Appendix E						**Key issue**
Economic						
Adverse economic impacts resulting from changes in agricultural and forestry productivity due to land acquisition or leasing.	Direct	Construction/Operation	Major	Likely	High	**Key issue**
Impacts (positive/negative) on other industries and businesses due to increased demand for services, materials, housing and other cost of living factors.	Indirect	Construction	Moderate	Likely	Medium	
Employment impacts in the region (positive and negative) due to local employment opportunities, competition for workers or increased expenditure by the project workforce.	Direct/Indirect	Construction	Moderate	Likely	Medium	
Noise and vibration						
Potential exceedances of airborne noise management levels from activities within and outside standard construction hours, including activities at construction compounds and workforce accommodation camps.	Direct	Construction	Moderate	Certain	High	**Key issue**
Construction traffic resulting in an increase in traffic noise greater than two decibels.	Direct	Construction	Moderate	Likely	Medium	
Potential exceedances of human comfort vibration levels during construction or work within safe working distances to structures.	Direct	Construction	Minor	Unlikely	Low	
Airborne noise impacts from the use of helicopters and/or drones.	Direct	Construction	Minor	Unlikely	Low	
Noise impacts from operation of energy hubs, switching stations and transmission lines.	Direct	Operation	Moderate	Certain	High	
Potential exceedances of human comfort vibration levels during operation.	Direct	Operation	Minor	Unlikely	Low	

Risk descriptor	Nature of impact	Project phase	Environmental risk screening			Environmental risk category
			Consequence	Likelihood	Risk rating	
Hazard and risk						
Potential risks to the project by bushfire, or bushfire risks due to the proposed activity in bushfire prone areas.	Direct/Indirect	Construction/Operation	Major	Likely	High	Key issue
Potential incidents associated with transport and storage of hazardous materials and dangerous goods.	Direct	Construction/Operation	Moderate	Unlikely	Low	
Impacts to the project due to mining subsidence.	Direct	Construction/Operation	Moderate	Likely	Medium	
Potential impacts to utilities causing significant disruption to services.	Direct	Construction	Moderate	Unlikely	Low	
Health risks to the surrounding community due to electric and magnetic fields from transmission lines, energy hubs and switching stations.	Indirect	Operation	Moderate	Likely	Medium	
Traffic and transport						
Changes to road network performance due to construction vehicle movements (including workforce) and temporary road/lane closures.	Direct	Construction	Moderate	Likely	Medium	Key issue
Impacts to condition of roads due to increased vehicular traffic.	Direct	Construction	Minor	Certain	Medium	
Impacts on access to and within properties.	Direct	Construction	Minor	Likely	Low	
Temporary disruptions to rail operations during transmission line stringing works.	Direct	Construction	Minor	Likely	Low	
Impacts to other aviation activities due to aerial stringing and/or deliveries by helicopters.	Indirect	Construction	Minor	Unlikely	Low	
Impacts to the performance of the road network during operation.	Direct	Operation	Minor	Unlikely	Low	
Cumulative impacts						
Potential temporary cumulative impacts with other major projects.	Direct/Indirect	Construction	Moderate	Likely	Medium	Key issue
Potential permanent cumulative impacts with other major projects.	Direct/Indirect	Operation	Moderate	Likely	Medium	

Risk descriptor	Nature of impact	Project phase	Environmental risk screening			Environmental risk category
			Consequence	Likelihood	Risk rating	
Waste management and resource use						
Generation of excess spoil that cannot be reused on site (unsuitable for reuse or insufficient space) and needs to be disposed of.	Direct	Construction	Minor	Unlikely	Low	Key issue
Increased resource demand on local and regional resources resulting in a resource becoming in short supply.	Direct	Construction	Moderate	Likely	Medium	
Inappropriate management of waste generated during construction.	Direct	Construction	Moderate	Unlikely	Low	
Impact to regional or local water supply due to construction water demands.	Direct	Construction	Moderate	Likely	Medium	
Inappropriate management of waste generated during operation.	Direct	Operation	Minor	Unlikely	Low	
Impact to local water supply due to operational water demands.	Direct	Operation	Minor	Unlikely	Low	
Hydrology, flooding and water quality						
Surface water quality impacts due to erosion and sedimentation, leaks and spills and offsite discharge of water from concrete batching plants.	Indirect	Construction	Minor	Likely	Low	Other
Potential exposure of soil salinity/saline soils resulting in off-site discharge of saline water resulting in exceedances of water quality trigger levels.	Indirect	Construction	Minor	Unlikely	Low	
Potential exposure of acid sulfate soils resulting in off-site discharge of acidic water.	Indirect	Construction	Minor	Unlikely	Low	
Adverse impacts on flooding due to changes in overland flow paths and existing drainage paths as a result of the interruption of flow paths by temporary construction structures, materials, plant and equipment, etc.	Indirect	Construction	Minor	Unlikely	Low	
Adverse impacts on flooding due to changes in overland flow paths as a result of the interruption of flow paths by permanent structures and infrastructure (energy hubs , transmission towers).	Indirect	Operation	Moderate	Unlikely	Low	

Risk descriptor	Nature of impact	Project phase	Environmental risk screening			Environmental risk category
			Consequence	Likelihood	Risk rating	
Impacts on hydrology due to changes to flow patterns (e.g. volume, rate, timing and velocity) and/or drainage patterns due to earthworks, stockpiling and other temporary changes to landform, dewatering or works in waterways for access tracks.	Direct	Construction	Minor	Unlikely	Low	
Impacts on hydrology due to changes to flow patterns (e.g. volume, rate, timing and velocity) and/or drainage patterns due to permanent structures and infrastructure (energy hubs and transmission towers).	Direct	Operation	Minor	Unlikely	Low	
Groundwater						
Impacts to nearby groundwater bores and groundwater dependent ecosystems due to groundwater drawdown, groundwater extraction for water supply, changes to groundwater quality and quantity and/or flow paths.	Indirect	Construction	Moderate	Unlikely	Low	Other
Impacts on groundwater quality due to mobilisation of contaminants, acidification or leaks and spills.	Indirect	Construction/Operation	Moderate	Unlikely	Low	
Soils and contamination						
Erosion as a result of the disturbance of soils, particularly in soil landscapes characterised by dispersive soils.	Direct	Construction	Minor	Likely	Low	Other
Physical or chemical changes to soil quality due to soil disturbance or compaction by construction activities, removal of vegetation or interference with aquifers.	Direct	Construction	Minor	Likely	Low	
Disturbance of contaminated soils, and subsequent mobilisation resulting impacts at adjacent receivers.	Direct	Construction	Minor	Likely	Low	
Exposure of acid sulfate soils or soil salinity during earthworks, and subsequent impacts to receiving environments and/or sensitive receivers.	Direct/Indirect	Construction	Minor	Likely	Low	
Adverse impacts to structures due to underlying soil/geology suitability, salinity and acid sulfate soils.	Direct	Operation	Minor	Unlikely	Low	
Contamination of soil due to leaks and spills.	Direct	Construction/Operation	Minor	Likely	Low	

Risk descriptor	Nature of impact	Project phase	Environmental risk screening			Environmental risk category
			Consequence	Likelihood	Risk rating	
Air quality						
Local air quality impacts due to dust generation (from exposed soil/stockpiles, excavation, concrete batching and vehicle movements) or emissions from construction plant and equipment.	Indirect	Construction	Minor	Likely	Low	**Other**
Local air quality impacts during operation.	Indirect	Operation	Minor	Unlikely	Low	
Climate change and greenhouse gas						
Impact of climate change on energy infrastructure and operations.	Direct	Operation	Minor	Likely	Low	**Other**
Emissions of greenhouse gases during construction from embodied energy in materials, or emissions from construction plant and vehicles.	Direct	Construction	Minor	Likely	Low	

Appendix C
Preliminary biodiversity assessment

Design
for a better
future /

EnergyCo

Central-West Orana Renewable Energy Zone Transmission Project

Preliminary Biodiversity Assessment

wsp

August 2022

Question today
Imagine tomorrow
Create for the future

Central-West Orana Renewable Energy Zone Transmission Project
Preliminary Biodiversity Assessment

EnergyCo

WSP
Level 3, 51-55 Bolton St
Newcastle NSW 2300
PO Box 1162
Newcastle NSW 2300

Tel: +61 2 4929 8300
Fax: +61 2 4929 8382
wsp.com

	Name	Date	Signature
Prepared by:	Liza Hill	30/08/2022	
Reviewed by:	Toby Lambert; Alex Cockerill	30/08/2022	
Approved by:	Paul Greenhalgh	30/08/2022	

Table of contents

CONTENTS (Continued)

List of tables

List of figures

List of appendices

Glossary

Avoid	measures taken by a proponent such as careful site selection or actions taken through the design, planning, construction and operational phases of the development to completely avoid impacts on biodiversity values, or certain areas of biodiversity. Refer to the BAM for operational guidance.
BioNet Atlas	the OEH database of flora and fauna records (formerly known as the NSW Wildlife Atlas). The Atlas contains records of plants, mammals, birds, reptiles, amphibians, some fungi, some invertebrates (such as insects and snails listed under the TSC Act) and some fish.
BioNet Vegetation Classification	the master vegetation community-level classification for use in vegetation mapping programs and regulatory biodiversity impact assessment frameworks in NSW. The BioNet Vegetation Classification is published by OEH and available at www.environment.nsw.gov.au/research/Visclassification.htm.
Broad condition state	areas of the same PCT that are in relatively homogenous condition. Broad condition is used for stratifying areas of the same PCT into a vegetation zone for the purpose of determining the vegetation integrity score.
BAM Credit Calculator	the computer program that provides decision support to assessors and proponents by applying the BAM, in particular by using the data required to be entered and the equations in Appendix 6 and Appendix 9 to calculate the number and class of biodiversity credits required to offset the impacts of a development or created at a biodiversity stewardship site.
Construction footprint	the area of land that is directly impacted on by a proposed development, including access roads, and areas used to store construction materials. The term development footprint is also taken to include clearing footprint of the project.
Habitat	an area or areas occupied, or periodically or occasionally occupied, by a species or ecological community, including any biotic or abiotic component.
IBRA region	a bioregion identified under the Interim Biogeographic Regionalisation for Australia (IBRA) system, which divides Australia into bioregions on the basis of their dominant landscape-scale attributes.
IBRA subregion	a subregion of a bioregion identified under the IBRA system.
Local population	the population that occurs in the study area. In cases where multiple populations occur in the study area or a population occupies part of the study area, impacts on each subpopulation must be assessed separately.
Locality	a 20 km radius surrounding the project in which threatened species database searches were conducted.
Minimise	a process applied throughout the development planning and design life cycle which seeks to reduce the residual impacts of development on biodiversity values.
Plant community type (PCT)	a NSW plant community type identified using the PCT classification system.
Project	EnergyCo – Central West Orana REZ Transmission

Species credits	the class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates.
Project study area	area identified by EnergyCo as the potential development footprint – nominally a 1 km wide corridor
Threatened ecological community (TEC)	means a critically endangered ecological community, an endangered ecological community or a vulnerable ecological community listed in Schedule 2 of the BC Act and/or Schedule of the EPBC Act..
Threatened species	critically endangered, endangered or vulnerable threatened species as defined by Schedule 1 of the BC Act, or any additional threatened species listed under Part 13 of the EPBC Act as critically endangered, endangered or vulnerable.
Vegetation class	a level of classification of vegetation communities defined in Keith (2004). There are 99 vegetation classes in NSW.
Vegetation formation	a broad level of vegetation classification as defined in Keith (2004). There are 16 vegetation formations and sub-formations in NSW.
Vegetation integrity	the condition of native vegetation assessed for each vegetation zone against the benchmark for the PCT.

Abbreviations

BAM	Biodiversity Assessment Methodology, as required for assessment under the *Biodiversity Conservation Act 2016* (BC Act) which commenced on 25 August 2017
BC Act	*Biodiversity Conservation Act 2016* (NSW) regulated by the NSW Government Environment, Energy and Science (ESS) (previously Office of Environment and Heritage)
BDAR	Biodiversity Development Assessment Report
DPE	The NSW Department of Planning and Environment
DAWE (DCCEEW)	Department of Agriculture, Water and the Environment. The department develops and implements national policy, programs and legislation to protect and conserve Australia's natural environment and cultural heritage and administers the EPBC Act. The Commonwealth Department of Department of Agriculture, Water and the Environment was previously known as: — Department of the Environment and Energy (DoEE) — Department of the Environment (DoE) — Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) — Department of the Environment, Water, Heritage and the Arts (DEWHA). — Department of Environment and Heritage (DEH). — Department of the Environment and Water Resources (DEWR). On July 1st 2022 became Department of Climate Change, Energy, the Environment and Water (DCCEEW)
EEC	Endangered ecological community
EES	NSW Department of Planning, Industry and Environment, Office of Environment, Energy and Science (previously OEH) The department develops and implements state policy, programs and legislation to protect and conserve New South Wales's natural environment and cultural heritage and administers the BC Act.
EIA	Environmental impact assessment
EIS	Environmental impact statement
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)*
FM Act	*Fisheries Management Act 1994 (NSW)*
LEP	Local Environmental Plan
LGA	Local Government Area
MNES	Matter/s of National Environmental Significance (MNES) protected by a provision of Part 3 of the EPBC Act.
NSW	New South Wales
OEH	Office of Environment and Heritage
PCT	A NSW plant community type (PCT) identified using the BioNet Vegetation Classification system.
PMDS	Protected Matters Database Search
SVTM	State vegetation type mapping
TEC	Threatened ecological community

Executive summary

This Preliminary Biodiversity Assessment has been prepared by WSP Australia Pty Ltd on behalf of EnergyCo for the proposed Central-West Orana Renewable Energy Zone (CWO REZ) transmission infrastructure project in the Central-West Orana area. The purpose of this report is to present preliminary biodiversity findings within the proposed study area based mostly on desktop assessment, with limited available field validation to inform the Scoping Report and Commonwealth EPBC Act Referral

Broad-scale state vegetation type mapping (SVTM) was relied on to inform the assessment of likelihood of occurrence for threatened communities, species, and populations in the project study area. Some limited field survey carried out in 2021 also informed this assessment.

Based on a combination of broad scale vegetation mapping and preliminary field investigations within some areas of the project study area, 34 native plant community types (PCTs) have the potential to occur in the study area. Of these, 16 are linked to the following Threatened Ecological Communities (TECs):

- Listed under the Biodiversity Conservation Act 2016 (BC Act):
  - Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions – Endangered
  - Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions – Endangered
  - White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregion – Critically Endangered
- Listed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act):
  - Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands – Endangered
  - White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland – Critically Endangered.

Preliminary desktop assessment identified the following threatened species as having a moderate or higher likelihood of occurrence within the project study area:

- 21 flora and 52 fauna threatened species listed under the BC Act
- 13 flora and 19 fauna threatened species listed under the EPBC Act.

Of those, six threatened flora and 21 threatened fauna species listed under the BC Act and one threatened flora and five threatened fauna species listed under the EPBC Act have been recorded within the project study area through either preliminary surveys conducted by WSP in 2021 or through BioNet Atlas records (EES, 2020).

Desktop assessment identified twelve migratory bird species, listed under the EPBC Act, with potential to occur within the project study area. Of those, seven have a moderate or higher likelihood of occurrence, with none having historic records within the project study area.

Other important biodiversity values identified within the study area include National Parks, Nature Reserves, Protected Areas, wetlands, and key fish habitat areas. The Wollar-Bylong arm of the project study area also intersects Regent Honeyeater Important Areas Mapping (identified Regent Honeyeater habitat).

1 Introduction

New South Wales (NSW) is currently undergoing an energy sector transformation that will change how we generate and use energy. The National Energy Market (NEM) (managed by the Australian Energy Market Operator (AEMO)) is transitioning from a system dominated by small number of large coal-fired generators located close to metropolitan centres to one of diverse renewable and distributed energy generation and storage located where the resource and environmental constraints permit.

The NSW Government is leading the development of Renewable Energy Zones (REZ) across NSW. REZs are modern day power stations which combine renewable energy generation (such as wind and solar) and energy storage systems (such as batteries and pumped hydro), supported by transmission infrastructure (high voltage (HV) poles and wires). A REZ groups new wind and solar power generation, undertaken by private developers into locations where it can be efficiently stored and transmitted across NSW and the NEM, requiring the coordination of power generation and transmission infrastructure by Energy Corporation of NSW (EnergyCo). EnergyCo is the NSW Government-controlled statutory authority that will lead the delivery of REZs in NSW.

Five REZs have been announced in NSW. This Preliminary Biodiversity Assessment is in respect of a project (described in Section 1.1) to facilitate the Central-West Orana REZ which has an intended network capacity of at least 3,000 megawatts. As the existing transmission network is not capable of transferring this amount of new electricity generation in the Central-West Orana REZ, new transmission infrastructure is needed to connect the new electricity generation and storage projects in the REZ to the National Energy Market (NEM).

1.1 Project overview

EnergyCo are proposing the construction and operation of new high voltage electricity transmission infrastructure and new energy hubs and switching stations required to connect energy generation and storage projects within the Central-West Orana REZ to the existing electricity network. The project would enable at least 3,000 megawatts of new network capacity to be unlocked by the mid-2020s and enable generators within the Central-West Orana REZ to export electricity to the rest of the network. The development of renewable energy generation and storage projects in the Central-West Orana REZ are subject to separate approvals.

An overview of the project is shown in Figure 1.1 and key features include:

- a new switching station at Wollar, to connect the project to Transgrid's existing Wollar Substation and onto the NEM
- new twin double circuit 500 kV transmission lines and associated infrastructure to connect to the NEM and single and double circuit 330 kV single lines to connect energy generation and storage projects within the Central-West Orana REZ to the energy hubs
- energy hubs at Merotherie and Elong Elong, to connect energy generation and storage projects within the Central-West Orana REZ to the new 500 kV network infrastructure
- switching stations along the 330 kV network infrastructure to transfer the energy generated from the energy generation projects onto the 330 kV network infrastructure
- establishment and upgrade of access tracks and public roads, and other ancillary works such as laydown and staging areas, earthwork material sites with crushing and screening plants, concrete batching plants, brake/winch sites, site offices and workforce accommodation camps
- utility adjustments required for construction of the new network infrastructure.

It is expected that construction of the project would commence in the second half of 2024 and take approximately three years to complete with initial operations commencing as early as mid-2027.

The project includes a southern extension of the transmission network between Elong Elong and Mumbil with a connection to the NSW transmission network. This section is under investigation and will be subject to a separate planning approval.

The project study area is generally a one kilometre (km) wide corridor in which the proposed transmission line, energy hubs and switching stations will be located. A refined corridor for the project would be identified in the Environmental Impact Statement (EIS). Additional locations that may be required for specific uses (such as access tracks, construction compounds and work force accommodation camps) outside the project study area would also be identified in the EIS.

1.2 Key terms

The following terms are used in reporting:

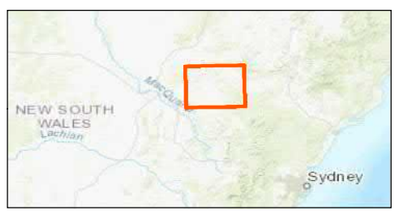
- Renewable Energy Zone (REZ): A geographic area with high-quality variable renewable energy resources (such as wind and solar), suitable topography and land use designations for development, and demonstrated interest from project developers.
- Central-West Orana REZ: A geographic area of approximately 20,000 square kilometres centred by Dubbo and Dunedoo and extending west to Narromine and east beyond Mudgee and to Wellington in the south and Gilgandra in the north, that will combine renewable energy generation, storage and HV transmission infrastructure to deliver energy to electricity consumers.
- The project: New HV electricity transmission infrastructure, consisting of new 500 kV and 330 kV transmission lines and related infrastructure, that would allow renewable energy generators and storage projects in the Central-West Orana REZ to connect to the existing transmission network.
- Energy hub: An energy hub is a substation where energy exported from renewable energy generators or storage is aggregated, transformed to 500 kV (where required) and exported to the transmission network.
- Project study area: Extends north to south from Coolah to Mumbil and east to west from Wollar to Cobbora (refer to Figure 1.1). The study area is generally a one kilometre wide corridor in which the proposed transmission line would be located. A refined corridor for the transmission line would be identified in the EIS. Additional locations that may be required for specific uses (such as access tracks, construction compounds and accommodation camps) outside the project study area would also be identified in the EIS.
- Single circuit transmission lines: A set of three conductors carried by a single tower set.
- Double circuit transmission lines: A set of six conductors carried by a single tower set.
- Twin transmission lines: A pair of single or double circuit transmission lines running parallel.
- Substation: A facility used to increase or decrease voltages between incoming and outgoing lines (e.g. 330 kV to 500 kV).
- Switching station: A facility used to connect two or more distinct transmission lines of the same designated voltage.
- Project disturbance area: comprises a nominal, generally220 m corridor within the project study area for the purpose of initial significance assessments under the *Biodiversity Conservation Act 2016* (BC Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). A revised clearing footprint to support project approval will be determined as part of the development of the Environmental Impact Statement (EIS), and a final clearing footprint will be determined in the detailed design stage following project approval.

Central-West Orana REZ Transmission

Figure 1.1
Location of the study corridor

Legend

- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Existing Transmission Line
- Road
- Watercourse
- Waterbodies
- Project Study Area



0 6,000 12,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:300,000 Date: 6/09/2022

Data sources: WSP 2022

1.3 Purpose of the report

This Preliminary Biodiversity Assessment (this report) has been prepared by WSP Australia Pty Ltd on behalf of EnergyCo. The purpose of this report is to present preliminary biodiversity findings within the study area to inform the scoping report and EPBC Referral for the project. The report is based primarily on desktop assessment, with limited available field validation

This report also identifies potential seasonal survey requirements that pose potential issues that would likely need to be addressed as part of a Biodiversity Development Assessment Report (BDAR) that would be prepared in accordance with the Biodiversity Assessment Method 2020 (BAM 2020) (EES 2020a). It is likely that a BDAR will need to be prepared to support an Environmental Impact Statement (EIS) for the project in accordance with the *Biodiversity Conservation Act 2016* (BC Act).

This report also considers 'Matters of National Environmental Significance' (MNES) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The overall purpose of this report to is to present all biodiversity constraints requiring assessment and/or consideration as part of project development and preparation of the EIS, under the relevant NSW and Commonwealth legislation. More detailed studies and assessment reporting for the refined design will be completed in the future in accordance with the requirements of the relevant determining authorities.

2 Methods

This chapter outlines the methods used to compile known or predicted biodiversity values within the project study area. All work for this report was carried out under the appropriate licences, including a scientific licence as required under Part 2 of the BC Act (License Number: SL100630) and an Animal Research Authority (TRIM 18/195) issued by the Department of Primary Industries (Agriculture).

2.1 Personnel

The contributors to the preparation of this report, their qualification and roles are provided below in Table 2.1.

Table 2.1 Contributors and their roles

Name	Qualifications	Role
Alex Cockerill	Bachelor of Science (Hons), BAM Accredited Assessor (BAAS17020)	Principal Ecologist – technical review
Toby Lambert	Bachelor of Environmental Science, BAM Accredited Assessor (BAAS17046)	Principal Ecologist – technical review
Liza Hill	BAppSc (Environmental Analysis), BAM Accredited Assessor (BAAS17071)	Principal Ecologist – report preparation
Devon Raiff	Bachelor of Science (Hons)	Ecologist – report preparation
Alicia Palmer	Bachelor of Science (Hons)	Ecologist – report preparation
Angela Sun	Bachelor of Science (Geospatial Science, Honours)	GIS

2.2 Nomenclature

Names of vegetation communities used in this report are based on the Plant Community Type (PCT) used in the NSW BioNet Vegetation Classification (DPIE 2022a).

These names are cross-referenced with those used for threatened ecological communities (TECs) listed under the BC Act and/or the EPBC Act. They are also cross-referenced with previous vegetation mapping using dominant species and structure of the community.

Names of plants used in this document follow PlantNet (Royal Botanic Gardens, 2022). Scientific names are used in this report for species of plant. The names of introduced species are denoted with an asterisk (*).

For threatened species of plants, the names used in the BioNet Atlas of NSW Wildlife (DPE 2022b) are also provided where these differ from the names used in the PlantNet database.

Names of vertebrate fauna follow the Australian Faunal Directory maintained by the Department of Agriculture, Water and the Environment (2022a). Common names are used in the report for species of animal. Both common and scientific names are provided in appendices.

For threatened species of animals, the names used in the BioNet Atlas of NSW Wildlife (DPE 2022b) and NSW Department Primary Industries (DPI 2022a) are provided.

2.3 Database and literature review

2.3.1 *Database searches*

The aim of the database searches was to identify threatened flora and fauna species, populations and ecological communities, Commonwealth listed migratory species or critical habitat recorded previously or predicted to occur near the project study area.

This allowed for known habitat characteristics to be compared with those present within the project study area to determine the likelihood of occurrence of each species or populations. These results informed the identification of appropriate field survey effort and the groups likely to occur.

Records of threatened species, populations and ecological communities known or predicted to occur in the locality of the project study area were obtained from a range of databases as detailed in Table 2.2.

Table 2.2 Database searches undertaken

Database	Search date	Area searched	Reference
Bionet Atlas of NSW Wildlife	11 Aug 2022	20 km search around the project study area	DPE (2022b)
Atlas of Living Australia	18 Aug 2022	Locality search around the project study area	Atlas of Living Australia (2022)
Protected Matters Search Tool	11 Aug 2022	20 km search around the project study area	DCCEEW (2022)
NSW Department of Primary Industries Critical Habitat register	11 Aug 2022	Search of the register	DPI (2022a)

2.3.2 *Literature and spatial data review*

The background research included analysis of the following information sources:

- Aerial photographic imagery (Land and Property Information)
- Interim Biogeographic Regionalisation of Australia (IBRA version 7.0) (Department of Environment & Energy 2016)
- Atlas of Groundwater Dependent Ecosystems (GDE) (Australian Bureau of Meteorology 2019)
- Biodiversity Values Map
- BioNet Vegetation Classification (DPE 2022a)
- BioNet Threatened Species Profile Database and data collection (DPE 2022c)
- Atlas of Living Australia – interactive map search (Atlas of living Australia 2022)
- State Vegetation Type Mapping (SVTM), specifically for the Upper Hunter (DPIE 2019a) and Central West/Lachlan Region (DPIE 2019b)
- Preliminary Ecological Assessment Central-West Orana REZ (Niche 2021)
- Fisheries Spatial Data Portal (DPI 2022a)
- DPI register of critical habitat (DPI 2022b).

2.4 Likelihood of occurrence assessment

An assessment was completed to assess the likelihood of occurrence of each threatened species, population and community (threatened biodiversity) identified with the potential to occur in the project study area. All threatened species, populations and communities identified during background research were considered (see Section 2.3).

Preliminary field surveys and habitat assessments were also utilised to inform the likelihood of occurrence assessment. Assessments were based on the habitat profile for the species and other habitat information in the Threatened Biodiversity Data Collection (TBDC) and the Species Profile and Threats Database (DPE 2022c).

The assessment also included consideration of the dates and locations of nearby records and information about species populations in the locality of project study area. The assessment results are summarised in Appendix A and Appendix B.

For this study, the likelihood of occurrence of threatened and migratory species and populations was determined based on the criteria shown in Table 2.3 below.

Table 2.3 Likelihood of occurrence criteria for threatened species and populations

Classification	Definition
Present	Species has been recorded within the last 5 years within the study area by ecological survey.
High	It is highly likely that a species inhabits the study area and is dependent on identified suitable habitat (i.e., for breeding or important life cycle periods such as winter flowing resources), has been recorded recently within the locality and is known or likely to maintain resident populations in the study area. Also, includes known or likely to visit the study area during regular seasonal movements or migration.
Moderate	Potential habitat is present within the project study area. Species unlikely to maintain sedentary populations; however, may seasonally use resources within the study area opportunistically or during migration. The species is unlikely to be dependent (i.e., for breeding or important life cycle periods such as winter flowing resources) on habitat within the study area, or habitat in a modified or degraded state. Includes cryptic flowering flora species that were seasonally targeted by surveys and that have not been recorded.
Low	It is unlikely that the species inhabits the project study area and has not been recorded recently in the locality (over 20 km). It may be an occasional visitor, but habitat similar to the study area is widely distributed in the local areas, meaning that the species is not dependent (i.e., for breeding or important life cycle periods such as winter flowing resources) on available habitat. Specific habitat is not present in the study area or the species are a non-cryptic perennial flora species that were specially targeted by surveys and not recorded.
None	Suitable habitat is absent from study area.

2.5 Field survey undertaken to date

Limited survey has been conducted within parts of the project study area by WSP in Spring 2021, and by Niche in Summer 2021. Survey day counts of each survey type reflect the varied number of ecologists working on each survey within the dates. This was usually in teams of two or three.

Data obtained during these surveys has been incorporated into this report to inform the assessment of likelihood of occurrence for threatened species, populations, and communities.

Table 2.4 summarises the field surveys that have been undertaken to date with further description of methodology provided in section 2.5.1.

Table 2.4 Survey summary within the project study area

Survey dates	Source	Survey type and effort
22-25 February 2021	Niche 2021[1]	20 rapid data points for validation of SVTM, opportunist flora and fauna observations, identification of sensitive areas, and flora and fauna habitat assessment.
6-10 September 2021	WSP[2]	Targeted flora searches threatened species, field recon, opportunistic flora (total 14 survey days).
11-17 September 2021	WSP[2]	Targeted flora searches threatened species, field recon, opportunistic flora (total 13 survey days).
20-24 September 2021	WSP[2]	Targeted flora searches threatened species, field recon, opportunistic flora (total 8 survey days).
6-17 September 2021	WSP[2]	Fauna survey including bat Anabat survey, camera traps, spotlighting, trapping, bird surveys and reptile tiles (total 11 survey days).
13-17 September 2021	WSP[2]	Fauna including bat Anabat survey, camera traps, spotlighting, trapping, bird surveys and reptile tiles (total 4 survey days).

(1) Niche 2021 – field work undertaken for a Preliminary Ecological Assessment for Central-West Orana REZ (Niche 2021)

(2) WSP –preliminary field survey undertaken by WSP for TransGrid in Spring 2021 for the proposed CWO REZ.

2.5.1 *Vegetation surveys*

2.5.1.1 Rapid data points

Rapid data points (RDPs) record the following:

- dominant exotic and native plant species present
- percent cover of native groundcover
- photograph of each location
- assessment of vegetation against threatened ecological community Scientific Determinations and EPBC Act condition thresholds
- threatened flora and/or fauna species identified
- other opportunistic fauna sightings including any significant fauna habitat resources (such as tree hollow, rock piles, and cracks and fissures present in wooden poles).

2.5.1.2 Vegetation mapping

Vegetation within the project study area had been previously mapped at the regional scale by broad-scale vegetation mapping that is published as SVTM (DPIE 2019a and b).

Due to the limited extent of available field validation, SVTM has been relied on. Field data was compared and analysed against the regional vegetation mapping key diagnostic species to confirm each vegetation type.

2.5.2 *Targeted flora surveys*

Targeted threatened flora surveys have included a number of methods including those provided in *Surveying Threatened Plants and Their Habitats* (EES 2020b). A description of each is described below.

Due to the scale of the project and areas still recovering from extended drought conditions within the project study area at the time of the survey, a systematic approach was taken, and two distinct survey techniques (methods) were used. Additional surveys in 2022-2023 will continue to add to the coverage of the project study area to enable detailed assessment.

2.5.2.1 Random meander

Random meander transects were completed in accordance with the technique described by Cropper (1993) whereby the recorder walks in a meandering pattern throughout the site. Attributes recorded during random meander transects included variation in species composition and vegetation structure, the presence or absence of threatened or priority weed species of plant and boundaries between vegetation communities.

2.5.2.2 Parallel field transverses

Parallel field transverses were used in vegetation types for large areas. This involved two botanists walking on a fixed bearing at 30 metres apart, covering 60 metres each side of the centreline of the project study area that allowed for a total coverage of a 120-metre corridor.

2.5.3 *Targeted fauna surveys*

2.5.3.1 Targeted bird surveys

Targeted bird surveys were completed using the standard 20-minute search within a 2-ha area methodology as described in Threatened birds – Survey Guidelines for Australia's Threatened Birds (DEWHA 2010). Surveys were generally completed in areas considered to have habitat for predicted threatened bird species. As far as practicable, bird surveys were completed during periods of high bird activity predominately, early morning or late afternoon, and optimum season. All birds were identified to the species level, either through direct observation or identification of calls.

2.5.3.2 Targeted Bat surveys

Anabat Bat detection

Passive ultrasonic bat detection was used with Anabat Express (Titley Scientific) units for the entire night (a minimum of six hours) starting at dusk for two nights. This was to record and identify the echolocation calls of microchiropteran bats foraging within and adjacent to the project study area. Anabat Express units were placed where bat activity was expected to be higher, based on potential foraging and/or roosting habitats being present.

The ZCA files (full night zero crossing analysis) recorded using the Anabat Express detectors were converted to zc sequence files using Anabat Insight (version 9.1) for analysis and to add metadata (e.g., species label, site identification etc). Calls were identified using zero- crossing analysis in both Analook W (version 4.9) and Anabat Insight (version 9.1) by visually comparing the time-frequency graph and call characteristics (e.g., characteristic frequency and call shape) with reference calls and/or species call descriptions from available reference material.

The Bat calls of NSW: Region based guide to the echolocation calls of microchiropteran bats (Pennay, Law, & Reinhold, 2004) was used to assist call analysis. Call identification was also assisted by consulting distribution information for potential species (Churchill, 2008; Pennay et al., 2011; Van Dyke et al., 2013) and records from the Bionet (DPE 2022b).

During roost watches and spotlighting surveys, an EchoMeter Touch (Wildlife Acoustics, USA) was used to actively record calls of emerging and foraging microbats as well as reference calls for some species. Calls were identified using zero-crossing analysis and full-spectrum in Anabat Insight (version 9.1).

2.5.3.3 Spotlighting

Spotlighting surveys were completed on foot by ecologists, targeting arboreal, flying, and large ground-dwelling mammals, as well as nocturnal birds, reptiles, and amphibians.

2.5.3.4 Opportunistic recording of fauna species and evidence of fauna activity

Opportunistic sightings of animals were recorded during field surveys. Evidence of animal activity, such as scats, diggings, scratch marks, nests/dreys, burrows etc., was also noted. This provided indirect information on animal presence and activity.

During these surveys, a hand-held GPS was used to record the locations of:

- hollow-bearing trees
- aquatic habitat
- rock outcrops.

2.5.3.5 Fauna habitat assessment

Fauna habitat assessments were completed to assess the likelihood of species of animal occurring in the project study area. Habitat assessments included the assessment and identification of habitat features through targeted meander surveys where works were proposed at the time of survey.

Opportunistic recordings of species were made through incidental sightings, aural recognition of calls and observations of indirect evidence of species presence (such as feeding signs, scratchings, nests/dreys, whitewash, owl pellets, burrows, and scats). This provided supplementary information on faunal species presence.

Fauna habitats were assessed generally by examining characteristics such as the structure and floristics of the canopy, understorey and ground vegetation, the structure and composition of the litter layer, and other habitat attributes important for feeding, shelter roosting and breeding. The following criteria were used to evaluate habitat values:

- **Good:** a full range of fauna habitat components are usually present (for example, old growth trees, fallen timber, feeding and roosting resources) and habitat linkages to other remnant ecosystems in the landscape are intact.
- **Moderate:** some fauna habitat components are missing (for example, old-growth trees and fallen timber), although linkages with other remnant habitats in the landscape are usually intact, but sometimes degraded.
- **Poor:** many fauna habitat elements in low quality remnants have been lost, including old growth trees (for example, due to past timber harvesting or land clearing) and fallen timber, and tree canopies are often highly fragmented. Habitat linkages with other remnant ecosystems in the landscape have usually been severely compromised by extensive past clearing.

3 Existing environment

An overview of the existing environment has been undertaken based on a combination of broad scale state vegetation type mapping (SVTM), threatened species database searches, literature review and limited preliminary field survey.

3.1 Native vegetation

The project study area includes a diversity of native vegetation types that fall into the following broad NSW vegetation formations:

- Grassy woodlands
- Grasslands
- Dry Sclerophyll Forests (Shrubby sub-formation)
- Dry Sclerophyll Forest (Shrub/grass sub-formation)
- Freshwater wetlands
- Forested wetlands
- Semi-arid Woodlands (Shrubby sub-formation).

SVTM was used to generate a list of potential native PCTs. Two SVTMs cover the study area, being:

- Upper Hunter v1.0 SVTM – VIS ID 4894 (DPIE 2019a)
- Central West – Lachlan SVM VIS ID 4468 (DPIE 2019b).

The vegetation formations based wholly on SVTM within the project study area contain a total of 34 native PCTs, which are illustrated in Figure 3.1. An overview of each PCT, its associated vegetation formation and class, threat status under the BC Act and EPBC Act, estimated percentage cleared (in NSW) and an indicative project disturbance area for initial significance assessments is presented in Table 3.1.

The relationship between the PCTs that have been mapped in the study area by SVTM and threatened ecological communities (TECs) is shown in Table 3.5. This is based on both the BioNet Vegetation Classification and assessment by WSP ecologists.

Table 3.1 Overview of native plant community types (PCT) within the indicative project disturbance area (ha) (mapped by SVTM)

PCT No.	Plant Community Type (PCT)	Vegetation class	Percent cleared	TEC fit[1]	BC Act[2]	EPBC Act[3]	SAII[4]	Project disturbance area (ha)[5]
Dry Sclerophyll Forest (Shrubby sub-formation)								
470	Mugga Ironbark – Narrow-leaved Ironbark – Buloke – Black Cypress Pine shrub grass open forest in the Goonoo forests and surrounding region, southern Brigalow Belt South Bioregion	Western Slopes Dry Sclerophyll Forests	33	–	–	–	–	2.64
482	Mugga Ironbark – Black Cypress Pine shrub/grass open forest of the upper Hunter Valley, mainly Sydney Basin Bioregion	Western Slopes Dry Sclerophyll Forests	20	–	–	–	–	0.19
1610	White Box – Black Cypress Pine shrubby woodland of the Western Slopes	Western Slopes Dry Sclerophyll Forests	67	–	–	–	–	273.82
1660	Narrow-leaved Ironbark heathy woodland on sandstone ranges of the Sydney Basin and Brigalow Belt South	Western Slopes Dry Sclerophyll Forests	15	–	–	–	–	0.02
1661	Narrow-leaved Ironbark – Black Pine – Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin	Western Slopes Dry Sclerophyll Forests	50	–	–	–	–	128.46
1669	Red Ironbark – Grey Gum – Narrow-leaved Stringybark – Brown Bloodwood shrubby open forest on sandstone ranges of the Sydney Basin	Western Slopes Dry Sclerophyll Forests	10	–	–	–	–	3.47
1674	Red Ironbark – Brown Bloodwood – Black Pine heathy open forest on sandstone ranges of the Sydney Basin	Western Slopes Dry Sclerophyll Forests	19	–	–	–	–	20.09
1675	Scribbly Gum – Narrow-leaved Ironbark – Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin	South Coast Sands Dry Sclerophyll Forests	27	–	–	–	–	45.97
1860	Growee Ranges Grey Gum-Scribbly Gum Forest	Southern Tableland Dry Sclerophyll Forests	n/a[10]	–	–	–	–	0.13

PCT No.	Plant Community Type (PCT)	Vegetation class	Percent cleared	TEC fit[1]	BC Act[2]	EPBC Act[3]	SAII[4]	Project disturbance area (ha)[5]
1861	Growee Ranges Grey Gum Sheltered Forest	Southern Tableland Dry Sclerophyll Forests	n/a[10]	–	–	–	–	5.75
1871	Western Hunter Dwyers Red Gum-Cypress Woodland	Western Slopes Dry Sclerophyll Forests	n/a[10]	–	–	–	–	6.18
Dry Sclerophyll Forest (Shrub-Grassy sub-formation)								
393	White Box shrubby woodland of the western Liverpool Range, Warrumbungle Range and south-west Pilliga forests, Brigalow Belt South Bioregion	North-west Slopes Dry Sclerophyll Woodlands	33	–	–	–	–	2.42
Forested Wetlands								
78	River Red Gum riparian tall woodland/open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion	Inland Riverine Forests	60	–	–	–	–	4.74
84	River Oak – Rough-barked Apple – red gum – box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion	Eastern Riverine Forests	40	–	–	–	–	6.62
1881	Western Hunter Flats Rough-barked Apple Forest	Eastern Riverine Forests	n/a[10]	–	–	–	–	60.40
Grasslands								
484	Derived tall spear grass grassland on mainly basalt hills of the Liverpool Plains, Liverpool Range and in the upper Hunter Valley (Merriwa district), south-eastern Brigalow Belt South Bioregion	Western Slopes Grasslands	n/a[11]	Equivalent / Part	CE[7]	CE[6]	Yes	578.74
796	Derived grassland of the NSW South Western Slopes	Western Slopes Grasslands	n/a[11]	Part	CE[6]	CE[6]	Yes	711.84
800	Derived grasslands of the slopes on the Merriwa Plateau	Western Slopes Grasslands	n/a[11]	Part	CE[6]	CE[6]	Yes	2.49

PCT No.	Plant Community Type (PCT)	Vegetation class	Percent cleared	TEC fit[1]	BC Act[2]	EPBC Act[3]	SAII[4]	Project disturbance area (ha)[5]
Grassy Woodlands								
81	Western Grey Box – cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion	Floodplain Transition Woodlands	78	Part	E[8]	E[8]	No	21.74
202	Fuzzy Box woodland on colluvium and alluvial flats in the Brigalow Belt South Bioregion (including Pilliga) and Nandewar Bioregion	Western Slopes Grassy Woodlands	75	Equivalent	E[9]	-	Yes	4.29
266	White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	Western Slopes Grassy Woodlands	94	Part	CE[6]	CE[6]	Yes	13.29
272	White Box – Black Cypress Pine – red gum +/- Mugga Ironbark shrubby woodland in hills of the NSW central western slopes	Western Slopes Grassy Woodlands	65	–	–	–	–	28.77
277	Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	Western Slopes Grassy Woodlands	94	Part	CE[6]	CE[6]	Yes	64.10
281	Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Western Slopes Grassy Woodlands	67	Part	CE[6]	CE[6]	Yes	99.06
395	Derived speargrass – wallaby grass – wire grass mixed forb grassland mainly in the Coonabarabran – Pilliga – Coolah region	Western Slopes Grassy Woodlands	0	Part	CE[6]	CE[6]	Yes	18.55
433	White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub-region, BBS Bioregion	Western Slopes Grassy Woodlands	85	Part	CE[6]	CE[6]	Yes	64.41
434	White Box grass shrub hill woodland on clay to loam soils on volcanic and sedimentary hills in the southern Brigalow Belt South Bioregion	Western Slopes Grassy Woodlands	65	Part	CE[6]	CE[6]	Yes	56.29
437	Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion	Western Slopes Grassy Woodlands	77	Part	CE[6]	CE[6]	Yes	16.09

PCT No.	Plant Community Type (PCT)	Vegetation class	Percent cleared	TEC fit[1]	BC Act[2]	EPBC Act[3]	SAII[4]	Project disturbance area (ha)[5]
461	Tumbledown Gum woodland on hills in the northern NSW South Western Slopes Bioregion and southern Brigalow Belt South Bioregion	Western Slopes Grassy Woodlands	50	–	–	–	–	53.12
488	Silvertop Stringybark – Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion	New England Grassy Woodlands	50	Part	CE[6]	CE[6]	Yes	82.91
511	Queensland Bluegrass – Redleg Grass – Rats Tail Grass – spear grass – panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion	Western Slopes Grassy Woodlands	0	Part	CE[6]	CE[6]	Yes	1702.91
1330	Yellow Box – Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion	Southern Tableland Grassy Woodlands	94	Equivalent	CE[6]	CE[6]	Yes	27.05
1696	Blakelys Red Gum – Rough-barked Apple shrubby woodland of central and upper Hunter	Coastal Valley Grassy Woodlands	46	–	–	–	–	18.17
Western Slopes Grassy Woodlands								
483	Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	Grassy Woodlands	90	Part	CE[6]	CE[6]	Yes	222.93

(1) TEC fit – from BioNet Vegetation Classification indicates the degree to which the PCT equates to the TEC – part=partially subset of the TEC, equivalent=wholly a subset of the TEC.
(2) BC Act – BC Act status: E=Endangered, CE=Critically Endangered under the Biodiversity Conservation Act (BC Act).
(3) EPBC Act – EPBC Act status: E=Endangered, CE=Critically Endangered under the Commonwealth Environment Protection and Biodiversity Conservation Act (EPBC Act).
(4) SAII = Serious and Irreversible Impact under the Biodiversity Conservation Act (BC Act).
(5) Area in hectares of PCT that is mapped within the Study area by the SVTM. This has not been confirmed by field survey.
(6) Partial subset of Box-Gum CEEC under BC Act and EPBC Act.
(7) Wholly a subset of Box-Gum CEEC under BC Act and EPBC Act.
(8) Partial subset of Inland Grey Box EEC under the BC Act and Grey Box Grassy Woodlands EEC under the EPBC Act.
(9) Wholly a subset of Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions.
(10) PCT no longer recognised.
(11) A percent cleared is not available for derived PCTs

Central-West Orana REZ Transmission

Figure 3.1 - Map 1 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Blakelys Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion
- Blue-leaved Ironbark - Black Cypress Pine shrubby sandstone open forest in the southern Brigalow Belt South Bioregion (including Goonoo)
- Derived grassland of the NSW South Western Slopes
- Fuzzy Box woodland on colluvium and alluvial flats in the Brigalow Belt South Bioregion (including Pilliga) and Nandewar Bioregion
- Narrow-leaved Ironbark - Black Cypress Pine +/- Blakelys Red Gum shrubby open forest on sandstone low hills in the southern Brigalow Belt South Bioregion (including Goonoo)
- Not Native
- Queensland Bluegrass - Redleg Grass - Rats Tail Grass - spear grass - panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion
- River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion
- Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- Western Grey Box - cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion
- Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion
- Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion

0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:25,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F002_PCTs_r1v6.mxd

Central-West Orana REZ Transmission

Figure 3.1 - Map 2 of 29
Vegetation (PCTs) in the study area

Elong Elong Energy Hub

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Blakelys Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion
- Blakelys Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion
- Blue-leaved Ironbark - Black Cypress Pine shrubby sandstone open forest in the southern Brigalow Belt South Bioregion (including Goonoo)
- Dapper Mugga Ironbark - Western Grey Box - Blakely's Red Gum - Black Cypress Pine grass shrub hill woodland (southern Brigalow Belt South Bioregion)
- Derived grassland of the NSW South Western Slopes
- Fuzzy Box woodland on colluvium and alluvial flats in the Brigalow Belt South Bioregion (including Pilliga) and Nandewar Bioregion
- Narrow-leaved Ironbark - Black Cypress Pine +/- Blakelys Red Gum shrubby open forest on sandstone low hills in the southern Brigalow Belt South Bioregion (including Goonoo)
- Not Native
- Queensland Bluegrass - Redleg Grass - Rats Tail Grass - spear grass - panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion
- River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion
- Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- Tumbledown Gum woodland on hills in the northern NSW South Western Slopes Bioregion and southern Brigalow Belt South Bioregion
- Western Grey Box - cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion
- White Box - Black Cypress Pine shrubby hill woodland in the east Pilliga - Mendooran - Gulgong regions, mainly Brigalow Belt South Bioregion
- Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion
- Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion

0 500 1,000
Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:25,000 Date: 6/09/2022

Data sources: WSP 2022

Central-West Orana REZ Transmission

Figure 3.1 - Map 3 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Blakelys Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion
- Dapper Mugga Ironbark - Western Grey Box - Blakely's Red Gum - Black Cypress Pine grass shrub hill woodland (southern Brigalow Belt South Bioregion)
- Derived grassland of the NSW South Western Slopes
- Narrow-leaved Ironbark - Black Cypress Pine +/- Blakelys Red Gum shrubby open forest on sandstone low hills in the southern Brigalow Belt South Bioregion (including Goonoo)
- Not Native
- Queensland Bluegrass - Redleg Grass - Rats Tail Grass - spear grass - panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion
- Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion
- Red Stringybark - Narrow-leaved Ironbark - Black Cypress Pine - hill red gum sandstone woodland of southern NSW Brigalow Belt South Bioregion
- River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion
- Tumbledown Gum woodland on hills in the northern NSW South Western Slopes Bioregion and southern Brigalow Belt South Bioregion
- Western Grey Box - cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion
- White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion

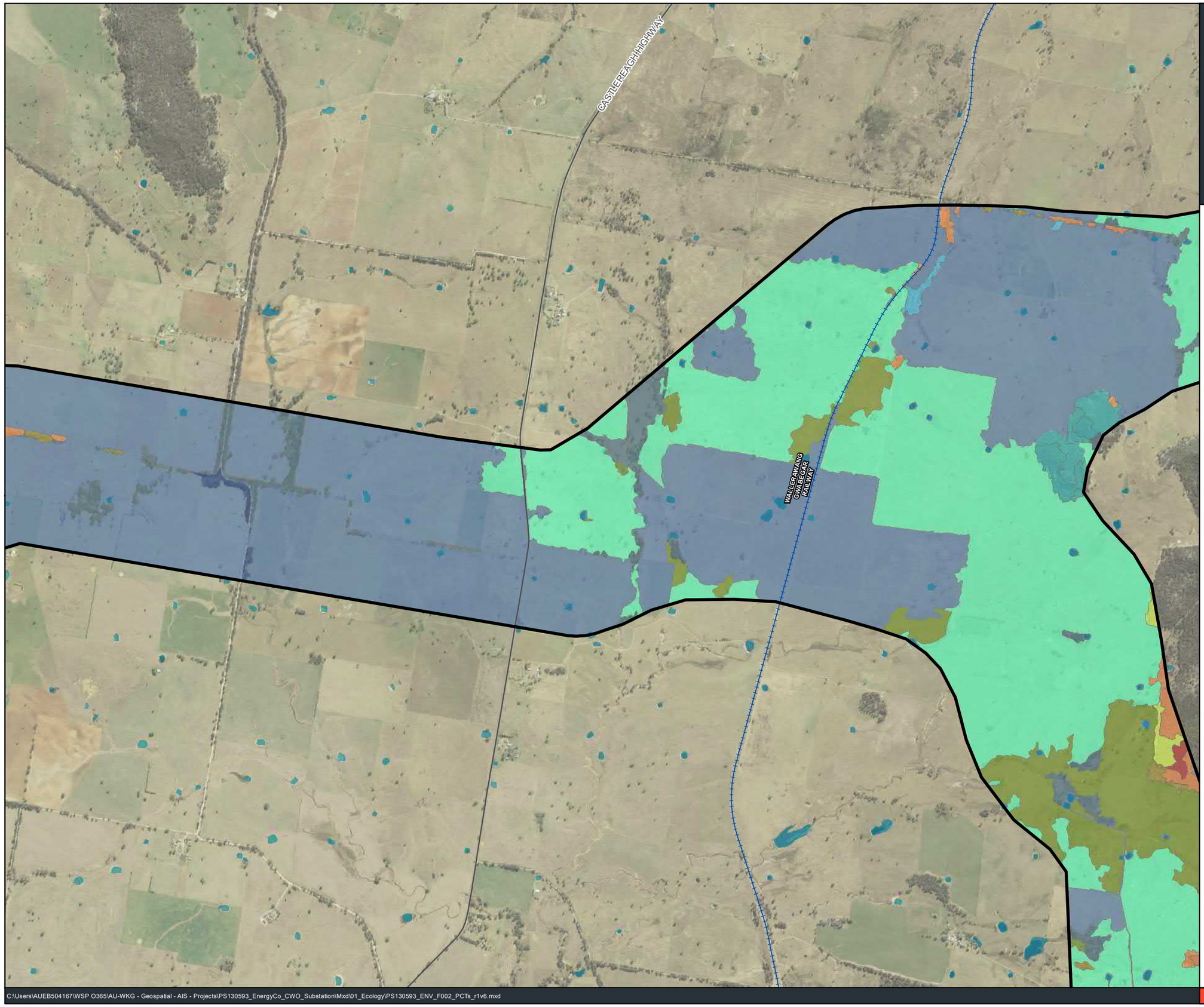
0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3
1:25,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F002_PCTs_r1v6.mxd



Central-West Orana REZ Transmission

Figure 3.1 - Map 4 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Blakelys Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion
- Derived grassland of the NSW South Western Slopes
- Mugga Ironbark - Narrow-leaved Ironbark - Buloke - Black Cypress Pine shrub grass open forest in the Goonoo forests and surrounding region, southern Brigalow Belt South Bioregion
- Narrow-leaved Ironbark - Black Cypress Pine +/- Blakelys Red Gum shrubby open forest on sandstone low hills in the southern Brigalow Belt South Bioregion (including Goonoo)
- Not Native
- Queensland Bluegrass - Redleg Grass - Rats Tail Grass - spear grass - panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion
- Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion
- Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- Tumbledown Gum woodland on hills in the northern NSW South Western Slopes Bioregion and southern Brigalow Belt South Bioregion
- Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions
- White Box - Black Cypress Pine - red gum +/- Mugga Ironbark shrubby woodland in hills of the NSW central western slopes
- White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion

0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

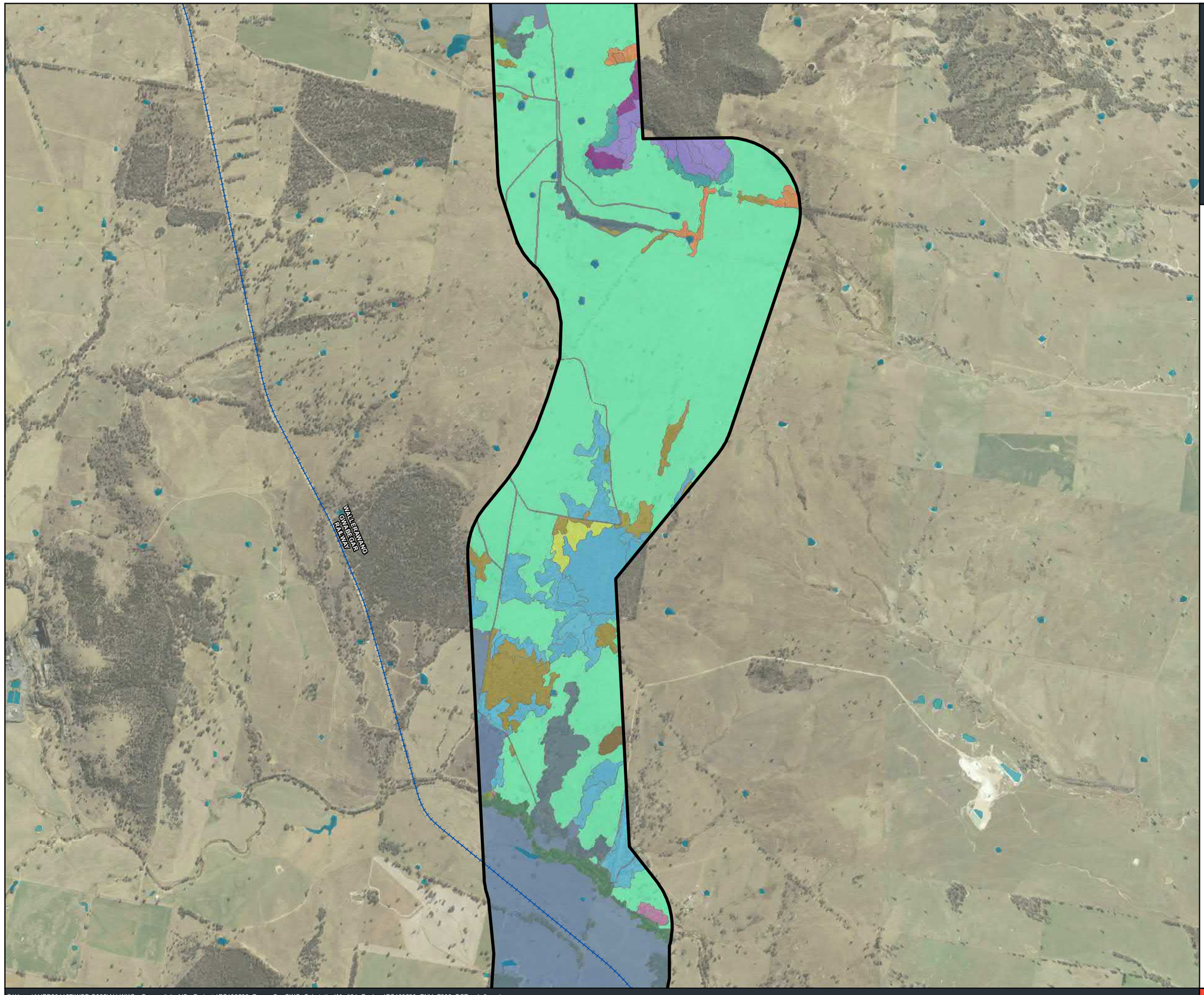
Scale ratio correct when printed at A3

1:25,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F002_PCTs_r1v6.mxd

www.wsp.com



Central-West Orana REZ Transmission

Figure 3.1 - Map 5 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Derived grassland of the NSW South Western Slopes
- Inland Scribbly Gum - Red Stringybark - Black Cypress Pine - Red Ironbark open forest on sandstone hills in the southern Brigalow Belt South Bioregion and northern NSW South Western Slopes Bioregion
- Mugga Ironbark - Narrow-leaved Ironbark - Buloke - Black Cypress Pine shrub grass open forest in the Goonoo forests and surrounding region, southern Brigalow Belt South Bioregion
- Narrow-leaved Ironbark - Black Cypress Pine +/- Blakelys Red Gum shrubby open forest on sandstone low hills in the southern Brigalow Belt South Bioregion (including Goonoo)
- Not Native
- Queensland Bluegrass - Redleg Grass - Rats Tail Grass - spear grass - panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion
- Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion
- Red Stringybark - Blakelys Red Gum +/- Long-leaved Box shrub/grass hill woodland of the NSW South Western Slopes Bioregion
- River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion
- Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- Tumbledown Gum woodland on hills in the northern NSW South Western Slopes Bioregion and southern Brigalow Belt South Bioregion
- Western Grey Box - cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion
- White Box - Black Cypress Pine - red gum +/- Mugga Ironbark shrubby woodland in hills of the NSW central western slopes
- White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion

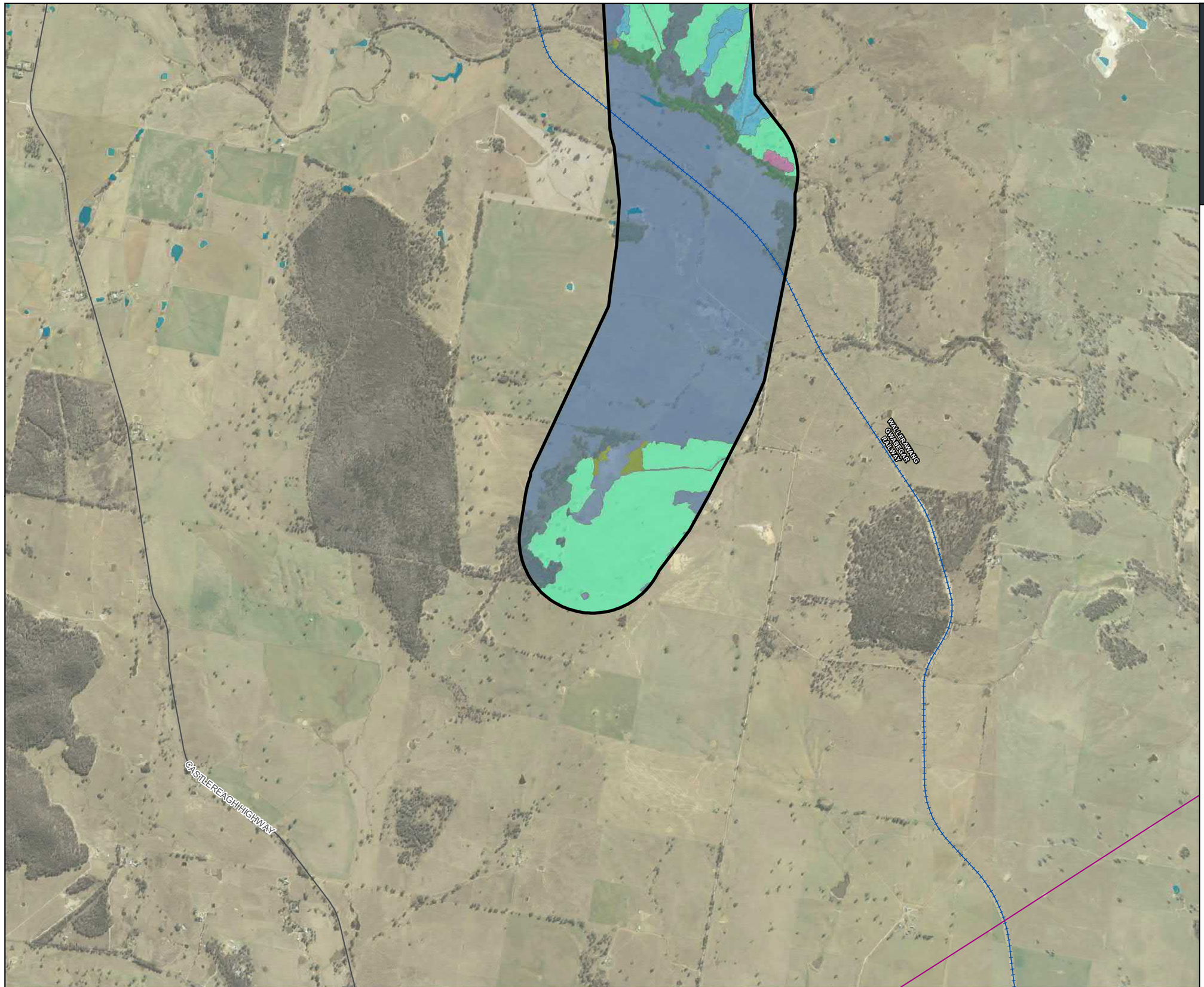
0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:25,000 Date: 6/09/2022

Data sources: WSP 2022



wsp

Central-West Orana REZ Transmission

Figure 3.1 - Map 6 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

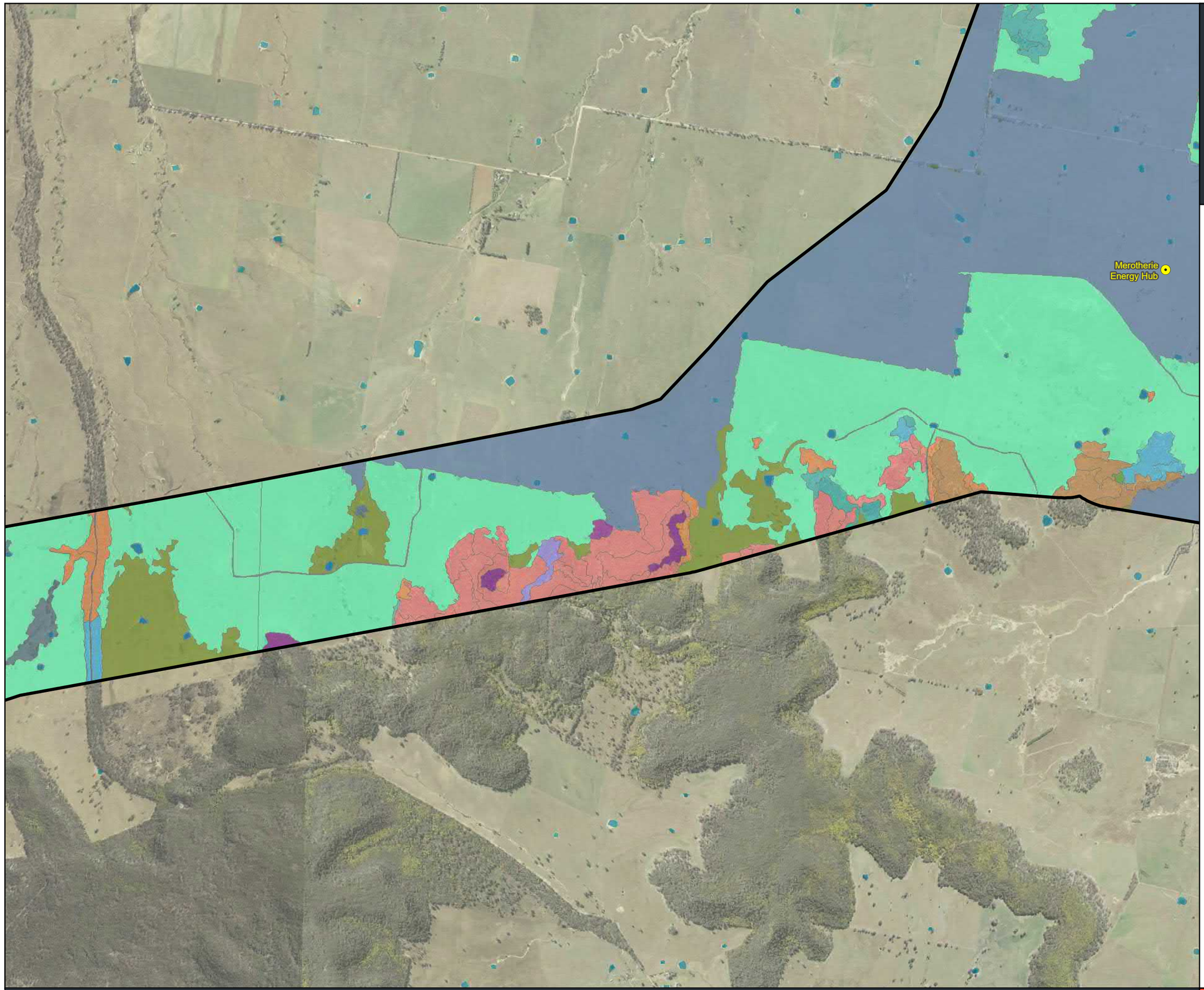
- Derived grassland of the NSW South Western Slopes
- Not Native
- Queensland Bluegrass - Redleg Grass - Rats Tail Grass - spear grass - panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion
- River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion
- Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- Western Grey Box - cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion
- White Box - Black Cypress Pine - red gum +/- Mugga Ironbark shrubby woodland in hills of the NSW central western slopes

0 500 1,000
Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3
1:25,000 Date: 6/09/2022

Data sources: WSP 2022



wsp

Central-West Orana REZ Transmission

Figure 3.1 - Map 7 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Blue-leaved Ironbark - Black Cypress Pine shrubby sandstone open forest in the southern Brigalow Belt South Bioregion (including Goonoo)
- Derived grassland of the NSW South Western Slopes
- Inland Scribbly Gum - Red Stringybark - Black Cypress Pine - Red Ironbark open forest on sandstone hills in the southern Brigalow Belt South Bioregion and northern NSW South Western Slopes Bioregion
- Mugga Ironbark - Black Cypress Pine - Red Stringybark - Blakelys Red Gum - Red Ironbark woodland on hillslopes and in valleys on ranges in the NSW central western slopes
- Narrow-leaved Ironbark - Black Cypress Pine +/- Blakelys Red Gum shrubby open forest on sandstone low hills in the southern Brigalow Belt South Bioregion (including Goonoo)
- Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion
- Not Native
- Queensland Bluegrass - Redleg Grass - Rats Tail Grass - spear grass - panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion
- Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion
- Red Stringybark - Narrow-leaved Ironbark - Black Cypress Pine - hill red gum sandstone woodland of southern NSW Brigalow Belt South Bioregion
- Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- Tumbledown Gum woodland on hills in the northern NSW South Western Slopes Bioregion and southern Brigalow Belt South Bioregion
- White Box - Black Cypress Pine - red gum +/- Mugga Ironbark shrubby woodland in hills of the NSW central western slopes

0 500 1,000 Meters

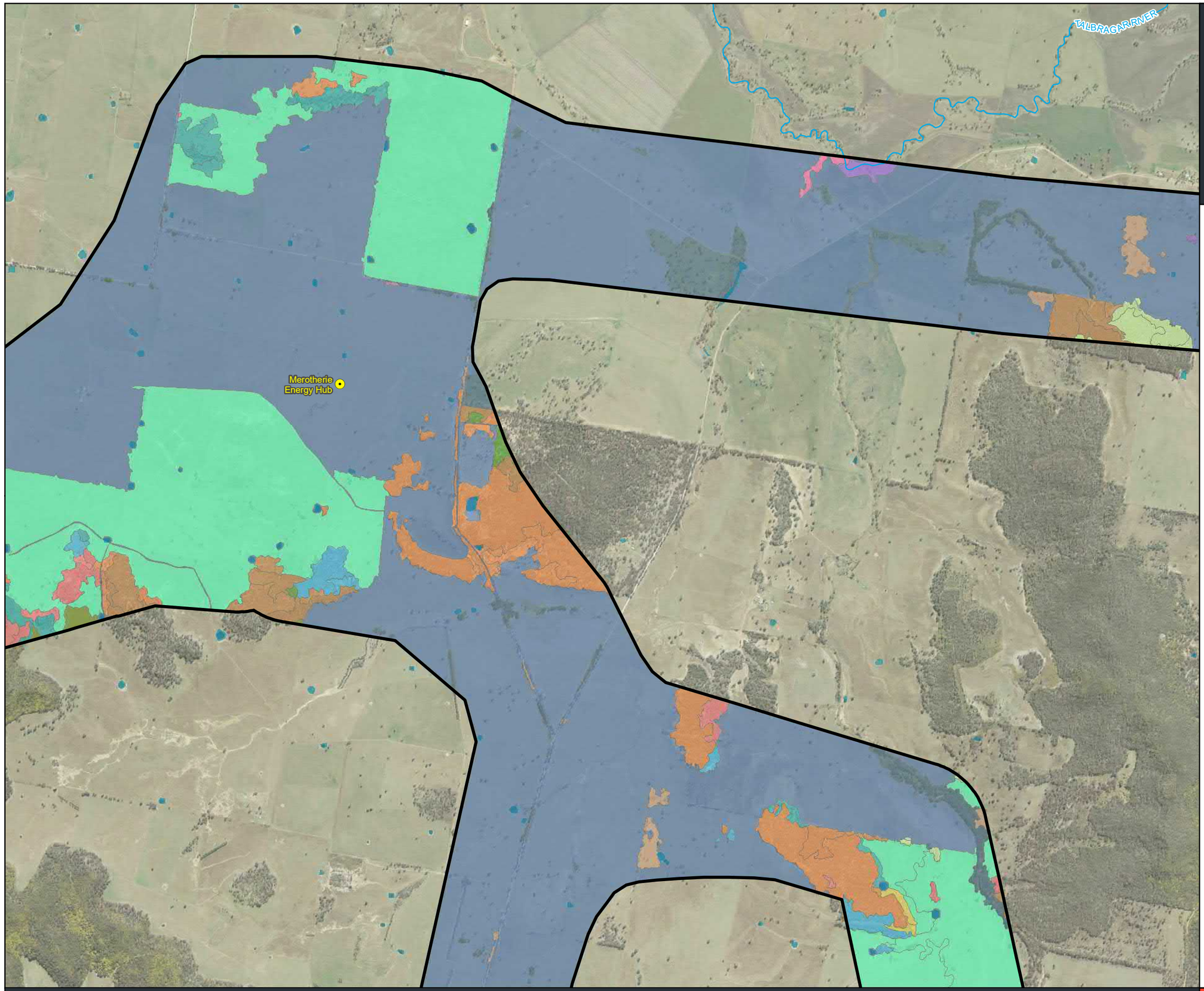
Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:25,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F002_PCTs_r1v6.mxd



Central-West Orana REZ Transmission

Figure 3.1 - Map 8 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Blakelys Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion
- Blue-leaved Ironbark - Black Cypress Pine shrubby sandstone open forest in the southern Brigalow Belt South Bioregion (including Goonoo)
- Derived grassland of the NSW South Western Slopes
- Fuzzy Box woodland on colluvium and alluvial flats in the Brigalow Belt South Bioregion (including Pilliga) and Nandewar Bioregion
- Mugga Ironbark - Black Cypress Pine - Red Stringybark - Blakelys Red Gum - Red Ironbark woodland on hillslopes and in valleys on ranges in the NSW central western slopes
- Narrow-leaved Ironbark - Black Cypress Pine +/- Blakelys Red Gum shrubby open forest on sandstone low hills in the southern Brigalow Belt South Bioregion (including Goonoo)
- Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion
- Not Native
- Queensland Bluegrass - Redleg Grass - Rats Tail Grass - spear grass - panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion
- Red Stringybark - Narrow-leaved Ironbark - Black Cypress Pine - hill red gum sandstone woodland of southern NSW Brigalow Belt South Bioregion
- Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- Rough-barked Apple - Yellow Box grass/shrub footslope open forest, Brigalow Belt South Bioregion
- Tumbledown Gum woodland on hills in the northern NSW South Western Slopes Bioregion and southern Brigalow Belt South Bioregion
- Western Grey Box - cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion
- White Box - Black Cypress Pine - red gum +/- Mugga Ironbark shrubby woodland in hills of the NSW central western slopes
- White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub-region, BBS Bioregion
- Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion

0 500 1,000
Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3
1:25,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F002_PCTs_r1v6.mxd

Central-West Orana REZ Transmission

Figure 3.1 - Map 9 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Derived grassland of the NSW South Western Slopes
- Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion
- Not Native
- Queensland Bluegrass - Redleg Grass - Rats Tail Grass - spear grass - panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion
- Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- Tumbledown Gum woodland on hills in the northern NSW South Western Slopes Bioregion and southern Brigalow Belt South Bioregion
- White Box - Black Cypress Pine - red gum +/- Mugga Ironbark shrubby woodland in hills of the NSW central western slopes
- White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
- Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion

0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:25,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F002_PCTs_r1v6.mxd

Central-West Orana REZ Transmission

Figure 3.1 - Map 10 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Central Tableland Ribbon Gum-Apple Gully Forest
- Derived grassland of the NSW South Western Slopes
- Mugga Ironbark - Black Cypress Pine - Red Stringybark - Blakelys Red Gum - Red Ironbark woodland on hillslopes and in valleys on ranges in the NSW central western slopes
- Narrow-leaved Ironbark - Black Cypress Pine +/- Blakelys Red Gum shrubby open forest on sandstone low hills in the southern Brigalow Belt South Bioregion (including Goonoo)
- Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion
- Non-native
- Not Native
- Queensland Bluegrass - Redleg Grass - Rats Tail Grass - spear grass - panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion
- Red Ironbark - Grey Gum - Narrow-leaved Stringybark - Brown Bloodwood shrubby open forest on sandstone ranges of the Sydney Basin
- Red Stringybark - Blakelys Red Gum +/- Long-leaved Box shrub/grass hill woodland of the NSW South Western Slopes Bioregion
- Red Stringybark - Narrow-leaved Ironbark - Black Cypress Pine - hill red gum sandstone woodland of southern NSW Brigalow Belt South Bioregion
- Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- Tumbledown Gum woodland on hills in the northern NSW South Western Slopes Bioregion and southern Brigalow Belt South Bioregion
- White Box - Black Cypress Pine - red gum +/- Mugga Ironbark shrubby woodland in hills of the NSW central western slopes
- White Box - Black Cypress Pine shrubby woodland of the Western Slopes
- White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion

0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

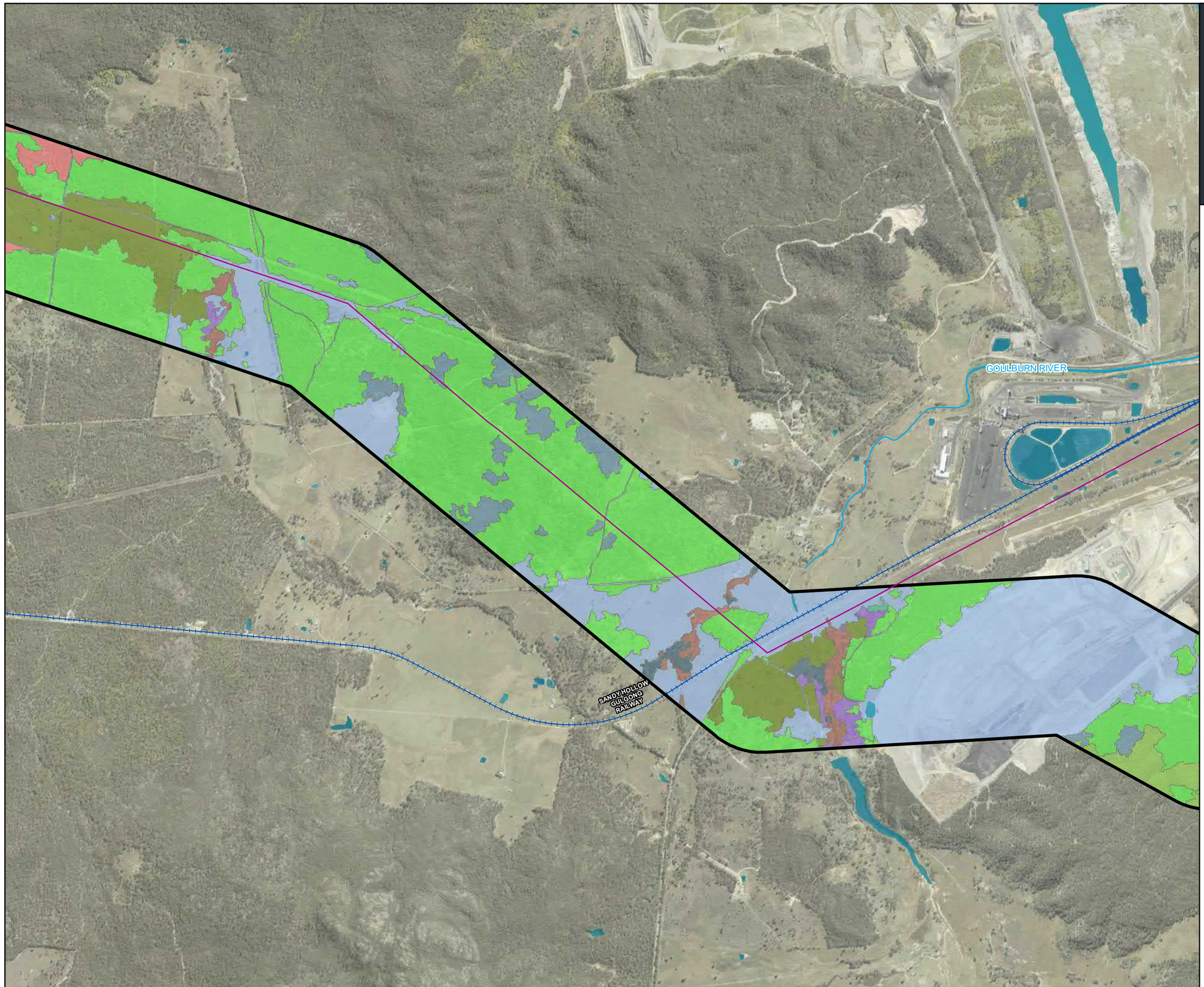
Scale ratio correct when printed at A3

1:25,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F002_PCTs_r1v6.mxd

www.wsp.com



wsp

Central-West Orana REZ Transmission

Figure 3.1 - Map 11 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Blakelys Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion
- Derived grassland of the NSW South Western Slopes
- Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion
- Non-native
- Ribbon Gum - Yellow Box grassy woodland on undulating terrain of the eastern tablelands, South Eastern Highlands Bioregion
- Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin
- Western Hunter Dwyers Red Gum-Cypress Woodland
- Western Hunter Flats Rough-barked Apple Forest
- White Box - Black Cypress Pine shrubby woodland of the Western Slopes

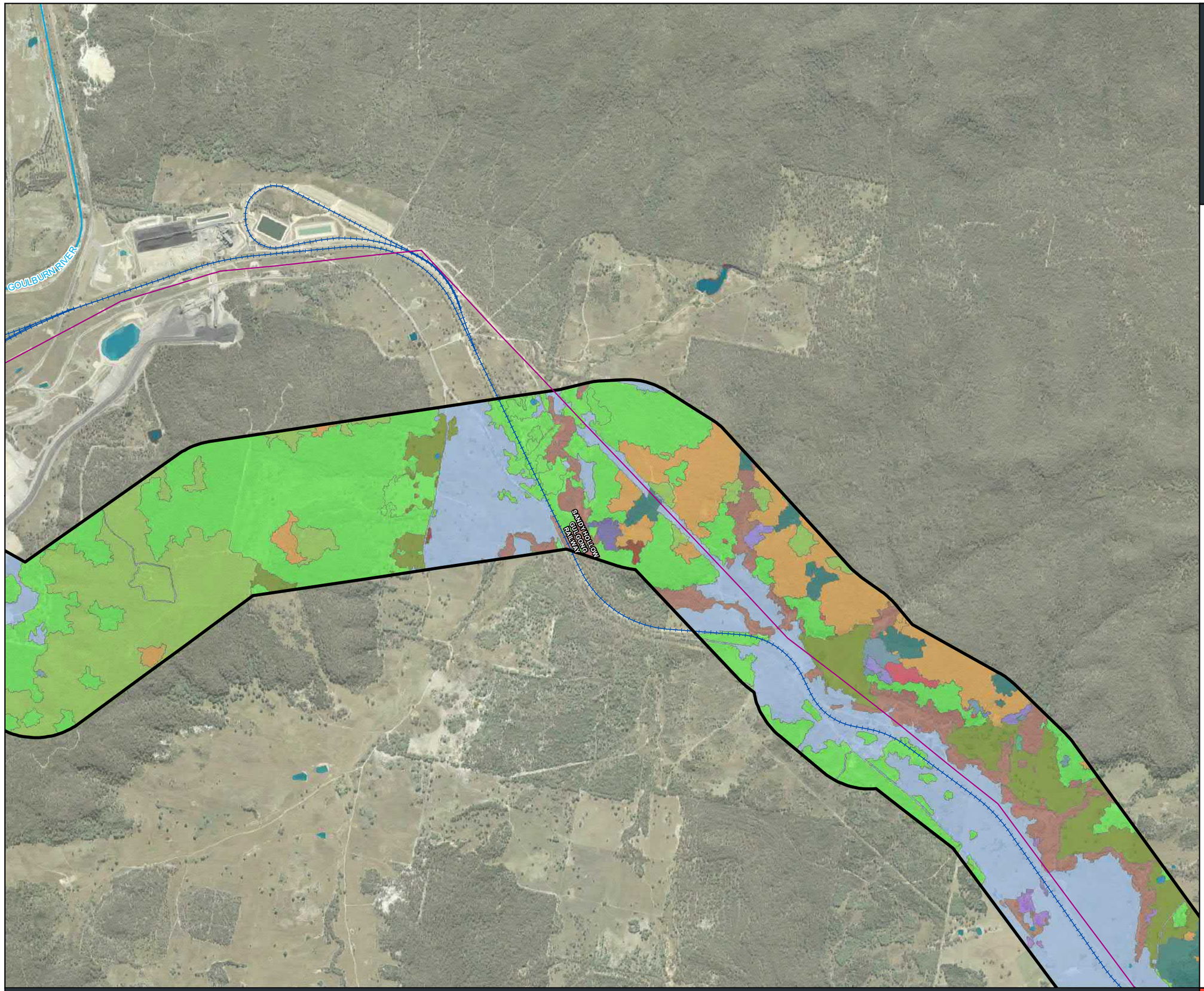
0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:25,000 Date: 6/09/2022

Data sources: WSP 2022



wsp

Central-West Orana REZ Transmission

Figure 3.1 - Map 12 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Blakelys Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion
- Central Tableland Ribbon Gum-Apple Gully Forest
- Derived grassland of the NSW South Western Slopes
- Growee Ranges Grey Gum Sheltered Forest
- Growee Ranges Grey Gum-Scribbly Gum Forest
- Non-native
- Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion
- Red Ironbark - Brown Bloodwood - Black Pine heathy open forest on sandstone ranges of the Sydney Basin
- Red Ironbark - Grey Gum - Black Pine heathy woodland on sandstone ranges of the Sydney Basin
- Ribbon Gum - Yellow Box grassy woodland on undulating terrain of the eastern tablelands, South Eastern Highlands Bioregion
- Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin
- Western Hunter Dwyers Red Gum-Cypress Woodland
- Western Hunter Flats Rough-barked Apple Forest
- Western Hunter Grey Gum-Stringybark Forest
- White Box - Black Cypress Pine shrubby woodland of the Western Slopes

0 500 1,000 Meters

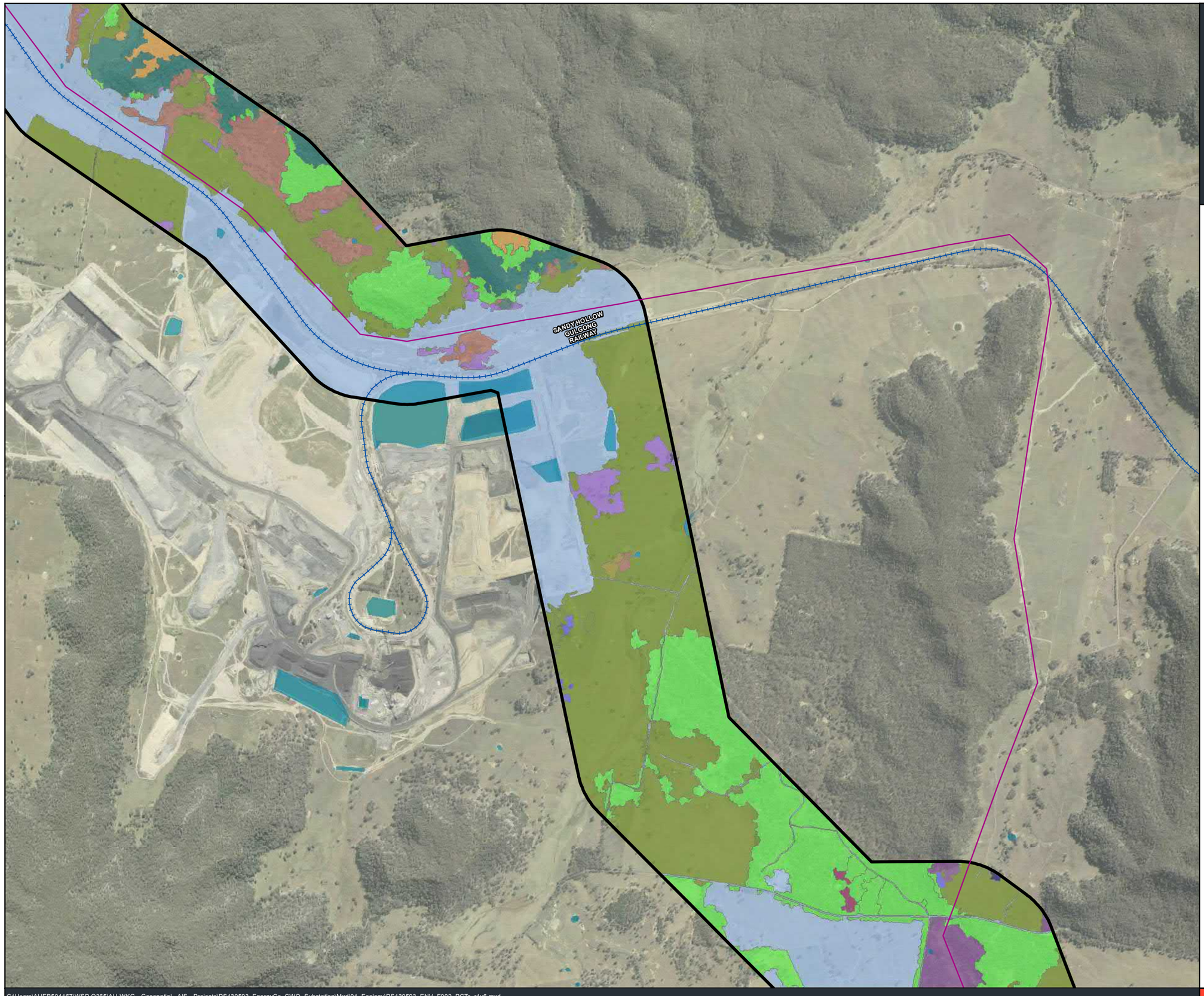
Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:25,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F002_PCTs_r1v6.mxd



wsp

Central-West Orana REZ Transmission

Figure 3.1 - Map 13 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Blakelys Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion
- Derived grassland of the NSW South Western Slopes
- Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion
- Growee Ranges Grey Gum Sheltered Forest
- Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin
- Non-native
- Red Ironbark - Brown Bloodwood - Black Pine heathy open forest on sandstone ranges of the Sydney Basin
- Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- Western Hunter Caleys Ironbark Low Forest
- Western Hunter Dwyers Red Gum-Cypress Woodland
- Western Hunter Flats Rough-barked Apple Forest
- Western Hunter Footslopes Box Woodland
- White Box - Black Cypress Pine shrubby woodland of the Western Slopes
- White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
- Yellow Box - Blakelys Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion

0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:25,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F002_PCTs_r1v6.mxd

Central-West Orana REZ Transmission

Figure 3.1 - Map 14 of 29
Vegetation (PCTs) in the study area

Wollar Substation

New Wollar Switching Station

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Derived grassland of the NSW South Western Slopes
- Hunter Escarpment Slaty Gum-Box Forest
- Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin
- Non-native
- Western Hunter Flats Rough-barked Apple Forest
- White Box - Black Cypress Pine shrubby woodland of the Western Slopes
- White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
- Yellow Box - Blakelys Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion

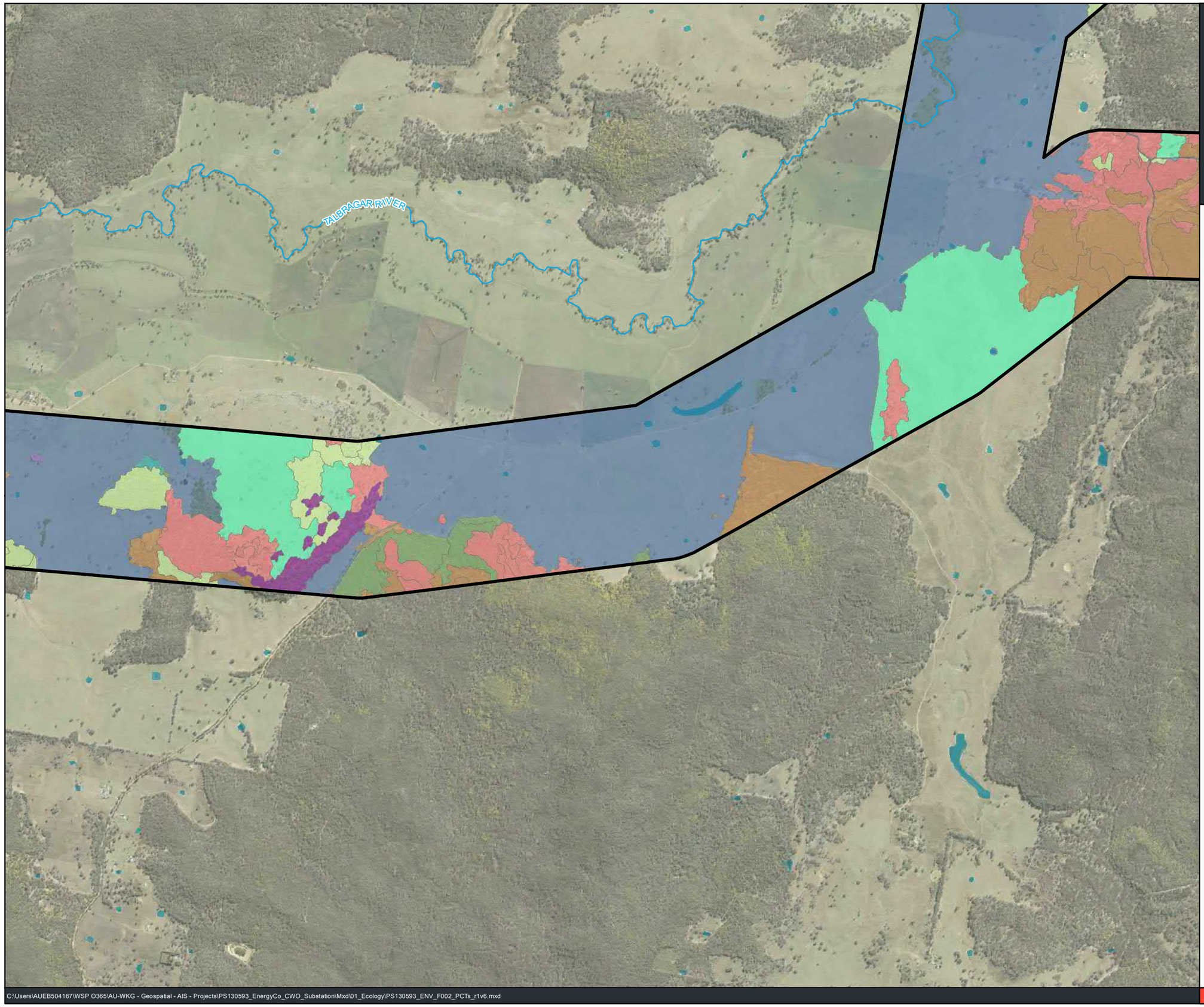
0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:25,000 Date: 6/09/2022

Data sources: WSP 2022



Central-West Orana REZ Transmission

Figure 3.1 - Map 15 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Blakelys Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion
- Blakelys Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion
- Inland Scribbly Gum - Red Stringybark - Black Cypress Pine - Red Ironbark open forest on sandstone hills in the southern Brigalow Belt South Bioregion and northern NSW South Western Slopes Bioregion
- Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion
- Not Native
- Queensland Bluegrass - Redleg Grass - Rats Tail Grass - spear grass - panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion
- Red Stringybark - Narrow-leaved Ironbark - Black Cypress Pine - hill red gum sandstone woodland of southern NSW Brigalow Belt South Bioregion
- Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- Rough-barked Apple - Blakelys Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region
- Rough-barked Apple - Yellow Box grass/shrub footslope open forest, Brigalow Belt South Bioregion
- Tumbledown Gum woodland on hills in the northern NSW South Western Slopes Bioregion and southern Brigalow Belt South Bioregion
- Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion

0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:25,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F002_PCTs_r1v6.mxd

www.wsp.com

Central-West Orana REZ Transmission

Figure 3.1 - Map 16 of 29
Vegetation (PCTs) in the study area

GOLDEN HIGHWAY

TALBRAGAR RIVER

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Blakelys Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion
- Blakelys Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion
- Fuzzy Box woodland on colluvium and alluvial flats in the Brigalow Belt South Bioregion (including Pilliga) and Nandewar Bioregion
- Inland Scribbly Gum - Red Stringybark - Black Cypress Pine - Red Ironbark open forest on sandstone hills in the southern Brigalow Belt South Bioregion and northern NSW South Western Slopes Bioregion
- Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion
- Not Native
- Queensland Bluegrass - Redleg Grass - Rats Tail Grass - spear grass - panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion
- Red Stringybark - Narrow-leaved Ironbark - Black Cypress Pine - hill red gum sandstone woodland of southern NSW Brigalow Belt South Bioregion
- Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- Rough-barked Apple - Yellow Box grass/shrub footslope open forest, Brigalow Belt South Bioregion
- Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion

0 500 1,000
Meters

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A3
1:25,000 Date: 6/09/2022

Data sources: WSP 2022

Central-West Orana REZ Transmission

Figure 3.1 - Map 17 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Blakelys Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion
- Inland Scribbly Gum - Red Stringybark - Black Cypress Pine - Red Ironbark open forest on sandstone hills in the southern Brigalow Belt South Bioregion and northern NSW South Western Slopes Bioregion
- Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion
- Not Native
- Queensland Bluegrass - Redleg Grass - Rats Tail Grass - spear grass - panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion
- Red Stringybark - Narrow-leaved Ironbark - Black Cypress Pine - hill red gum sandstone woodland of southern NSW Brigalow Belt South Bioregion
- Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- Rough-barked Apple - Blakelys Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region
- Rough-barked Apple - Yellow Box grass/shrub footslope open forest, Brigalow Belt South Bioregion

0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:25,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F002_PCTs_r1v6.mxd

www.wsp.com

Central-West Orana REZ Transmission

Figure 3.1 - Map 18 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Blakelys Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion
- Blue-leaved Ironbark - Black Cypress Pine shrubby sandstone open forest in the southern Brigalow Belt South Bioregion (including Goonoo)
- Dapper Mugga Ironbark - Western Grey Box - Blakely's Red Gum - Black Cypress Pine grass shrub hill woodland (southern Brigalow Belt South Bioregion)
- Derived tall spear grass grassland on mainly basalt hills of the Liverpool Plains, Liverpool Range and in the upper Hunter Valley (Merriwa district), south-eastern Brigalow Belt South Bioregion
- Inland Scribbly Gum - Red Stringybark - Black Cypress Pine - Red Ironbark open forest on sandstone hills in the southern Brigalow Belt South Bioregion and northern NSW South Western Slopes Bioregion
- Narrow-leaved Ironbark - Black Cypress Pine +/- Blakelys Red Gum shrubby open forest on sandstone low hills in the southern Brigalow Belt South Bioregion (including Goonoo)
- Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion
- Not Native
- Queensland Bluegrass - Redleg Grass - Rats Tail Grass - spear grass - panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion
- Red Stringybark - Narrow-leaved Ironbark - Black Cypress Pine - hill red gum sandstone woodland of southern NSW Brigalow Belt South Bioregion
- Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- Rough-barked Apple - Yellow Box grass/shrub footslope open forest, Brigalow Belt South Bioregion
- White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion
- White Box grass shrub hill woodland on clay to loam soils on volcanic and sedimentary hills in the southern Brigalow Belt South Bioregion
- White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub-region, BBS Bioregion
- White Cypress Pine - Buloke - White Box shrubby open forest on hills in the Liverpool Plains - Dubbo region, Brigalow Belt South Bioregion
- Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion

0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:25,000 Date: 6/09/2022

Data sources: WSP 2022

wsp

Central-West Orana REZ Transmission

Figure 3.1 - Map 19 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Black Cypress Pine - Narrow-leaved Ironbark - red gum +/- White Bloodwood shrubby open forest on hills of the southern Pilliga, Coonabarabran and Garawilla regions, Brigalow Belt South Bioregion
- Blakelys Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion
- Derived tall spear grass grassland on mainly basalt hills of the Liverpool Plains, Liverpool Range and in the upper Hunter Valley (Merriwa district), south-eastern Brigalow Belt South Bioregion
- Narrow-leaved Ironbark - Black Cypress Pine +/- Blakelys Red Gum shrubby open forest on sandstone low hills in the southern Brigalow Belt South Bioregion (including Goonoo)
- Not Native
- Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- Rough-barked Apple - Yellow Box grass/shrub footslope open forest, Brigalow Belt South Bioregion
- White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion
- White Box grass shrub hill woodland on clay to loam soils on volcanic and sedimentary hills in the southern Brigalow Belt South Bioregion
- White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub-region, BBS Bioregion
- Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion

0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:25,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F002_PCTs_r1v6.mxd

Central-West Orana REZ Transmission

Figure 3.1 - Map 20 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Black Cypress Pine - Narrow-leaved Ironbark - red gum +/- White Bloodwood shrubby open forest on hills of the southern Pilliga, Coonabarabran and Garawilla regions, Brigalow Belt South Bioregion
- Blakelys Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion
- Blue-leaved Ironbark - Black Cypress Pine shrubby sandstone open forest in the southern Brigalow Belt South Bioregion (including Goonoo)
- Derived grassland of the NSW South Western Slopes
- Derived speargrass - wallaby grass - wire grass mixed forb grassland mainly in the Coonabarabran - Pilliga - Coolah region
- Derived tall spear grass grassland on mainly basalt hills of the Liverpool Plains, Liverpool Range and in the upper Hunter Valley (Merriwa district), south-eastern Brigalow Belt South Bioregion
- Inland Scribbly Gum - Red Stringybark - Black Cypress Pine - Red Ironbark open forest on sandstone hills in the southern Brigalow Belt South Bioregion and northern NSW South Western Slopes Bioregion
- Narrow-leaved Ironbark - Black Cypress Pine +/- Blakelys Red Gum shrubby open forest on sandstone low hills in the southern Brigalow Belt South Bioregion (including Goonoo)
- Not Native
- Queensland Bluegrass - Redleg Grass - Rats Tail Grass - spear grass - panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion
- Red Stringybark - Narrow-leaved Ironbark - Black Cypress Pine - hill red gum sandstone woodland of southern NSW Brigalow Belt South Bioregion
- River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion
- Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- Rough-barked Apple - Blakelys Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region
- Rough-barked Apple - Yellow Box grass/shrub footslope open forest, Brigalow Belt South Bioregion
- White Box grass shrub hill woodland on clay to loam soils on volcanic and sedimentary hills in the southern Brigalow Belt South Bioregion
- White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub-region, BBS Bioregion
- Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion

0 500 1,000
Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3
1:25,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F002_PCTs_r1v6.mxd

Central-West Orana REZ Transmission

Figure 3.1 - Map 21 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Black Cypress Pine - Narrow-leaved Ironbark - red gum +/- White Bloodwood shrubby open forest on hills of the southern Pilliga, Coonabarabran and Garawilla regions, Brigalow Belt South Bioregion
- Derived grassland of the NSW South Western Slopes
- Derived speargrass - wallaby grass - wire grass mixed forb grassland mainly in the Coonabarabran - Pilliga - Coolah region
- Derived tall spear grass grassland on mainly basalt hills of the Liverpool Plains, Liverpool Range and in the upper Hunter Valley (Merriwa district), south-eastern Brigalow Belt South Bioregion
- Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley
- Not Native
- Queensland Bluegrass - Redleg Grass - Rats Tail Grass - spear grass - panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion
- Rough-barked Apple - Yellow Box grass/shrub footslope open forest, Brigalow Belt South Bioregion
- White Box grass shrub hill woodland on clay to loam soils on volcanic and sedimentary hills in the southern Brigalow Belt South Bioregion
- White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub-region, BBS Bioregion
- Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion

0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3
1:25,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F002_PCTs_r1v6.mxd

Central-West Orana REZ Transmission

Figure 3.1 - Map 22 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

0 500 1,000
Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:25,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F002_PCTs_r1v6.mxd

Central-West Orana REZ Transmission

Figure 3.1 - Map 23 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Blakelys Red Gum - Rough-barked Apple shrubby woodland of central and upper Hunter
- Blakelys Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion
- Derived grassland of the NSW South Western Slopes
- Derived tall spear grass Plains Grass? grassland on mainly basalt hills of the Liverpool Plains, Liverpool Range and in the upper Hunter Valley (Merriwa district), south-eastern Brigalow Belt South Bioregion
- Mugga Ironbark - Black Cypress Pine shrub/grass open forest of the upper Hunter Valley, mainly Sydney Basin Bioregion
- Narrow-leaved Ironbark - Black Pine - Narrow-leaved Wattle shrub - grass open forest on sandstone slopes of the upper Hunter and Sydney Basin
- Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin
- Narrow-leaved Ironbark heathy woodland on sandstone ranges of the Sydney Basin and Brigalow Belt South
- Non-native
- Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion
- Red Ironbark - Grey Gum - Black Pine heathy woodland on sandstone ranges of the Sydney Basin
- Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin
- Western Hunter Flats Rough-barked Apple Forest

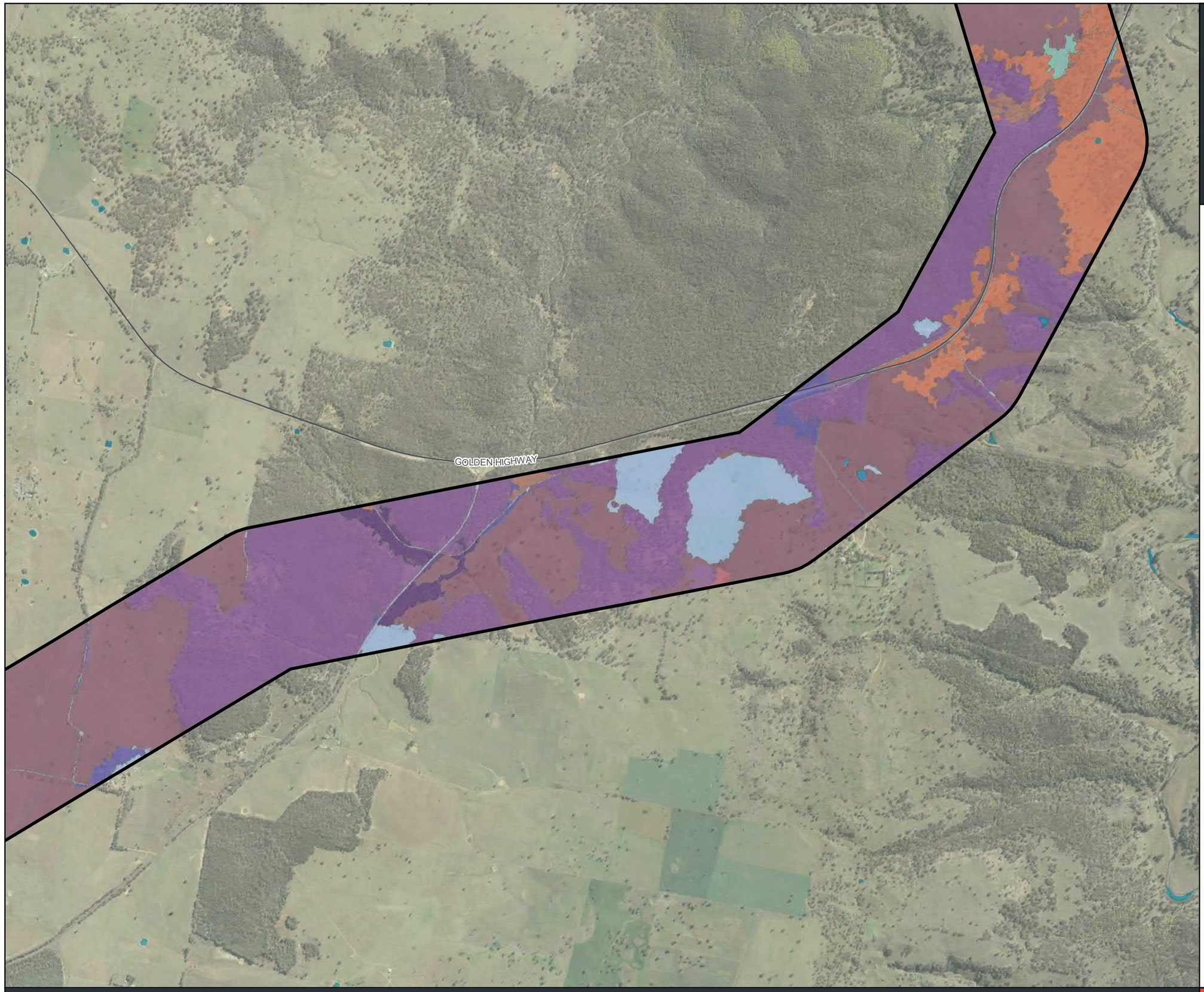
0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3
1:25,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F002_PCTs_r1v6.mxd



wsp

Central-West Orana REZ Transmission

Figure 3.1 - Map 24 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Blakelys Red Gum - Rough-barked Apple shrubby woodland of central and upper Hunter
- Derived grasslands of the slopes on the Merriwa Plateau
- Derived tall spear grass Plains Grass? grassland on mainly basalt hills of the Liverpool Plains, Liverpool Range and in the upper Hunter Valley (Merriwa district), south-eastern Brigalow Belt South Bioregion
- Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley
- Narrow-leaved Ironbark - Black Cypress Pine shrub - grass woodland upper Hunter and northern Wollemi
- Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin
- Non-native
- River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion
- Western Hunter Flats Rough-barked Apple Forest

0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:25,000 Date: 6/09/2022

Data sources: WSP 2022

Central-West Orana REZ Transmission

Figure 3.1 - Map 25 of 29
Vegetation (PCTs) in the study area

GOLDEN HIGHWAY

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Derived tall spear grass Plains Grass? grassland on mainly basalt hills of the Liverpool Plains, Liverpool Range and in the upper Hunter Valley (Merriwa district), south-eastern Brigalow Belt South Bioregion
- Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley
- Non-native
- Western Hunter Flats Rough-barked Apple Forest
- Yellow Box - Rough-barked Apple grassy woodland of the upper Hunter and Liverpool Plains

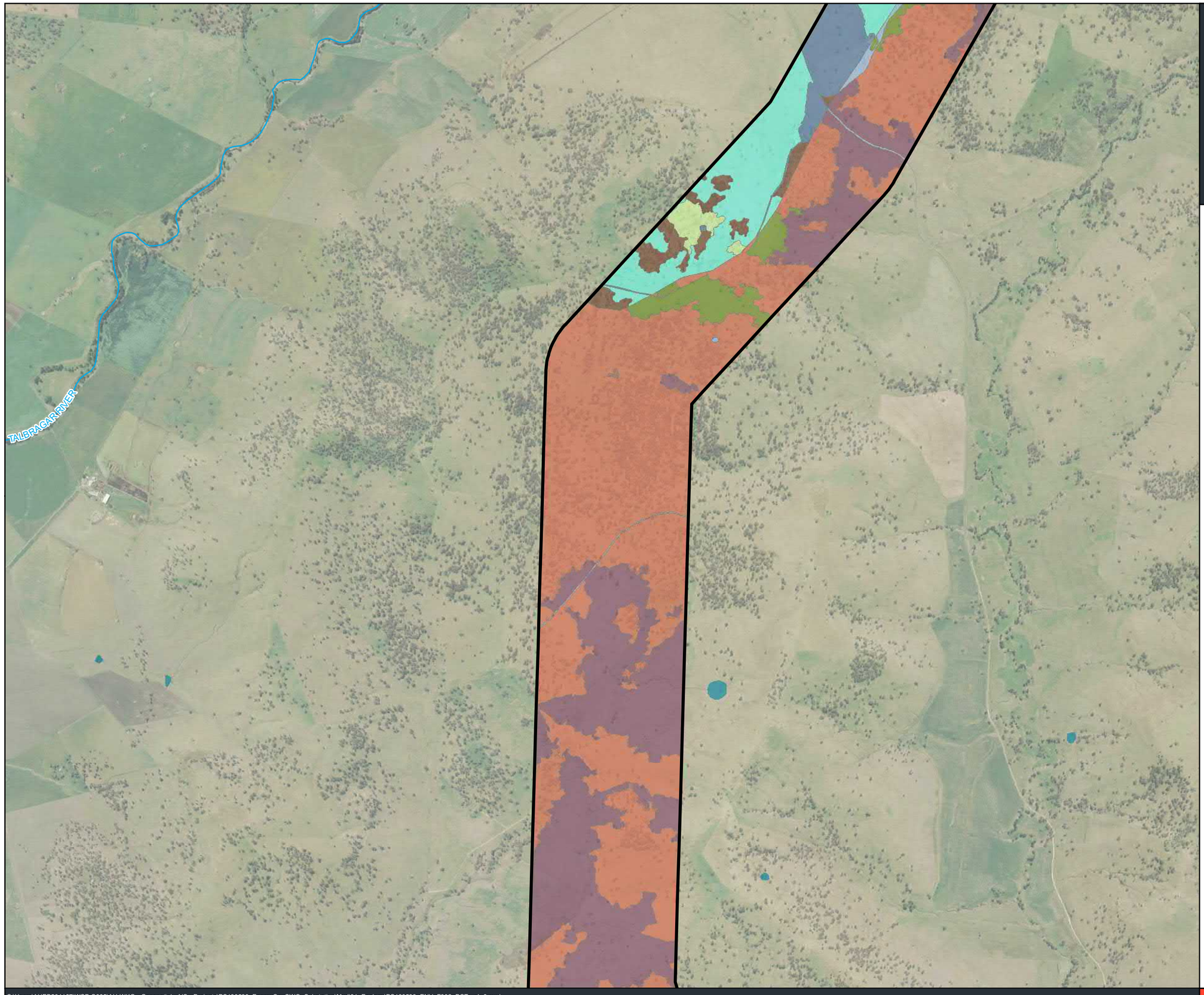
0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:25,000 Date: 6/09/2022

Data sources: WSP 2022



wsp

Central-West Orana REZ Transmission

Figure 3.1 - Map 26 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Derived grassland of the NSW South Western Slopes
- Derived tall spear grass Plains Grass? grassland on mainly basalt hills of the Liverpool Plains, Liverpool Range and in the upper Hunter Valley (Merriwa district), south-eastern Brigalow Belt South Bioregion
- Derived tall spear grass grassland on mainly basalt hills of the Liverpool Plains, Liverpool Range and in the upper Hunter Valley (Merriwa district), south-eastern Brigalow Belt South Bioregion
- Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley
- Non-native
- Not Native
- Rough-barked Apple - Yellow Box grass/shrub footslope open forest, Brigalow Belt South Bioregion
- Western Hunter Flats Rough-barked Apple Forest
- White Box grass shrub hill woodland on clay to loam soils on volcanic and sedimentary hills in the southern Brigalow Belt South Bioregion

0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:25,000 Date: 6/09/2022

Data sources: WSP 2022

TALBRAGAR RIVER

wsp

Central-West Orana REZ Transmission

Figure 3.1 - Map 27 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Derived grassland of the NSW South Western Slopes
- Derived tall spear grass Plains Grass? grassland on mainly basalt hills of the Liverpool Plains, Liverpool Range and in the upper Hunter Valley (Merriwa district), south-eastern Brigalow Belt South Bioregion
- Derived tall spear grass grassland on mainly basalt hills of the Liverpool Plains, Liverpool Range and in the upper Hunter Valley (Merriwa district), south-eastern Brigalow Belt South Bioregion
- Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley
- Non-native
- Not Native
- Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- White Box grass shrub hill woodland on clay to loam soils on volcanic and sedimentary hills in the southern Brigalow Belt South Bioregion
- White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub-region, BBS Bioregion
- Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion

0 500 1,000
Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3
1:25,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F002_PCTs_r1v6.mxd

Central-West Orana REZ Transmission

Figure 3.1 - Map 28 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Derived tall spear grass grassland on mainly basalt hills of the Liverpool Plains, Liverpool Range and in the upper Hunter Valley (Merriwa district), south-eastern Brigalow Belt South Bioregion
- Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley
- Not Native
- River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion
- Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- Rough-barked Apple - Yellow Box grass/shrub footslope open forest, Brigalow Belt South Bioregion
- Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion
- White Box grass shrub hill woodland on clay to loam soils on volcanic and sedimentary hills in the southern Brigalow Belt South Bioregion
- White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub-region, BBS Bioregion
- White Box shrubby woodland of the western Liverpool Range, Warrumbungle Range and south-west Pilliga forests, Brigalow Belt South Bioregion
- Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion

0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:25,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F002_PCTs_r1v6.mxd

Central-West Orana REZ Transmission

Figure 3.1 - Map 29 of 29
Vegetation (PCTs) in the study area

- Existing Substation
- Energy hub/switching station indicative location
- Road
- Watercourse
- Railway
- Existing Transmission Line
- Project Study Area

State Vegetation - Plant Community Type

- Derived tall spear grass grassland on mainly basalt hills of the Liverpool Plains, Liverpool Range and in the upper Hunter Valley (Merriwa district), south-eastern Brigalow Belt South Bioregion
- Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley
- Not Native
- Queensland Bluegrass - Redleg Grass - Rats Tail Grass - spear grass - panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion
- River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion
- Rough-barked Apple - Yellow Box grass/shrub footslope open forest, Brigalow Belt South Bioregion
- Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion
- White Box grass shrub hill woodland on clay to loam soils on volcanic and sedimentary hills in the southern Brigalow Belt South Bioregion
- White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub-region, BBS Bioregion
- White Box shrubby woodland of the western Liverpool Range, Warrumbungle Range and south-west Pilliga forests, Brigalow Belt South Bioregion
- Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion

0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:25,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F002_PCTs_r1v6.mxd

3.2 Weeds, pathogens, and pests

Invasive plants and animals, and plant and animal pathogens can affect threatened biodiversity through direct mortality and modification to vegetation structure and composition. The Key Threatening Process listings detailed in Table 3.2 are considered to have potential to affect the biodiversity within the project disturbance area and are the subject of:

Table 3.2 Key threatening process listings

Listed Key Threatening Process
Competition and land degradation by rabbits
Competition and land degradation by unmanaged goats
Dieback caused by root-rot fungus (*Phytophthora cinnamomi*)
Infection of amphibians with chytrid fungus resulting in chytridiomycosis
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants
Predation by European red fox
Predation by feral cats
Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs
Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species

3.3 Key fish habitat

3.3.1 *Aquatic ecology assessment*

Aquatic habitats within the study area were assessed against the following policy and guidelines for fish habitat conservation and management:

- *Policy and guidelines for fish habitat conservation and management* (DPI 2013)
- *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003).
- Aquatic Ecology in Environmental Impact Assessment – EIA Guideline (Smith 2003).

The Aquatic Ecology in Environmental Impact Assessment – EIA Guideline was used to guide the level of aquatic assessment required for this Preliminary Biodiversity Assessment. There is sufficient existing information from previous studies within the project study area to describe the existing aquatic environment and to assess the quality and importance of the aquatic environments potentially impacted.

Searches of the following databases, existing mapping and other literature were used to identify aquatic biodiversity values present within the project study area:

- Fisheries NSW Spatial Data Portal (freshwater threatened species maps)
- Protected Matters Search Tool
- Key Fish Habitat mapping.

For the purpose of this Preliminary Biodiversity Assessment, the aquatic ecology assessment incorporates a desktop assessment only.

3.3.2 *Existing aquatic environment*

The project study area is located within the Macquarie, Talbragar, and Goulburn River catchments. As the project study area is a 1 km wide corridor, it crosses sections of large number of poor quality first, second and third order streams. Larger third and fourth order streams intersect the project study area as well as the Talbragar River. Streams within the project study area and surrounding locality were assessed for Key Fish Habitat through a search on the Department of Primary Industries (DPI) Fisheries Spatial Data Portal (Table 3.3). The project study area also contains the catchment areas (but does not cross the main channel) for the Cudgegong River (to the south of the project).

Streams with suitable habitat present in the project study area include the Mitchell, Wollar and Wilpinjong Creeks. Mitchell Creek, a tributary of the Macquarie River catchment, flows in a generally north westerly direction from its headwaters near Bodangora through to Ballimore where it joins the Talbragar River. Wollar Creek, a tributary of the Goulburn River catchment, flows in a generally north easterly direction from its headwaters near Wollar through Goulburn River National Park where it joins Goulburn River. Wilpinjong Creek, a tributary of Wollar Creek, flows in a generally south easterly direction from its headwaters near Ulan through Wollar where it joins Wollar Creek.

The catchments within which the project study area is located have been impacted from a mixture of rural activities and urbanisation. These activities have modified the natural aquatic environment substantially, including major infrastructure developments, roads, rail and agriculture.

The catchments of Macquarie, Talbragar and Cudgegong Rivers consists of gently sloping rural land that is largely cleared. Land use in the project study area from the south-west to the north-east consists mostly of cleared rural properties. Very few patches of remnant bushland occur within these catchment areas. The catchment area of the Goulburn River is present to the east of the project study area and consists primarily of cleared rural properties, as well as coal mines, state forests and Goulburn River National Park.

The project study area is dominated by surface runoff from rainfall which concentrates into defined watercourse catchments. Many of the watercourses are interrupted by storages including farm dams and larger reservoirs including Lake Burrendong to the south west of the project study area. These are used for stock-watering, irrigation and cropping which reflects the current land uses in the region.

Historic records of rainfall and flood events indicates that runoff is typically confined to the main channels and relatively quickly flow down to the lower portions of the catchments in the project study area. Water quality, quantity and velocity of flows within the project study area have been influenced by agricultural activities. Vegetation removal, agriculture, de-snagging, and construction of in-stream dams has affected the physical stability of the waterways within the project study area and streambank erosion is common.

3.3.3 *Fish habitat and waterway classification*

There are a number of named and unnamed watercourses intersecting the project study area which contain key fish habitat. Named watercourses in the project study area containing key fish habitat are listed in Table 3.3 below.

The key fish habitat and associated sensitivity classification scheme is demonstrated in Table 1 of the *Policy and guidelines for fish habitat conservation and management* (DPIE, 2013). Under this scheme any known or expected protected or threatened species habitat or area of declared ‘critical habitat’ under the *Fisheries Management Act 1994* (FM Act) is defined as “TYPE 1 - Highly sensitive key fish habitat”.

A search of the freshwater threatened species maps (DPI 2022 a and b) found habitat for Eel-tailed Catfish (*Tandanus tandanus*) is present in the Macquarie River and habitat for the Southern Purple Spotted Gudgeon (*Mogurnda adspersa*) is present throughout all streams listed as key fish habitat within the project study area and surrounds. Although key fish habitat is present within the project study area, avoidance will be achieved by spanning these areas with the powerlines so that no direct impact to aquatic species or habitat occurs from the project.

Table 3.3 Named watercourses intersecting the project study area

Strahler Order	Occurrences within Project study area	Watercourse names
6	4	Talbragar River, Four Mile Creek, Moolarben Creek, Coolaburragundy River.
5	10	Bounty Creek, Busbys Creek, Cainbil Creek, Cockabutta Creek, Cumbo Creek, Sandy Creek, Sportmans Holllow Creek, Tallwang Creek, Turee Creek, Wilpinjong Creek.
4	16	Bounty Creek, Cainbil Creek, Collier Creek, Four Mile Creek, Green Wattle Gully, Ironbark Creek, Laheys Creek, Miangulliah Creek, Mona Creek, Murragamba Creek, Sportmans Hollow Creek, Spring Flat Creek, Starkeys Creek, Talbragar River, Wagrobil Creek, Wilpinjong Creek.
3	12	Bens Creek, Bowenbong Creek, Curryall Creek, Ironbark Creek, Miangulliah Creek, Murrumbline Creek, Norfolk Island Creek, Pine Creek, Salty Creek, Sportsmans Hollow Creek, Spring Creek, Turrill Creek.
2	15	Back Creek, Blackheath Creek, Copes Creek, Curryall Creek, Deep Creek, Huxleys Creek, Junction Creek, Miangulliah Creek, Moreton Bay Creek, Narrow Creek, Planters Creek, Tallawang Creek, Tucklan Creek, Turill Creek, White Creek.
1	13	Back Creek, Browns Creek, Deadmans Creek, Junction Creek, Miangulliah Creek, Oliver Creek, Patricks Creek, Salty Creek, Spring Creek, Stubbo Creek, Tallawang Creek, White Creek, Yellow Waterholes Gully.

Note: Several creeklines appear in more than one category. This reflects the multiple intersection of the creekline with the project study area, and were in some locations, the creek may be of a difference size (or Strahler order)

3.3.4 *Threatened aquatic species*

The desktop searches returned four threatened fish listed under the EPBC Act as having the potential to occur within the locality: Flathead Galaxia (*Galaxias rostratus*), Macquarie Perch (*Macquaria australasica*), Trout Cod (*Maccullochella macquariensis*), and Murray Cod (*Maccullochella peelii*). The Flathead Galaxia, Macquarie Perch and Trout Cod are also listed as threatened species under the FM Act.

A search of the NSW Department of Primary Industries (DPI) Fisheries Spatial Data Portal on 17 August 2022 found that the waterways within the project study area contain mapped habitat for Southern Purple Spotted Gudgeon (*Mogurnda adspersa*) and Eel-tailed Catfish (*Tandanus tandanus*) listed under the FM Act, based on predicted occupancy extents. An assessment of the likelihood of occurrence of all threatened aquatic species was undertaken to determine the potential for these species to occur within the project study area (see Appendix B). Furthermore, the project study area is located outside of the known distribution of the Macquarie Perch, Trout Cod and Murray Cod suggesting that these species are unlikely to occur.

3.3.5 *Groundwater dependent ecosystems*

Groundwater dependent ecosystems (GDEs) are communities of plants, animals, and other organisms whose extent and life processes are dependent on groundwater. When considering GDEs, groundwater is generally defined as the saturated zone of the regolith (the layer of loose rock resting on bedrock, constituting the surface of most land) and its associated capillary fringe, but it excludes soil water held under tension in soil pore spaces (the unsaturated zone or vadose zone) (Eamus *et al*. 2006).

GDEs include a diverse range of ecosystems, from those entirely dependent on groundwater to those that may use groundwater while not having a dependency on it for survival (i.e., ecosystems or organisms that use groundwater opportunistically or as a supplementary source of water) (Hatton and Evans 1998). Broad classes of GDEs that have the potential to be present within or near the project study area include:

- Ecosystems dependent on the surface expression of groundwater may be present in the project study area. This category of GDE includes base-flow rivers and watercourses, wetlands, some floodplains and mound springs and estuarine seagrass beds. Although plant roots are generally below ground, this class of groundwater dependent ecosystems requires a surface expression of groundwater, which may, in many cases, then soak below the soil surface and thereby become available to plant roots.
- Ecosystems dependent on the subsurface presence of groundwater, often accessed via the capillary fringe (non-saturated zone above the saturated zone of the water table) when roots penetrate this zone, are likely to be present in the project study area. This class of GDE includes terrestrial ecosystems such as River Red Gum (*Eucalyptus camaldulensis*) forests on the Murray–Darling basin. No surface expression of groundwater is required in this class of groundwater dependent ecosystems.

Groundwater levels on alluvial floodplains that support the forested wetland PCTs are expected to be shallow. The groundwater systems within the project study area are recharged via the infiltration of rainfall and surface water runoff. Infiltration is thought to occur primarily through the overlying weathered profile of the South-Western Slopes through the Macquarie, Goulburn, Talbragar, and Cudgegong Alluvial Ground Water Sources.

The Groundwater Dependent Ecosystems Atlas provides a national dataset of Australian GDEs based on a methodology that incorporates data from multiple sources including climate, river basins, groundwater systems, vegetation mapping, surface water mapping and conceptual understanding of how groundwater and ecosystems interact (Australian Bureau of Meteorology, 2022). Review of the GDE Atlas in the project study area indicates likelihoods of GDAs being present. Australian Bureau of Meteorology GDE mapping in the project study area is illustrated in Figure 3.2.

Preliminary assessment of the possible relationships of PCTs and GDEs in the project study area indicates that several PCTs in the study area have a high or moderate potential to be GDEs. Table 3.4 provides a summary of this preliminary assessment.

The terrestrial GDE mapping indicates that the floodplain wetlands, including the Inland Forested Wetlands formations, are high potential terrestrial GDEs (i.e., have a high potential for groundwater interaction) that may rely on surface expression of groundwater. Portions of Grassy Woodland PCTs adjacent to these Forested Wetlands are also considered high potential terrestrial GDEs. The Forested Wetlands are most likely to rely on subsurface presence of groundwater.

The portions of the remaining Grassy Woodland and Dry Sclerophyll Forest PCTs within the project study area are likely Moderate Potential GDEs (i.e., have a moderate potential for groundwater interaction).

All remaining Grassy Woodland, Grassland, Semi-arid Woodland and Dry Sclerophyll Forest PCTs within the study area are likely to be Low Potential GDEs (i.e., have a Low potential for groundwater interaction). These drier forest types are not obligate GDEs (i.e., they are not entirely dependent on groundwater) but are likely to be opportunistic facultative GDEs that depend on the subsurface presence of groundwater (often accessed via the capillary fringe – subsurface water just above the water table) in some locations but not in others, particularly where an alternative source of water (i.e. rainfall) cannot be accessed to maintain ecological function. The plants within these PCTs would use shallow soil water before seeking deeper soil water or groundwater. The trees may take up groundwater from the capillary fringe when necessary (e.g., during dry seasons or in extended drought). The survival and position of these Forested Wetland PCTs rely on the current hydrology of the area. Anything that impacts hydrology will impact these High Potential GDEs.

Table 3.4 Groundwater Dependent Ecosystem Potential of PCTs in project study area

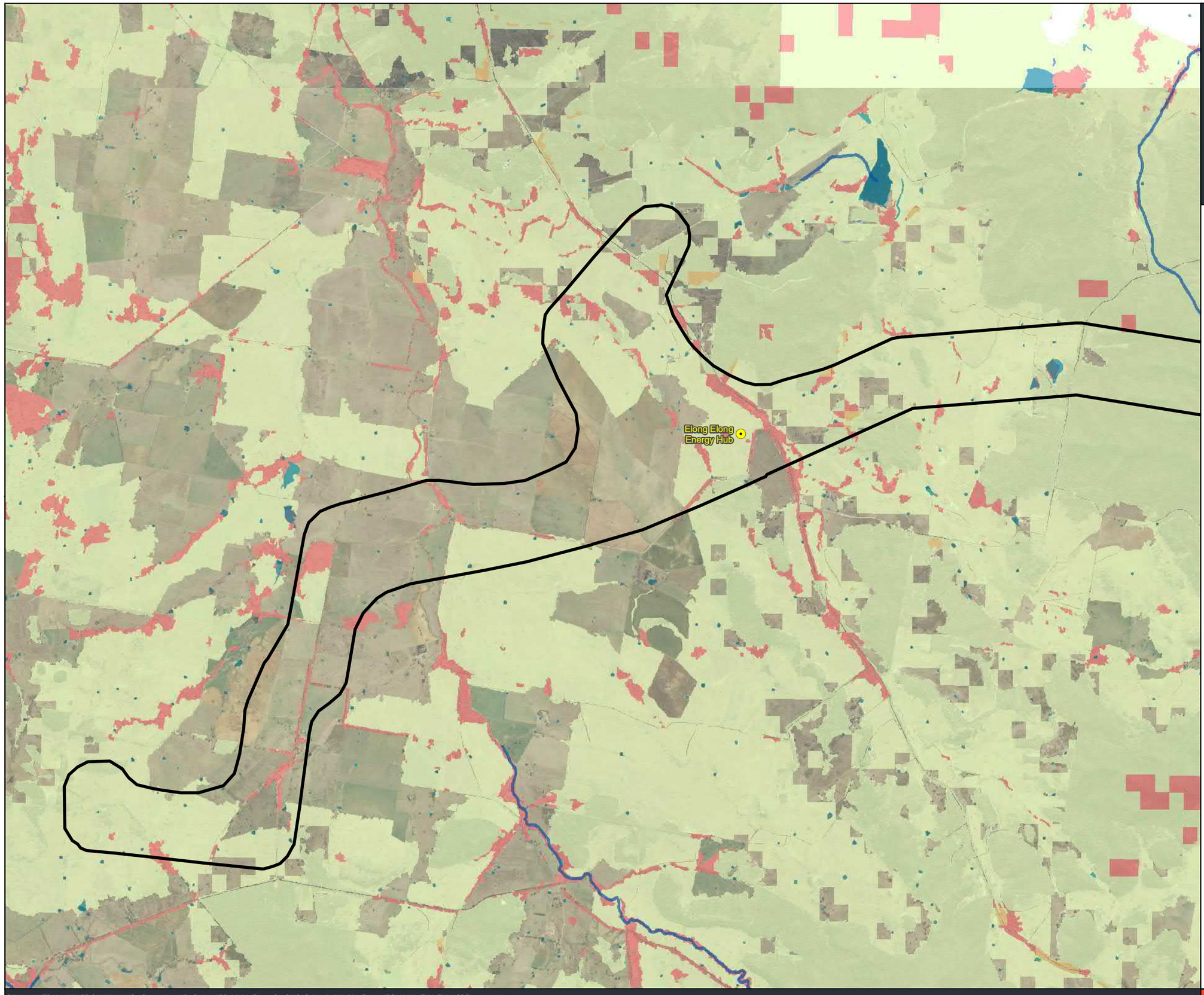
Vegetation formation[1]	PCT No.	PCT name	TEC[2]	GDE potential
FW	78	River Red Gum riparian tall woodland/open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion	–	High
FW	84	River Oak – Rough-barked Apple – red gum – box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion	–	High
FW	1881	Western Hunter Flats Rough-barked Apple Forest	–	High
GWL	81	Western Grey Box – cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion	yes	High[3]
GWL	281	Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	yes	High[3]
GWL	461	Tumbledown Gum woodland on hills in the northern NSW South Western Slopes Bioregion and southern Brigalow Belt South Bioregion	–	High[3]
DSF (Shrubby)	1661	Narrow-leaved Ironbark – Black Pine – Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin	–	Moderate
DSF (Shrubby)	1675	Scribbly Gum – Narrow-leaved Ironbark – *Bossiaea rhombifolia* heathy open forest on sandstone ranges of the Sydney Basin	–	Moderate
GWL	266	White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	yes	Moderate
DSF (Shrubby)	470	Mugga Ironbark – Narrow-leaved Ironbark – Buloke – Black Cypress Pine shrub grass open forest in the Goonoo forests and surrounding region, southern Brigalow Belt South Bioregion	–	Low
DSF (Shrubby)	482	Mugga Ironbark – Black Cypress Pine shrub/grass open forest of the upper Hunter Valley, mainly Sydney Basin Bioregion	–	Low
DSF (Shrubby)	1610	White Box – Black Cypress Pine shrubby woodland of the Western Slopes	–	Low
DSF (Shrubby)	1660	Narrow-leaved Ironbark heathy woodland on sandstone ranges of the Sydney Basin and Brigalow Belt South	–	Low
DSF (Shrubby)	1669	Red Ironbark – Grey Gum – Narrow-leaved Stringybark - Brown Bloodwood shrubby open forest on sandstone ranges of the Sydney Basin	–	Low
DSF (Shrubby)	1674	Red Ironbark – Brown Bloodwood – Black Pine heathy open forest on sandstone ranges of the Sydney Basin	–	Low
DSF (Shrubby)	1860	Growee Ranges Grey Gum-Scribbly Gum Forest	–	Low
DSF (Shrubby)	1861	Growee Ranges Grey Gum Sheltered Forest	–	Low
DSF (Shrubby)	1871	Western Hunter Dwyers Red Gum-Cypress Woodland	–	Low

Vegetation formation[1]	PCT No.	PCT name	TEC[2]	GDE potential
DSF (Shrubby)		Dry Sclerophyll Forest (Shrub-Grassy subformation)	–	Low
DSF (Shrubby)	393	White Box shrubby woodland of the western Liverpool Range, Warrumbungle Range and south-west Pilliga forests, Brigalow Belt South Bioregion	–	Low
GL	484	Derived tall spear grass grassland on mainly basalt hills of the Liverpool Plains, Liverpool Range and in the upper Hunter Valley (Merriwa district), south-eastern Brigalow Belt South Bioregion	yes	Low
GL	796	Derived grassland of the NSW South Western Slopes	yes	Low
GWL	201	Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion	yes	Low
GWL	202	Fuzzy Box woodland on colluvium and alluvial flats in the Brigalow Belt South Bioregion (including Pilliga) and Nandewar Bioregion	yes	Low
GWL	272	White Box – Black Cypress Pine – red gum +/- Mugga Ironbark shrubby woodland in hills of the NSW central western slopes	–	Low
GWL	277	Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	yes	Low
GWL	395	Derived speargrass – wallaby grass – wire grass mixed forb grassland mainly in the Coonabarabran – Pilliga – Coolah region	yes	Low
GWL	433	White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub-region, BBS Bioregion	yes	Low
GWL	434	White Box grass shrub hill woodland on clay to loam soils on volcanic and sedimentary hills in the southern Brigalow Belt South Bioregion	yes	Low
GWL	437	Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion	yes	Low
GWL	488	Silvertop Stringybark – Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion	yes	Low
GWL	511	Queensland Bluegrass – Redleg Grass – Rats Tail Grass – spear grass – panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion	yes	Low
GWL	1330	Yellow Box – Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion	yes	Low
GWL	1696	Blakelys Red Gum - Rough-barked Apple shrubby woodland of central and upper Hunter	–	Low
WSGW	483	Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	yes	Low

(1) Vegetation Formation: FW = Forested Wetland; GWL = Grassy Woodland; DSF = Dry Sclerophyll Forest; WSGW = Western Slopes Grassy Woodland

(2) TEC = PCT may be part of a Threatened Ecological Community (see Table 3.5)

(3) High potential where adjacent to a forested wetland



wsp

Central-West Orana REZ Transmission

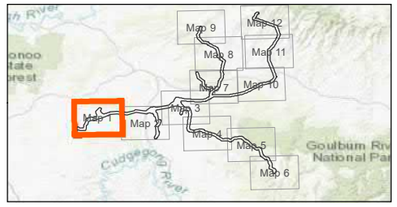
Figure 3-2 - Map 1 of 12
Groundwater Dependant Ecosystems

Legend

- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Project Study Area
- BOM Groundwater Dependent Ecosystems - Aquatic

BOM Groundwater Dependent Ecosystems - Terrestrial

- High potential GDE - from regional studies
- Moderate potential GDE - from regional studies
- Low potential GDE - from regional studies



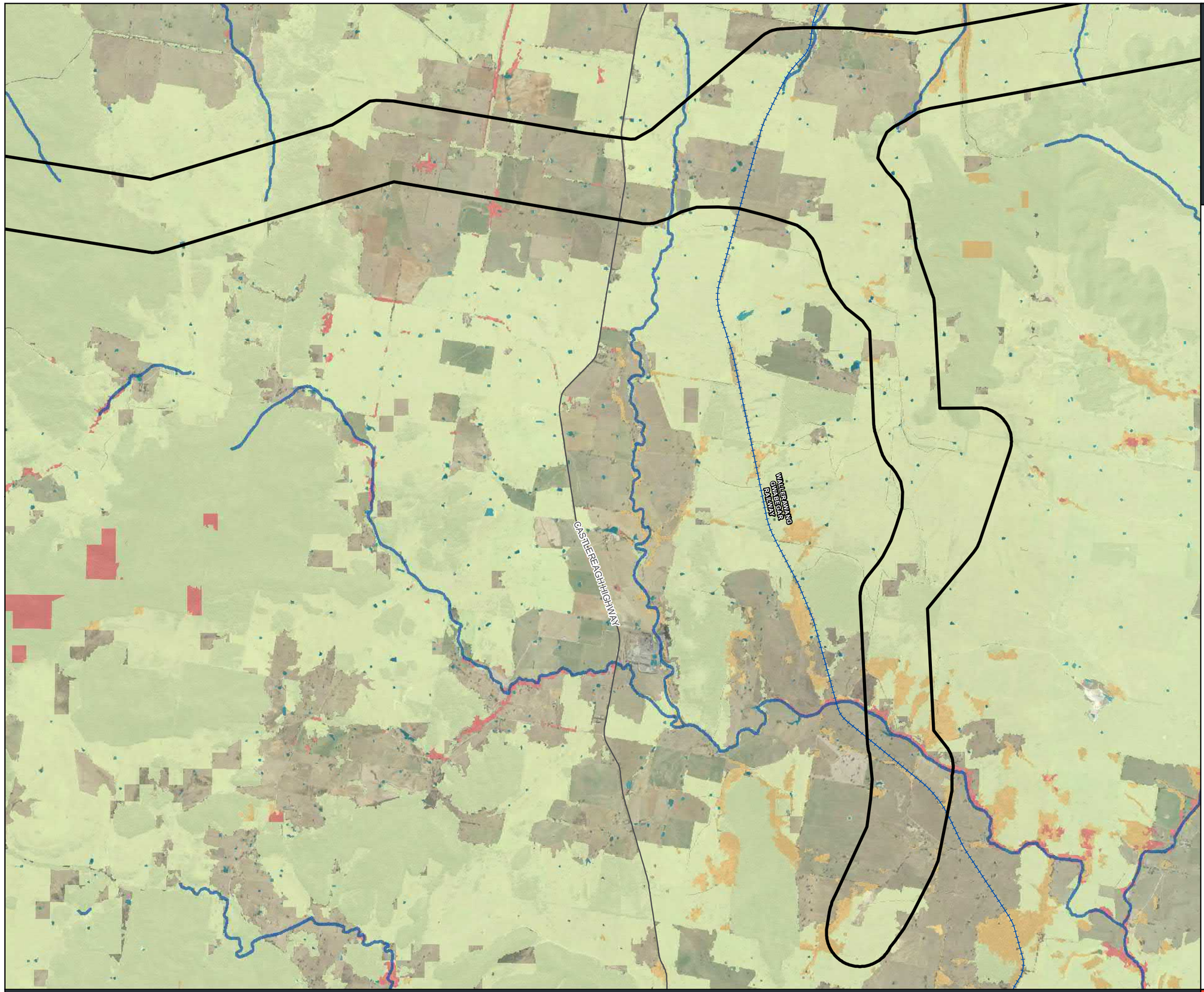
0 500 1,000
Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:55,000 Date: 6/09/2022

Data sources: WSP 2022



wsp

Central-West Orana REZ Transmission

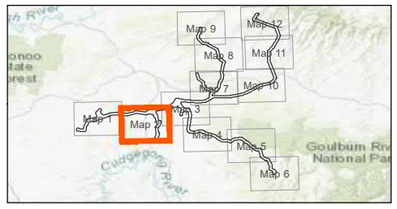
Figure 3-2 - Map 2 of 12
Groundwater Dependant Ecosystems

Legend

- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Project Study Area
- BOM Groundwater Dependent Ecosystems - Aquatic

BOM Groundwater Dependent Ecosystems - Terrestrial

- High potential GDE - from regional studies
- Moderate potential GDE - from regional studies
- Low potential GDE - from regional studies



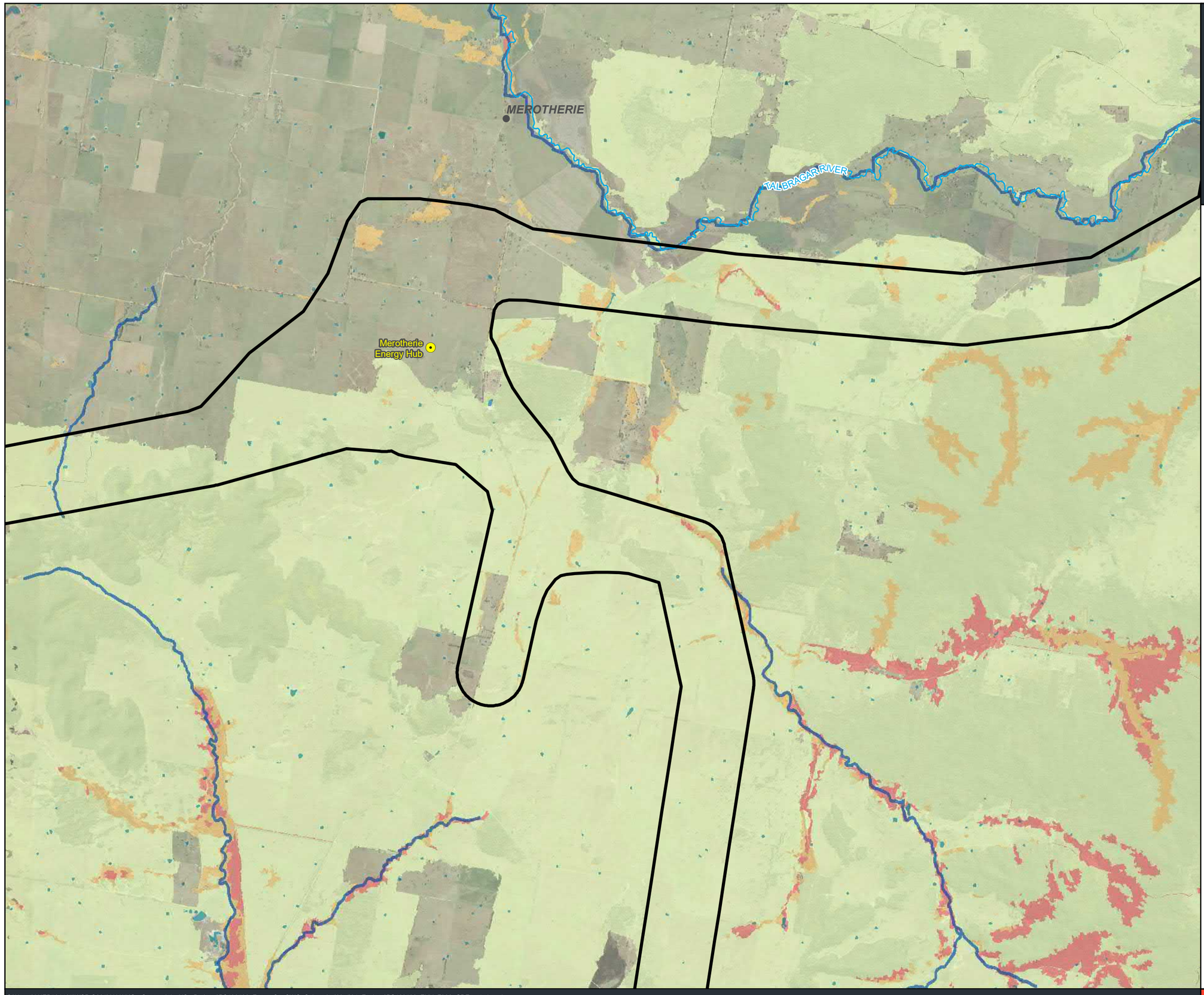
0 500 1,000
Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:55,000 Date: 6/09/2022

Data sources: WSP 2022



wsp

Central-West Orana REZ Transmission

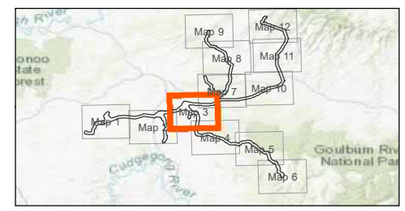
Figure 3-2 - Map 3 of 12
Groundwater Dependant Ecosystems

Legend

- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Project Study Area
- BOM Groundwater Dependent Ecosystems - Aquatic

BOM Groundwater Dependent Ecosystems - Terrestrial

- High potential GDE - from regional studies
- Moderate potential GDE - from regional studies
- Low potential GDE - from regional studies



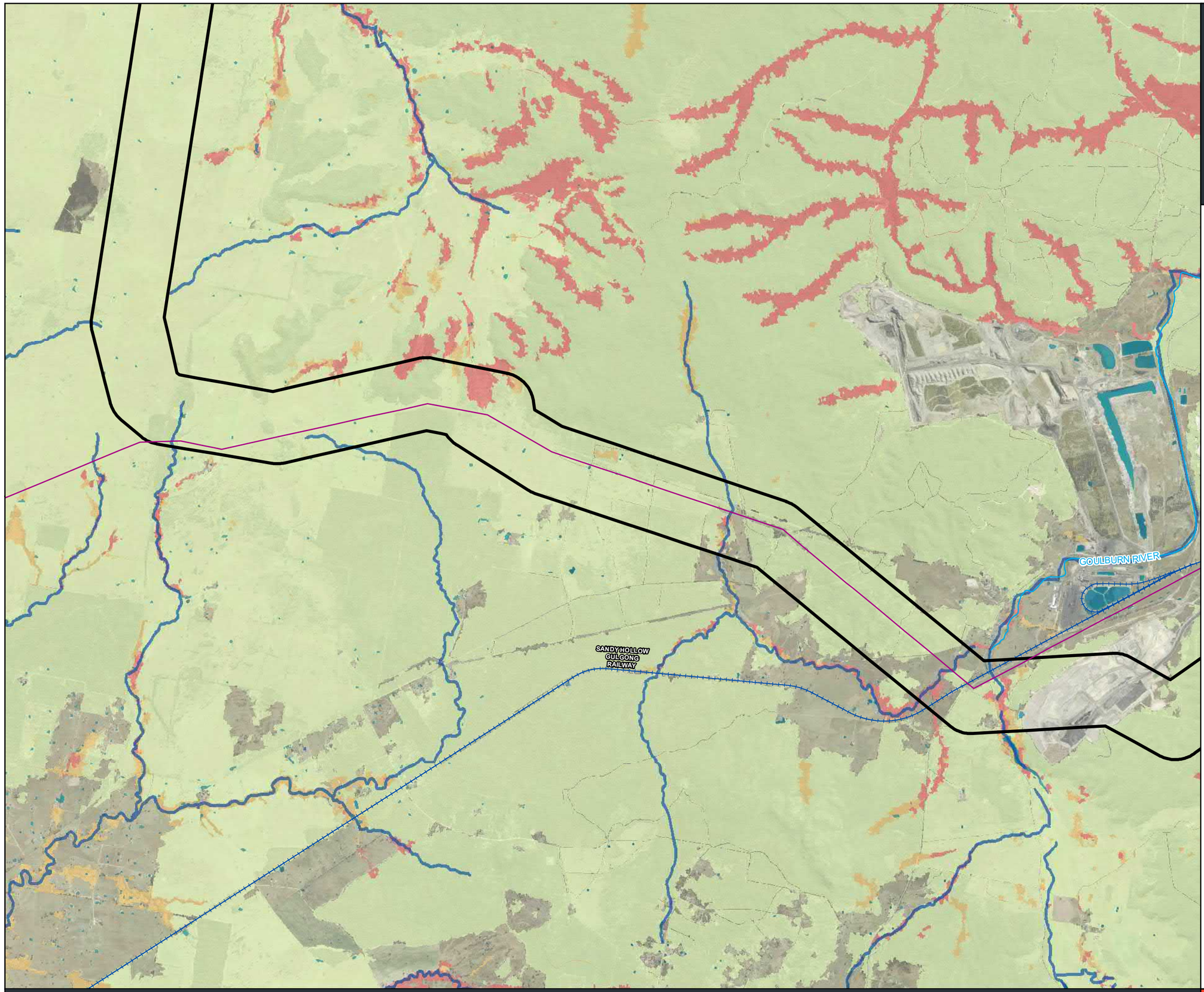
0 500 1,000
Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:55,000 Date: 6/09/2022

Data sources: WSP 2022



wsp

Central-West Orana REZ Transmission

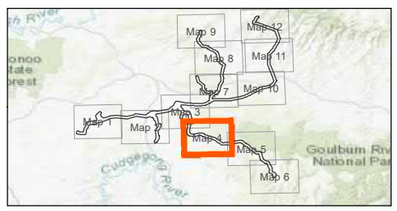
Figure 3-2 - Map 4 of 12
Groundwater Dependant Ecosystems

Legend

- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Project Study Area
- BOM Groundwater Dependent Ecosystems - Aquatic

BOM Groundwater Dependent Ecosystems - Terrestrial

- High potential GDE - from regional studies
- Moderate potential GDE - from regional studies
- Low potential GDE - from regional studies



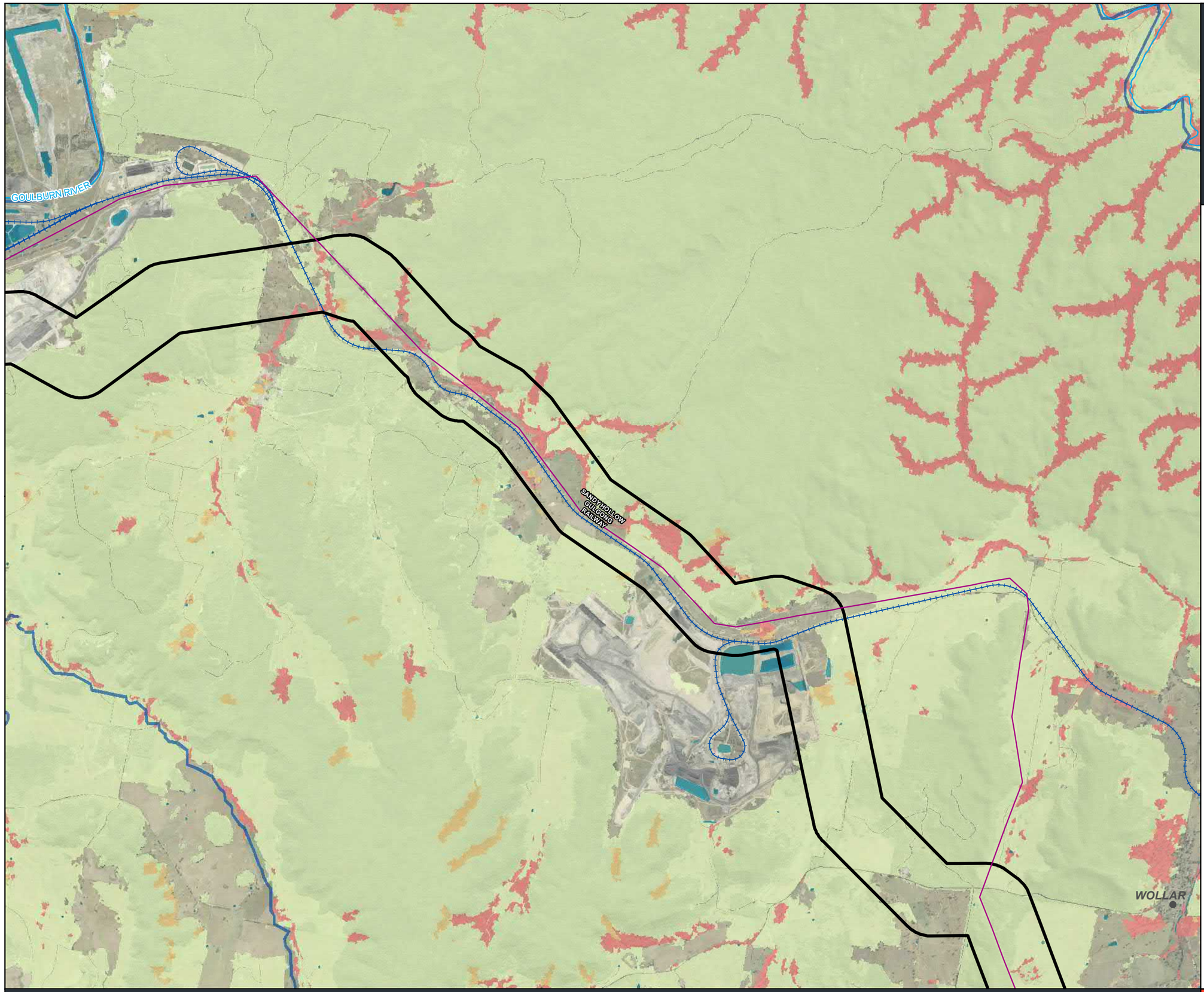
0 500 1,000
Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:55,000 Date: 6/09/2022

Data sources: WSP 2022



wsp

Central-West Orana REZ Transmission

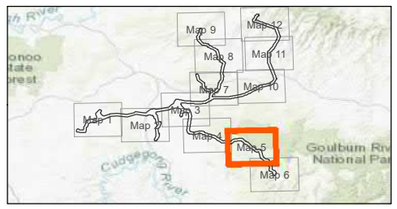
Figure 3-2 - Map 5 of 12
Groundwater Dependant Ecosystems

Legend

- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Project Study Area
- BOM Groundwater Dependent Ecosystems - Aquatic

BOM Groundwater Dependent Ecosystems - Terrestrial

- High potential GDE - from regional studies
- Moderate potential GDE - from regional studies
- Low potential GDE - from regional studies



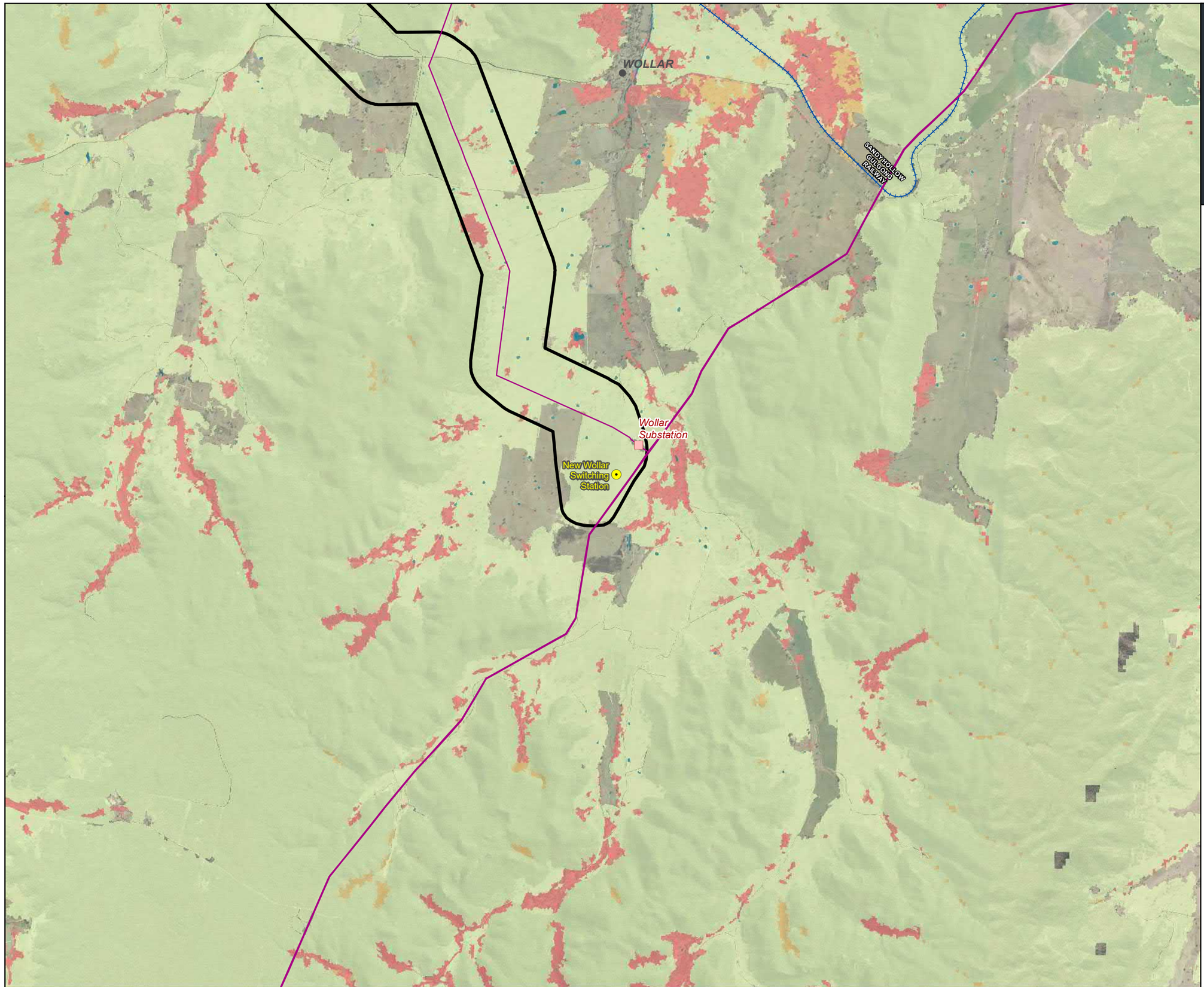
0 500 1,000
Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:55,000 Date: 6/09/2022

Data sources: WSP 2022



wsp

Central-West Orana REZ Transmission

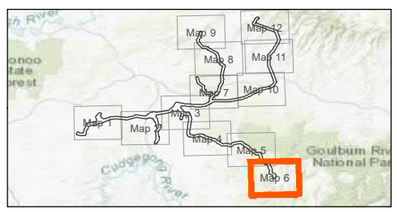
Figure 3-2 - Map 6 of 12
Groundwater Dependant Ecosystems

Legend

- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Project Study Area
- BOM Groundwater Dependent Ecosystems - Aquatic

BOM Groundwater Dependent Ecosystems - Terrestrial

- High potential GDE - from regional studies
- Moderate potential GDE - from regional studies
- Low potential GDE - from regional studies



0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:55,000 Date: 6/09/2022

Data sources: WSP 2022

Central-West Orana REZ Transmission

Figure 3-2 - Map 7 of 12
Groundwater Dependant Ecosystems

UARBRY

GOLDEN HIGHWAY

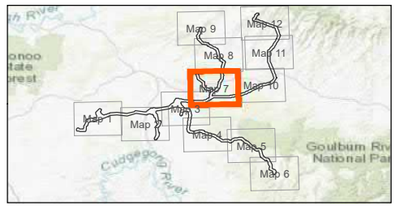
TALBRAGAR RIVER

Legend

- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Project Study Area
- BOM Groundwater Dependent Ecosystems - Aquatic

BOM Groundwater Dependent Ecosystems - Terrestrial

- High potential GDE - from regional studies
- Moderate potential GDE - from regional studies
- Low potential GDE - from regional studies



0 500 1,000
Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:55,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F008_GDEs_r1v4.mxd

wsp

Central-West Orana REZ Transmission

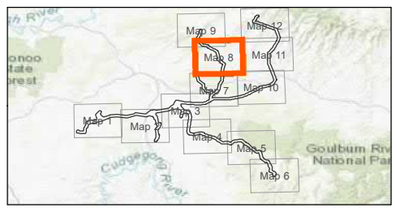
Figure 3-2 - Map 8 of 12
Groundwater Dependant Ecosystems

Legend

- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Project Study Area
- BOM Groundwater Dependent Ecosystems - Aquatic

BOM Groundwater Dependent Ecosystems - Terrestrial

- High potential GDE - from regional studies
- Moderate potential GDE - from regional studies
- Low potential GDE - from regional studies



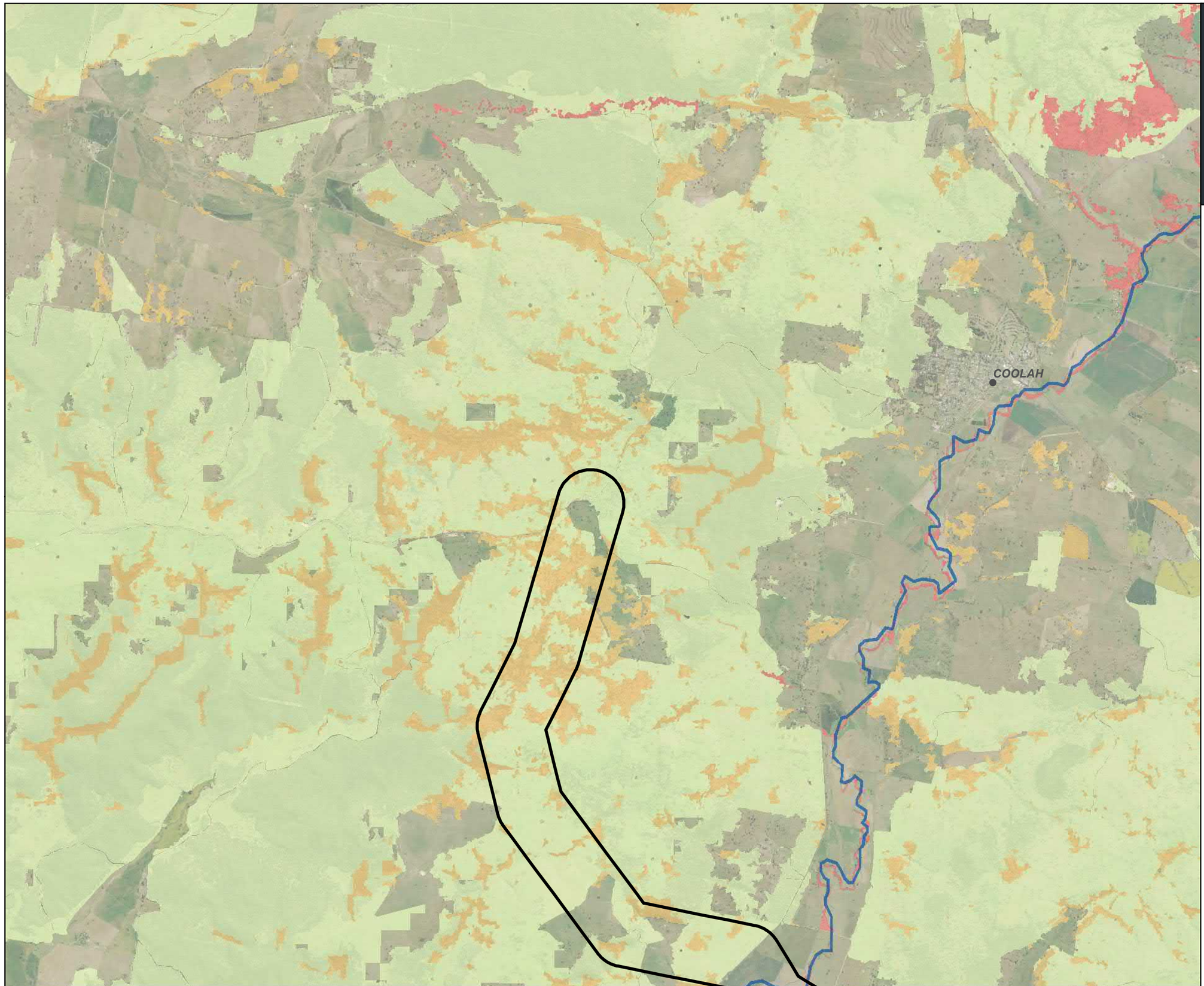
0 500 1,000
Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:55,000 Date: 6/09/2022

Data sources: WSP 2022



Central-West Orana REZ Transmission

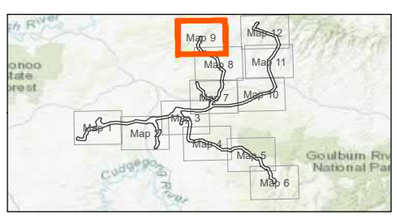
Figure 3-2 - Map 9 of 12
Groundwater Dependant Ecosystems

Legend

- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Project Study Area
- BOM Groundwater Dependent Ecosystems - Aquatic

BOM Groundwater Dependent Ecosystems - Terrestrial

- High potential GDE - from regional studies
- Moderate potential GDE - from regional studies
- Low potential GDE - from regional studies



0 500 1,000
Meters

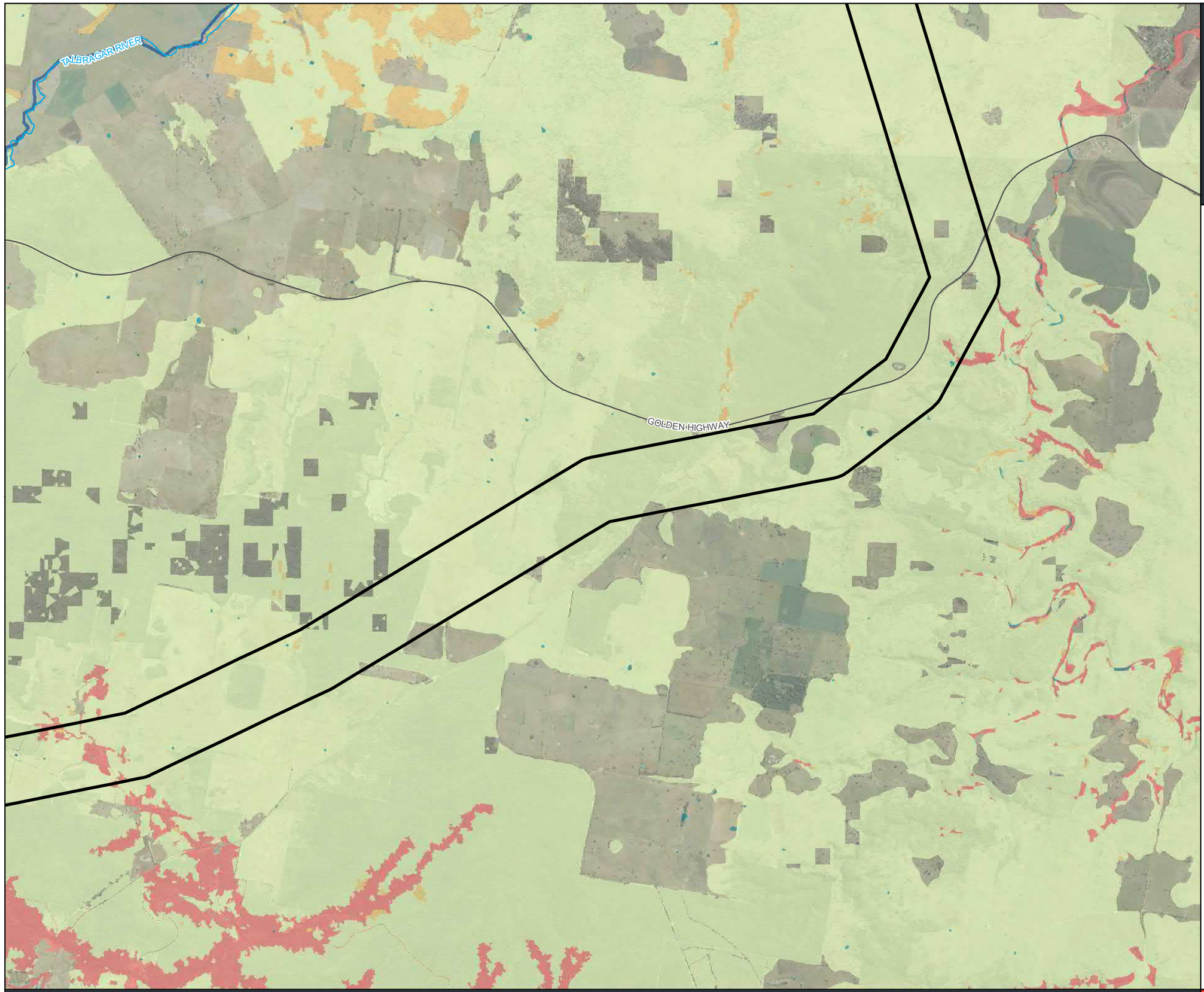
Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:55,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F008_GDEs_r1v4.mxd



Central-West Orana REZ Transmission

Figure 3-2 - Map 10 of 12
Groundwater Dependant Ecosystems

Legend

- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Project Study Area
- BOM Groundwater Dependent Ecosystems - Aquatic

BOM Groundwater Dependent Ecosystems - Terrestrial

- High potential GDE - from regional studies
- Moderate potential GDE - from regional studies
- Low potential GDE - from regional studies

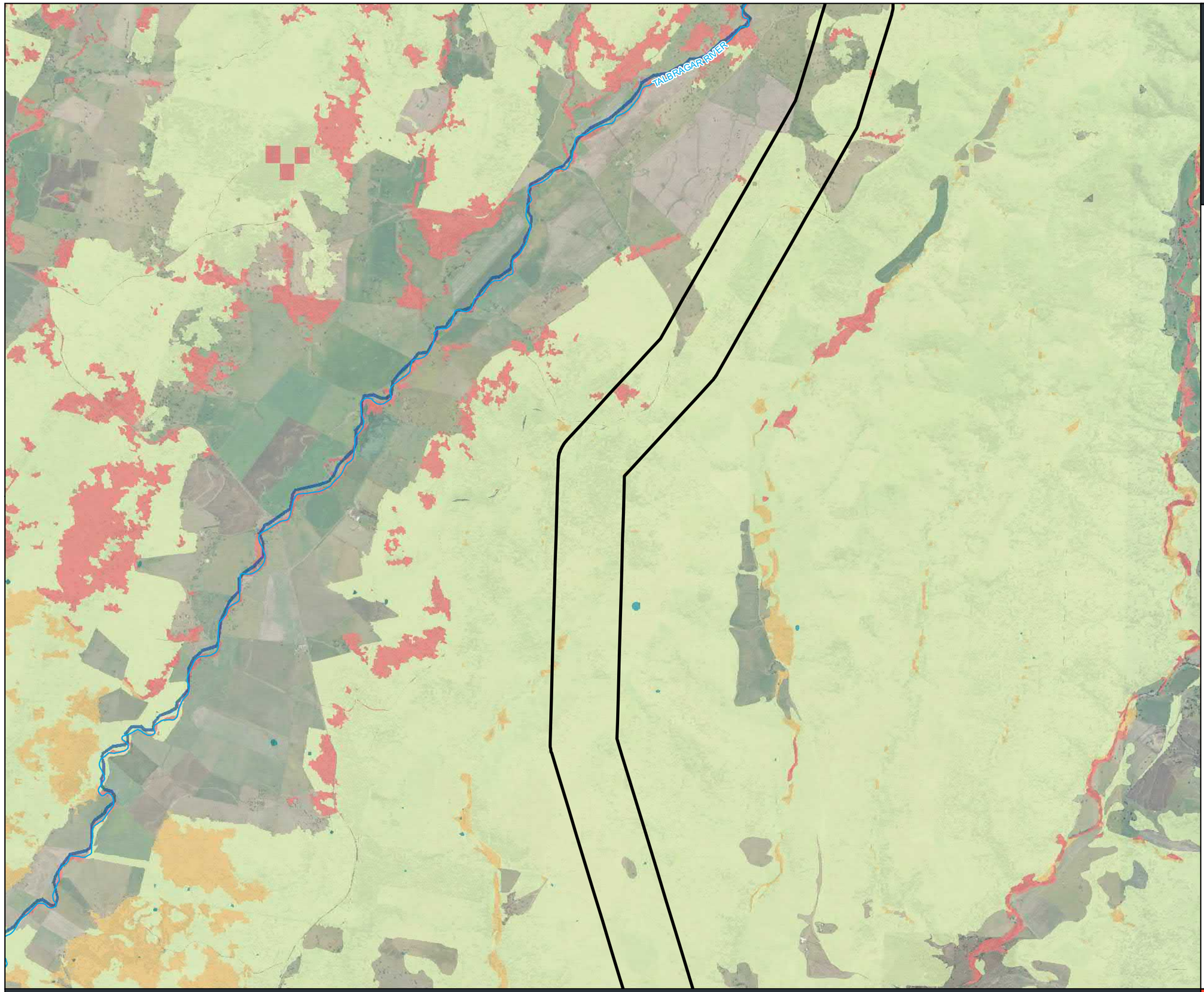
0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:55,000 Date: 6/09/2022

Data sources: WSP 2022



wsp

Central-West Orana REZ Transmission

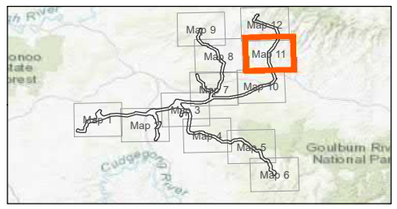
Figure 3-2 - Map 11 of 12
Groundwater Dependant Ecosystems

Legend

- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Project Study Area
- BOM Groundwater Dependent Ecosystems - Aquatic

BOM Groundwater Dependent Ecosystems - Terrestrial

- High potential GDE - from regional studies
- Moderate potential GDE - from regional studies
- Low potential GDE - from regional studies



0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

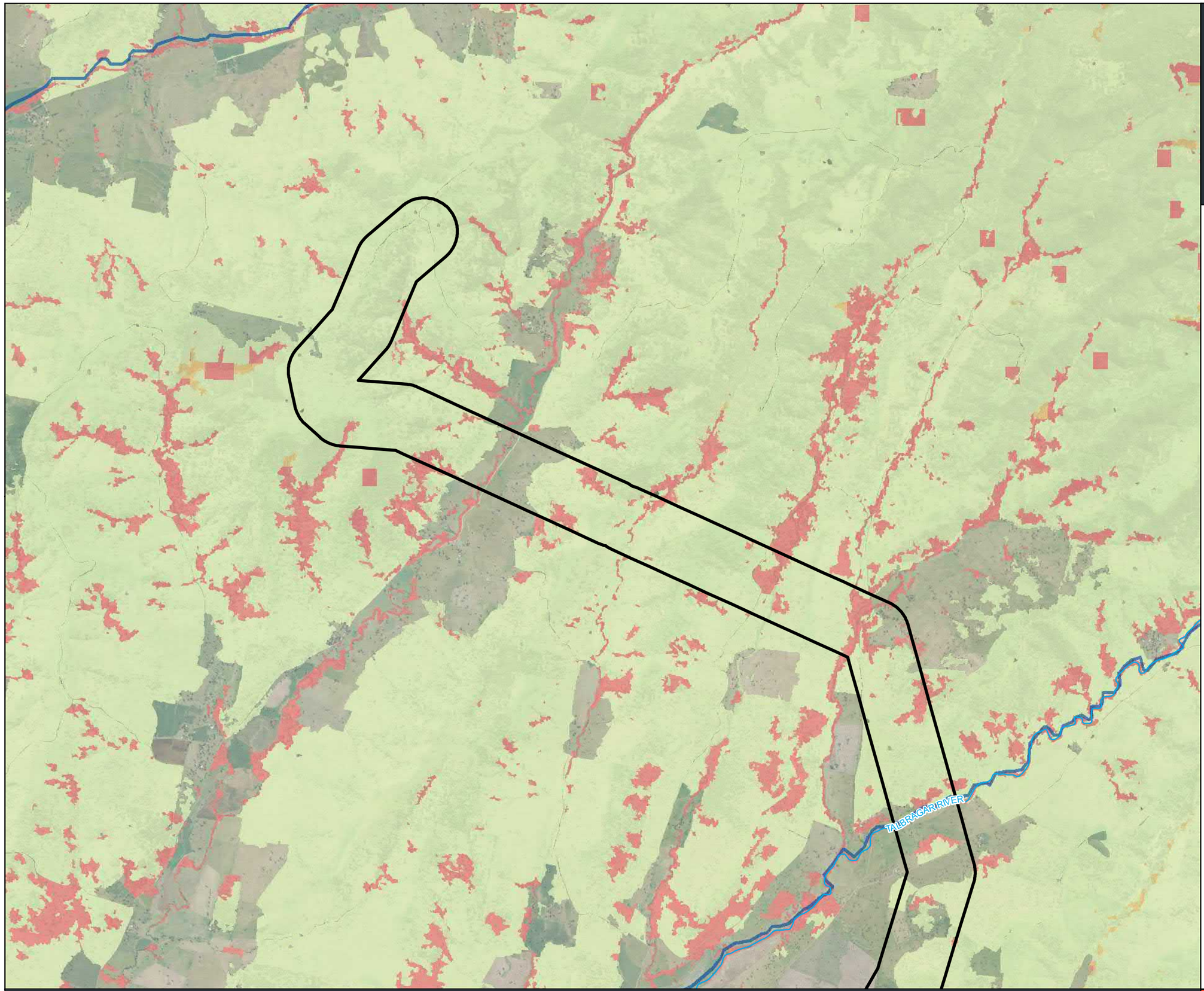
1:55,000 Date: 6/09/2022

Data sources: WSP 2022

wsp

Central-West Orana REZ Transmission

Figure 3-2 - Map 12 of 12
Groundwater Dependant Ecosystems

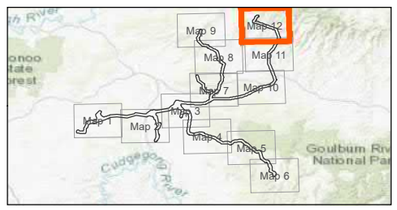


Legend

- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Project Study Area
- BOM Groundwater Dependent Ecosystems - Aquatic

BOM Groundwater Dependent Ecosystems - Terrestrial

- High potential GDE - from regional studies
- Moderate potential GDE - from regional studies
- Low potential GDE - from regional studies



0 500 1,000
Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:55,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F008_GDEs_r1v4.mxd

3.4 Threatened Biodiversity – *Biodiversity Conservation Act 2016*

An overview of threatened biodiversity entities listed under the BC Act are presented below, including those candidate entities identified under the BC Act for Serious and Irreversible Impacts (SAII). SAII entities are threatened biodiversity considered to be most at risk of extinction and any assessment of proposed State Significant Infrastructure with SAII impacts requires specific consideration of any additional and appropriate measures that will minimise those impacts prior to approval.

3.4.1 *Threatened ecological communities*

A total of three threatened ecological communities listed under the BC Act have been identified as potentially occurring within the project study area based on their alliance to native vegetation recorded either through field verification or broad scale mapping. These communities are considered candidate threatened ecological communities and include:

- Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions – Endangered.
- Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions – Endangered.
- White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregion – Critically Endangered.

An overview of each threatened ecological community, its threat status, associated PCTs and indicative project disturbance area is presented in Table 3.5. TECs as recorded during preliminary field surveys and/or predicted using broad scale mapping are shown within the project study area in Figure 3.3.

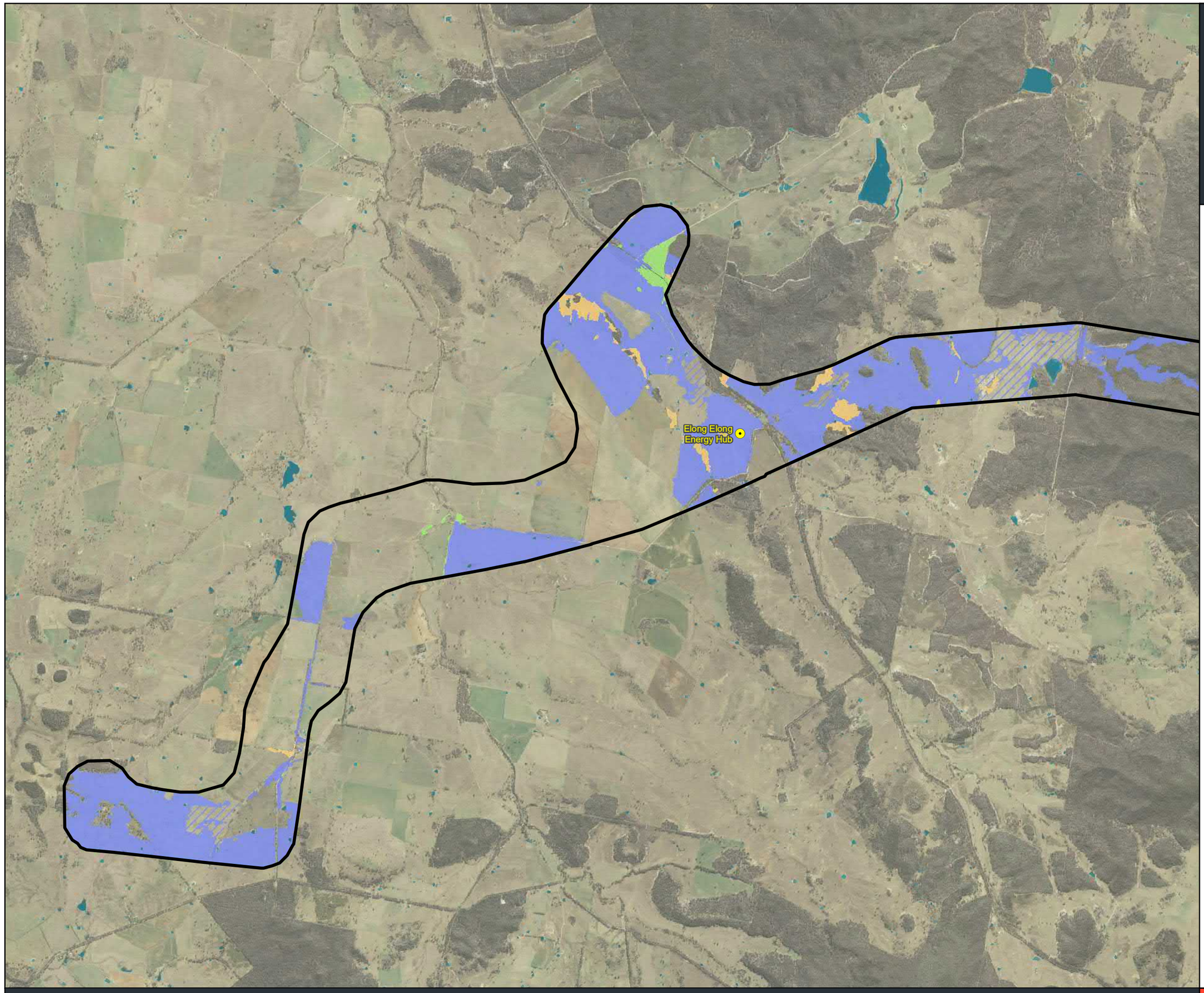
Other TECs have a lower likelihood of occurring; however field survey is required to determine their presence in the project disturbance area. These include:

- Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions, listed as Endangered under the BC Act. If present, this EEC would most likely occur in the northern extent of the project study area where it overlaps with the Brigalow Belt South bioregion.
- Hunter Valley Weeping Myall Woodland of the Sydney Basin bioregion listed as a Critically Endangered under the BC Act. If present, this CEEC would most likely occur in the Bylong valley within the Sydney Basin bioregion. It would likely occur in small, isolated stands with a relatively poor ecological condition.
- Whilst not a TEC, the Eucalyptus camaldulensis population in the Hunter catchment is listed as an Endangered population under the BC Act. If present, this endangered population will occur on river flats within the Hunter catchment, such as in in the Bylong sub-catchment of the Hunter. The most western record of the population is near Mudgee.

Table 3.5 Threatened ecological communities listed under the BC Act and associated PCTs

Threatened ecological community	BC Act[1]	Associated Plant Community Type	Indicative project disturbance area (ha)
Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	E	Aligns (in part) with the following PCT mapped within the project disturbance area: — PCT 81	5.5
Fuzzy Box Woodland on Alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions	E/SAII	Aligns (equivalent to) with the following PCT mapped within the project disturbance area: — PCT 201 — PCT 202	4.36
White Box – Yellow Box – Blakely's Red Gum Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregion	CE/SAII	Aligns (equivalent to) with the following PCTs recorded within the project disturbance area: — PCT 484 — PCT 1330 The following PCTs align partly align to this TEC: — PCT 266 — PCT 268 — PCT 277 — PCT 281 — PCT 395 — PCT 433 — PCT 434 — PCT 437 — PCT 483 — PCT 488 — PCT 511 — PCT 796 — PCT 800	3660.66

(1) Endangered (E), and SAII = Serious and Irreversible Impact under the *Biodiversity Conservation Act* (BC Act)



wsp

Central-West Orana REZ Transmission

Figure 3.3 - Map 1 of 12
Vegetation (TECs) in the study area

Legend

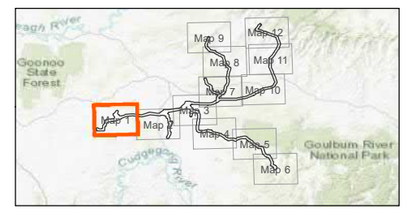
- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Project Study Area

Threatened Ecological Communities

- Fuzzy Box Woodland on Alluvial Soils (EEC on BC Act & EPBC Act)
- Inland Grey Box Woodland (EEC on BC Act & EPBC Act)

Box-Gum Woodland & DNG (CEEC on BC Act & EPBC Act)

- Box-Gum Woodland
- DNG



0 1,100 2,200
Meters

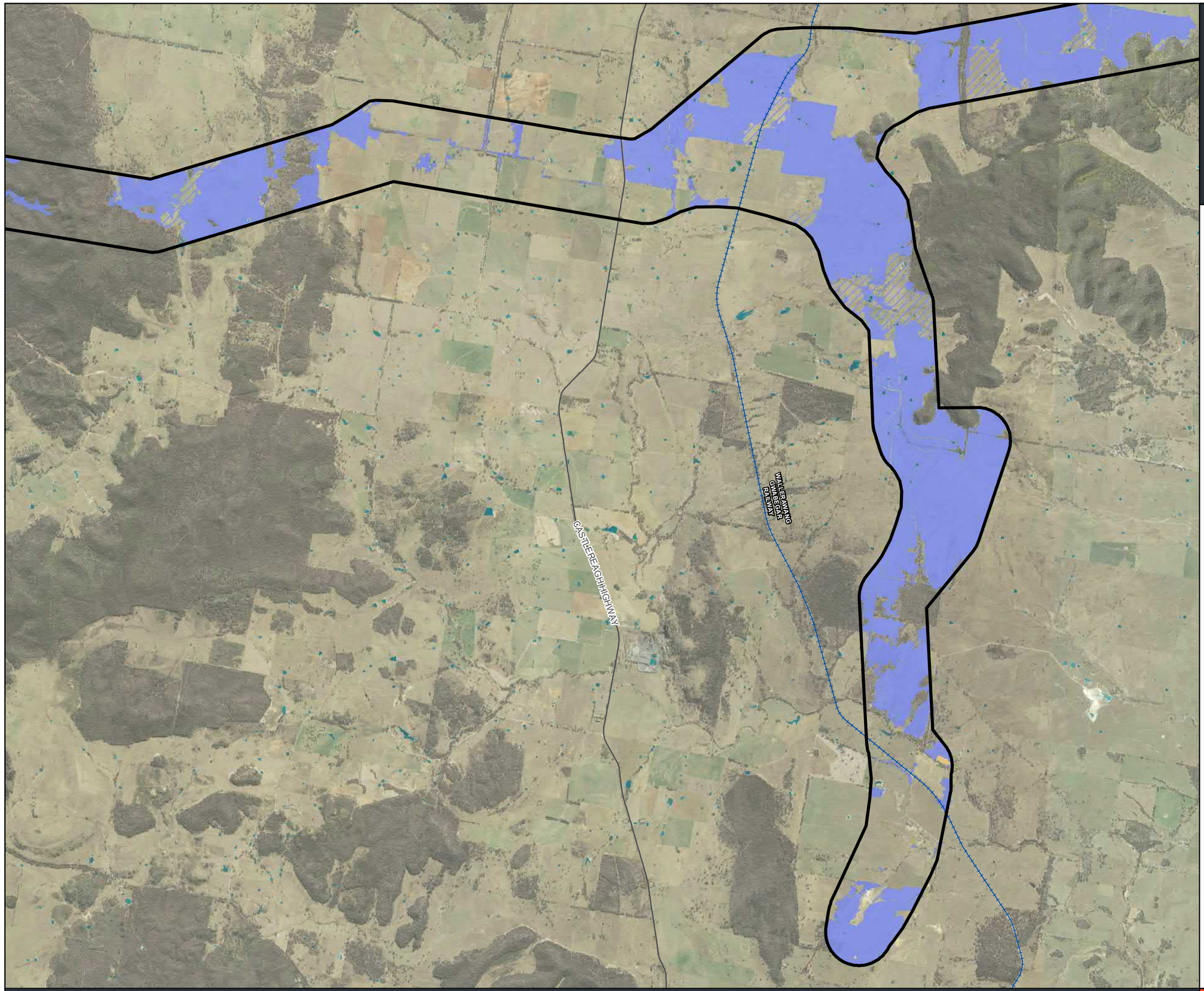
Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:55,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F003_TECs_r1v7.mxd



Central-West Orana REZ Transmission

Figure 3.3 - Map 2 of 12
Vegetation (TECs) in the study area

Legend

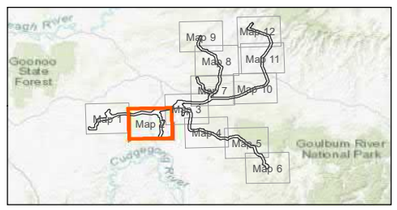
- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Project Study Area

Threatened Ecological Communities

- Fuzzy Box Woodland on Alluvial Soils (EEC on BC Act & EPBC Act)
- Inland Grey Box Woodland (EEC on BC Act & EPBC Act)

Box-Gum Woodland & DNG (CEEC on BC Act & EPBC Act)

- Box-Gum Woodland
- DNG



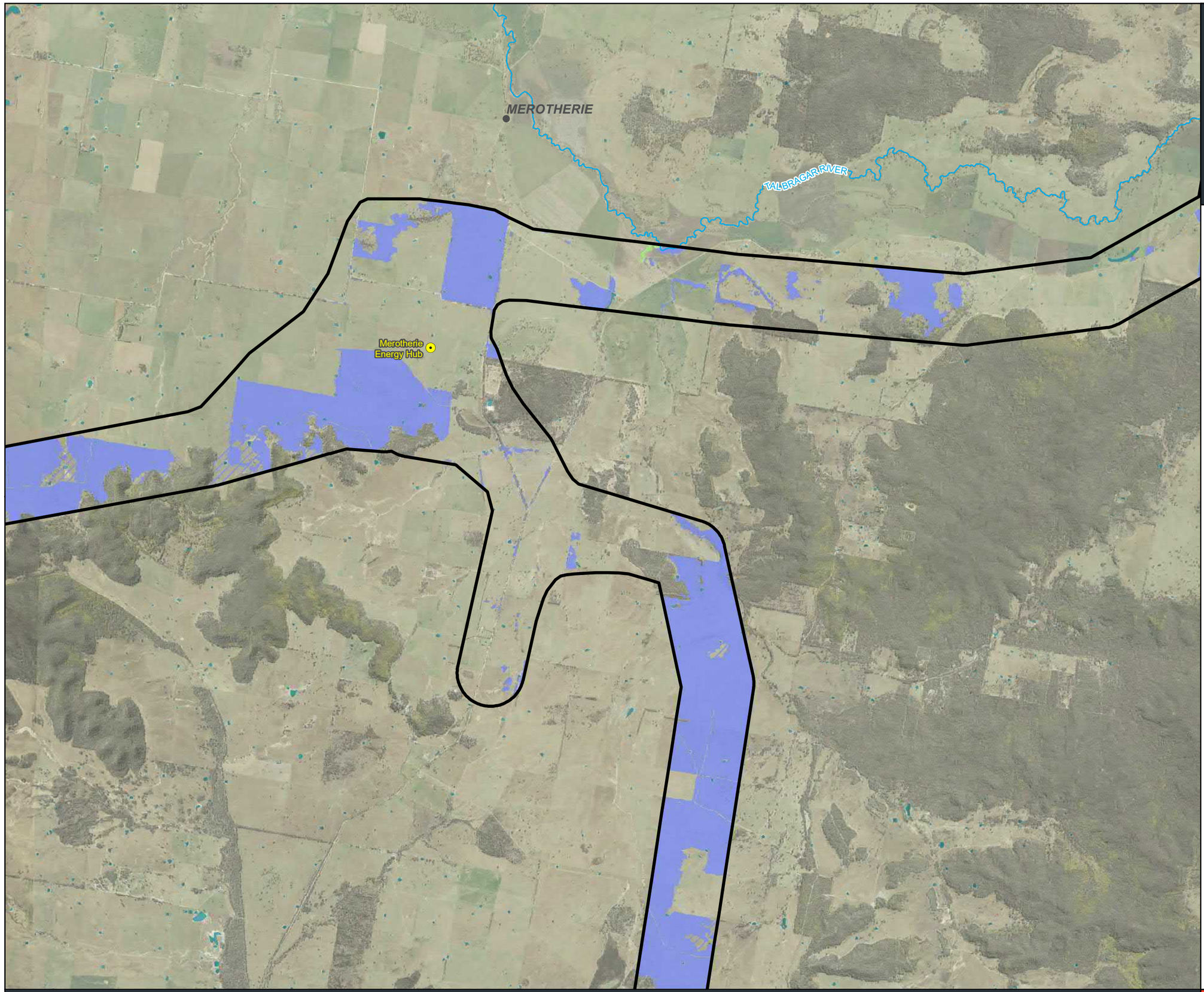
0 1,100 2,200 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:55,000 Date: 6/09/2022

Data sources: WSP 2022



Central-West Orana REZ Transmission

Figure 3.3 - Map 3 of 12
Vegetation (TECs) in the study area

Legend

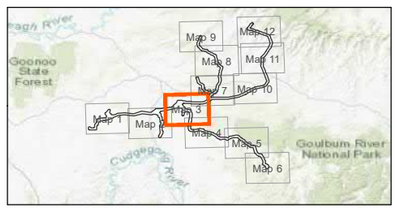
- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Project Study Area

Threatened Ecological Communities

- Fuzzy Box Woodland on Alluvial Soils (EEC on BC Act & EPBC Act)
- Inland Grey Box Woodland (EEC on BC Act & EPBC Act)

Box-Gum Woodland & DNG (CEEC on BC Act & EPBC Act)

- Box-Gum Woodland
- DNG



0 1,100 2,200
Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:55,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F003_TECs_r1v7.mxd

Central-West Orana REZ Transmission

Figure 3.3 - Map 4 of 12
Vegetation (TECs) in the study area

SANDY HOLLOW GULGONG RAILWAY

GOULBURN RIVER

Legend

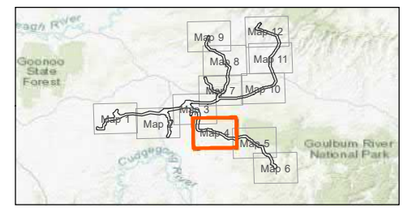
- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Project Study Area

Threatened Ecological Communities

- Fuzzy Box Woodland on Alluvial Soils (EEC on BC Act & EPBC Act)
- Inland Grey Box Woodland (EEC on BC Act & EPBC Act)

Box-Gum Woodland & DNG (CEEC on BC Act & EPBC Act)

- Box-Gum Woodland
- DNG



0 1,100 2,200 Meters

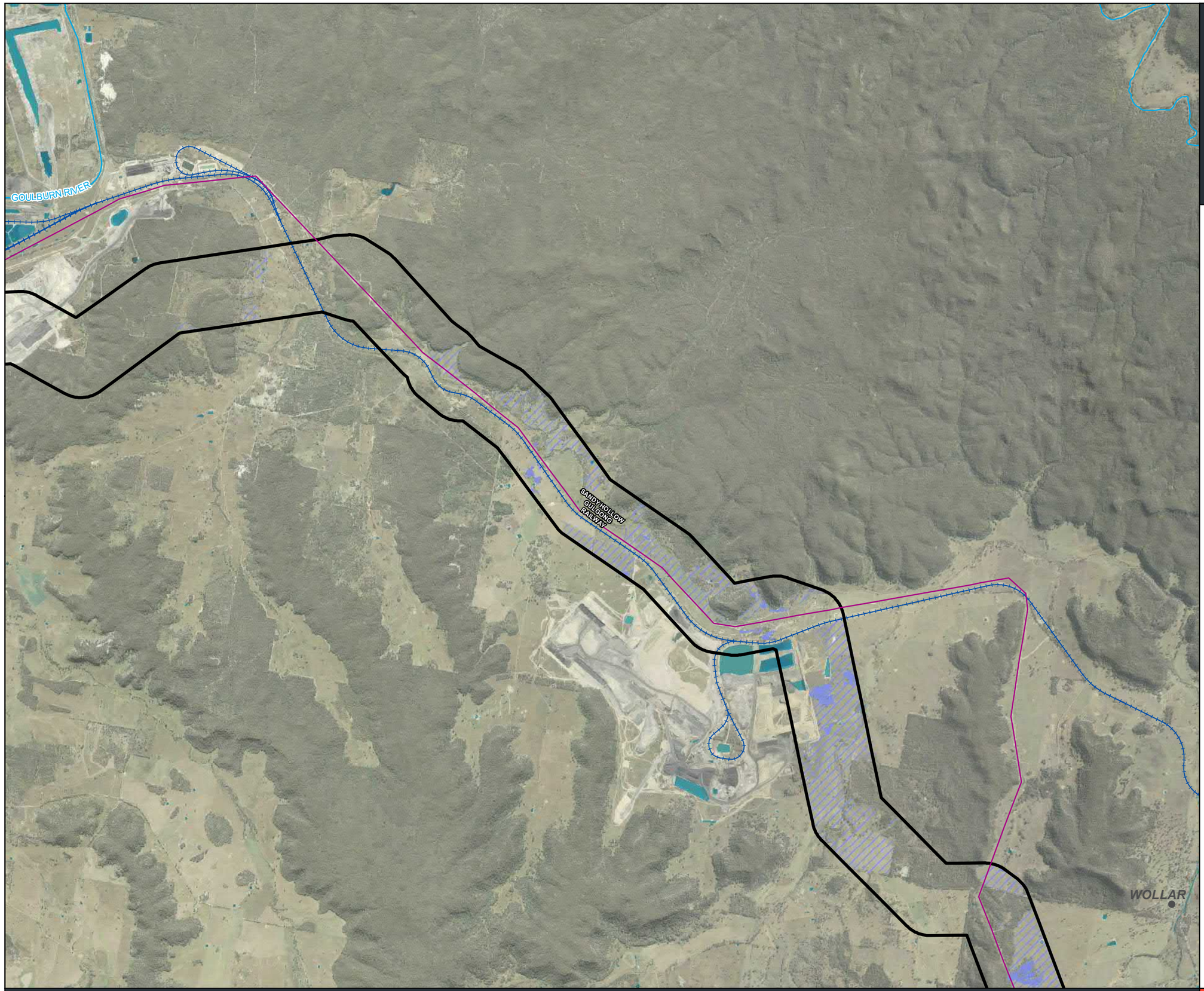
Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:55,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F003_TECs_r1v7.mxd



Central-West Orana REZ Transmission

Figure 3.3 - Map 5 of 12
Vegetation (TECs) in the study area

Legend

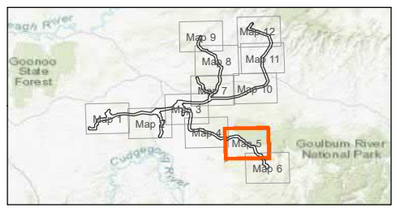
- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Project Study Area

Threatened Ecological Communities

- Fuzzy Box Woodland on Alluvial Soils (EEC on BC Act & EPBC Act)
- Inland Grey Box Woodland (EEC on BC Act & EPBC Act)

Box-Gum Woodland & DNG (CEEC on BC Act & EPBC Act)

- Box-Gum Woodland
- DNG



0 1,100 2,200 Meters

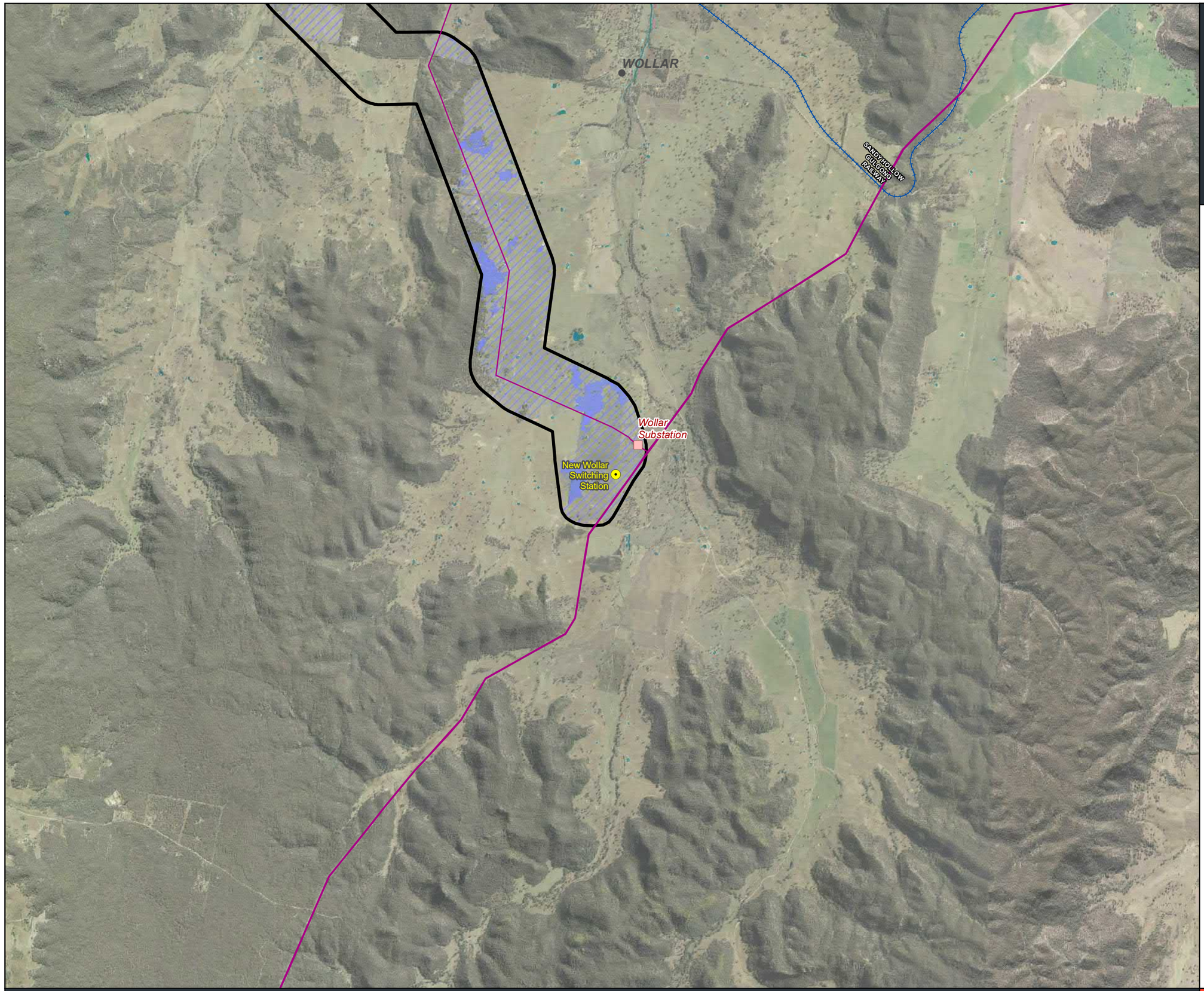
Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:55,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F003_TECs_r1v7.mxd



wsp

Central-West Orana REZ Transmission

Figure 3.3 - Map 6 of 12
Vegetation (TECs) in the study area

Legend

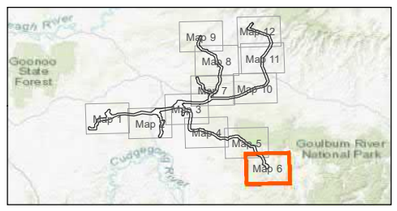
- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Project Study Area

Threatened Ecological Communities

- Fuzzy Box Woodland on Alluvial Soils (EEC on BC Act & EPBC Act)
- Inland Grey Box Woodland (EEC on BC Act & EPBC Act)

Box-Gum Woodland & DNG (CEEC on BC Act & EPBC Act)

- Box-Gum Woodland
- DNG



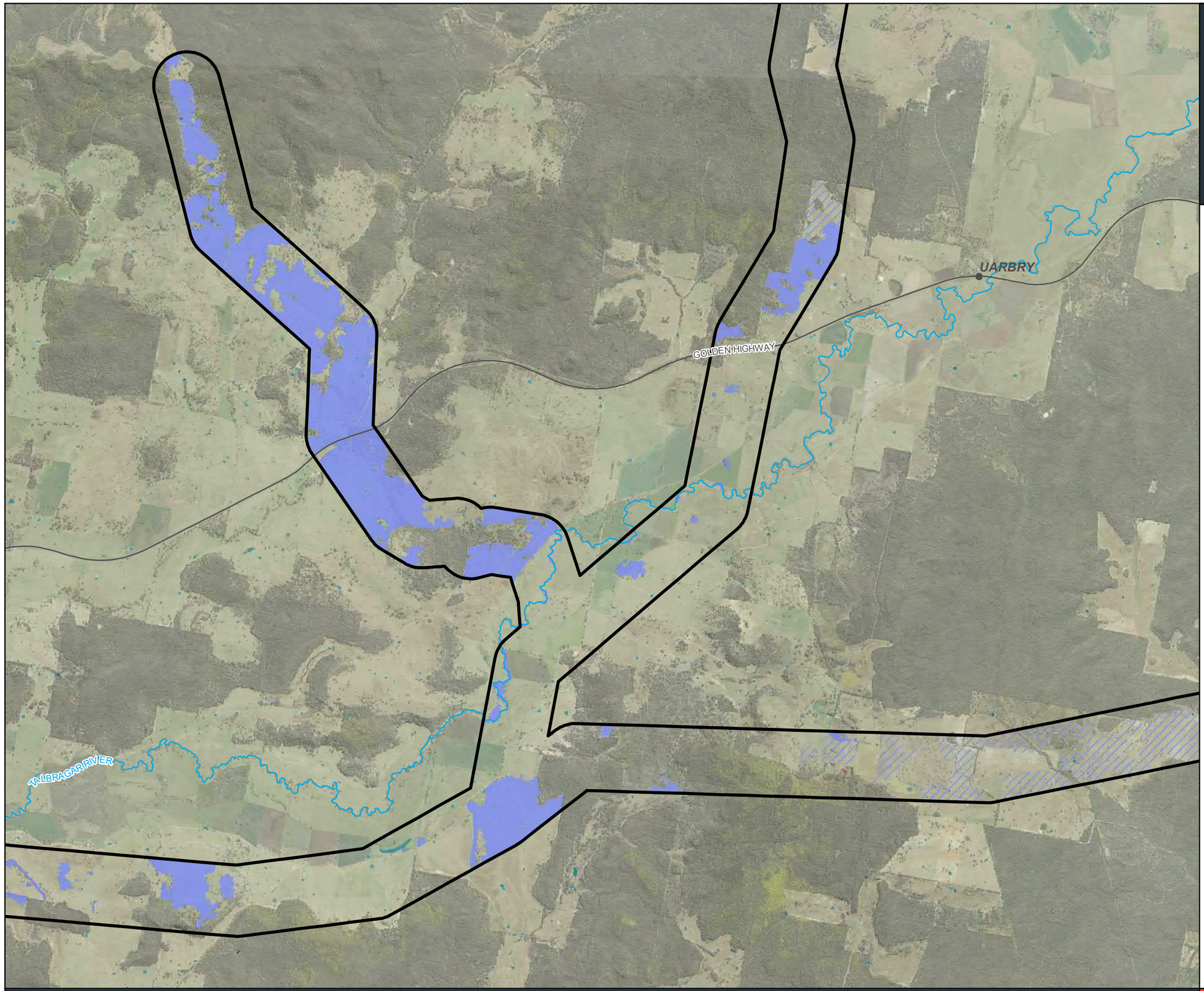
0 1,100 2,200 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:55,000 Date: 6/09/2022

Data sources: WSP 2022



Central-West Orana REZ Transmission

Figure 3.3 - Map 7 of 12
Vegetation (TECs) in the study area

Legend

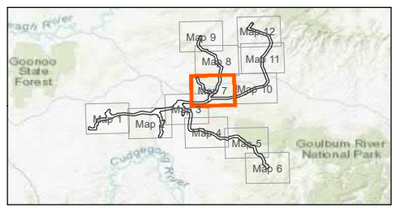
- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Project Study Area

Threatened Ecological Communities

- Fuzzy Box Woodland on Alluvial Soils (EEC on BC Act & EPBC Act)
- Inland Grey Box Woodland (EEC on BC Act & EPBC Act)

Box-Gum Woodland & DNG (CEEC on BC Act & EPBC Act)

- Box-Gum Woodland
- DNG



0 1,100 2,200 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:55,000 Date: 6/09/2022

Data sources: WSP 2022

wsp

Central-West Orana REZ Transmission

Figure 3.3 - Map 8 of 12
Vegetation (TECs) in the study area

Legend

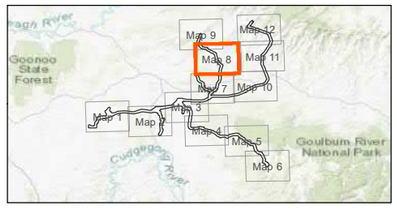
- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Project Study Area

Threatened Ecological Communities

- Fuzzy Box Woodland on Alluvial Soils (EEC on BC Act & EPBC Act)
- Inland Grey Box Woodland (EEC on BC Act & EPBC Act)

Box-Gum Woodland & DNG (CEEC on BC Act & EPBC Act)

- Box-Gum Woodland
- DNG



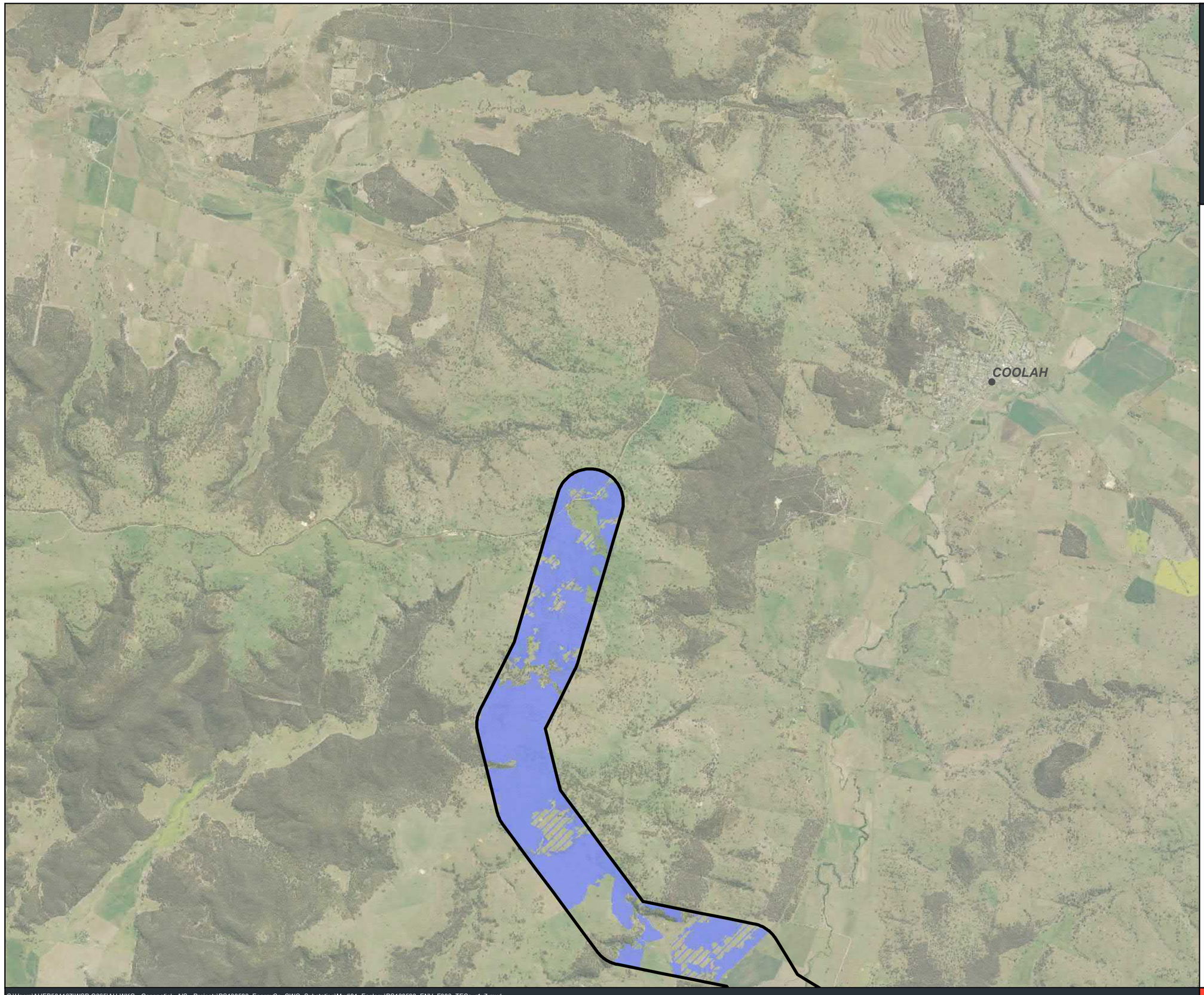
0 1,100 2,200 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:55,000 Date: 6/09/2022

Data sources: WSP 2022



wsp

Central-West Orana REZ Transmission

Figure 3.3 - Map 9 of 12
Vegetation (TECs) in the study area

Legend

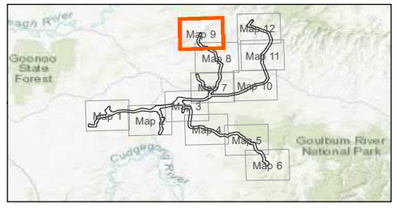
- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Project Study Area

Threatened Ecological Communities

- Fuzzy Box Woodland on Alluvial Soils (EEC on BC Act & EPBC Act)
- Inland Grey Box Woodland (EEC on BC Act & EPBC Act)

Box-Gum Woodland & DNG (CEEC on BC Act & EPBC Act)

- Box-Gum Woodland
- DNG



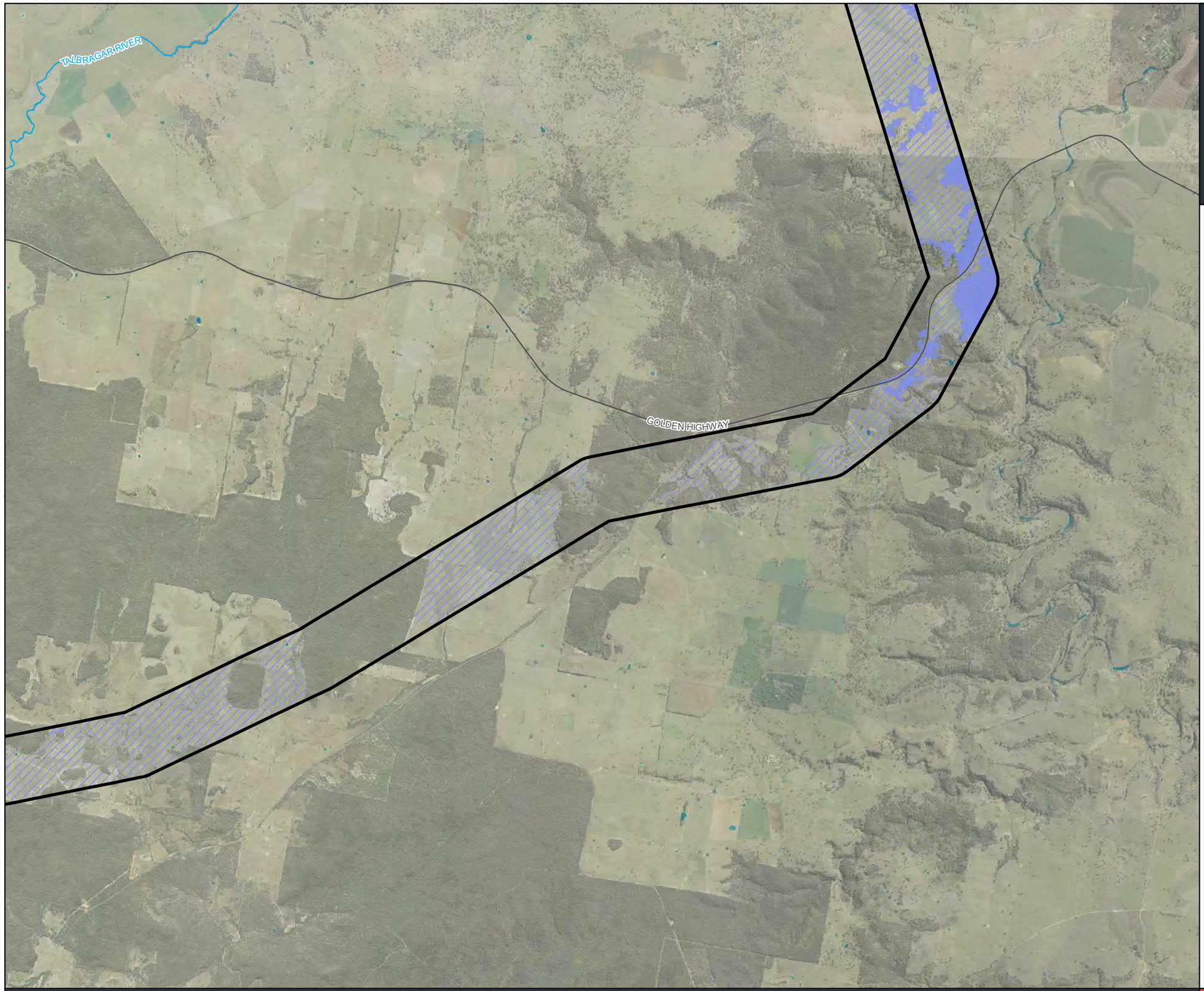
0 1,100 2,200 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:55,000 Date: 6/09/2022

Data sources: WSP 2022



Central-West Orana REZ Transmission

Figure 3.3 - Map 10 of 12
Vegetation (TECs) in the study area

Legend

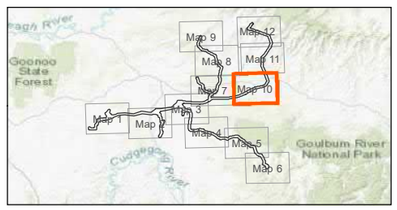
- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Project Study Area

Threatened Ecological Communities

- Fuzzy Box Woodland on Alluvial Soils (EEC on BC Act & EPBC Act)
- Inland Grey Box Woodland (EEC on BC Act & EPBC Act)

Box-Gum Woodland & DNG (CEEC on BC Act & EPBC Act)

- Box-Gum Woodland
- DNG



0 1,100 2,200
Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:55,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F003_TECs_r1v7.mxd

wsp

Central-West Orana REZ Transmission

Figure 3.3 - Map 11 of 12
Vegetation (TECs) in the study area

Legend

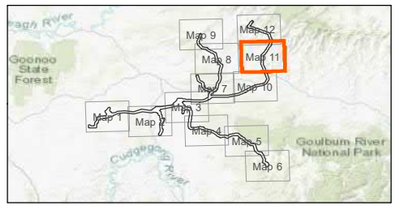
- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Project Study Area

Threatened Ecological Communities

- Fuzzy Box Woodland on Alluvial Soils (EEC on BC Act & EPBC Act)
- Inland Grey Box Woodland (EEC on BC Act & EPBC Act)

Box-Gum Woodland & DNG (CEEC on BC Act & EPBC Act)

- Box-Gum Woodland
- DNG



0 1,100 2,200 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:55,000 Date: 6/09/2022

Data sources: WSP 2022

wsp

Central-West Orana REZ Transmission

Figure 3.3 - Map 12 of 12
Vegetation (TECs) in the study area

TALBRAGAR RIVER

Legend

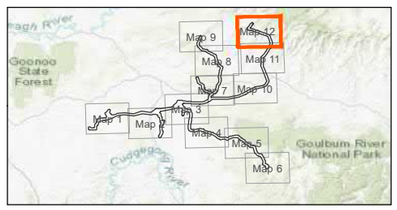
- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Project Study Area

Threatened Ecological Communities

- Fuzzy Box Woodland on Alluvial Soils (EEC on BC Act & EPBC Act)
- Inland Grey Box Woodland (EEC on BC Act & EPBC Act)

Box-Gum Woodland & DNG (CEEC on BC Act & EPBC Act)

- Box-Gum Woodland
- DNG



0 1,100 2,200 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:55,000 Date: 6/09/2022

Data sources: WSP 2022

3.4.2 *Threatened species*

An overview of the likelihood of occurrence assessment for threatened flora and fauna species listed under the BC Act, that are predicted or known to occur within the project study area, are presented below.

3.4.2.1 Threatened flora species

Database searches have identified a total of 22 threatened flora species that are predicted or known to occur within the locality of the project study area that are listed as threatened under the BC Act.

The results of likelihood of occurrence assessments identified that 21 threatened flora species have a moderate or higher likelihood of occurrence within the project study area (see Appendix A for further detail). Six of these threatened flora species have already been recorded during targeted survey or have Bionet records that fall within the project study area (Table 3.6 and Figure 3.4). These species are described below.

Table 3.6 Threatened flora species within the project disturbance area

Species name	Common name	BC Act[1]	EPBC Act[2]	SAII[3]
Acacia ausfeldii	Ausfeld's Wattle	V	–	No
Diuris tricolor	Pine Donkey Orchid	V	–	No
Eucalyptus cannonii	Capertee Stringybark	V	–	No
Pomaderris queenslandica	Scant Pomaderris	E	–	No
Prasophyllum petalum	Tarengo Leek Orchid	E	E	No
Swainsona sericea	Silky Swainson-pea	V	–	No

(1) BC Act – BC Act status: V=Vulnerable, E=Endangered, under the *Biodiversity Conservation Act* (BC Act)
(2) EPBC Act – EPBC Act status: V=Vulnerable, E=Endangered, under the Commonwealth *Environment Protection and Biodiversity Conservation Act* (EPBC Act).
(3) SAII = Serious and Irreversible Impact

Three threatened populations listed under the BC Act with the potential to occur in the project study area were identified on database searches. These are:

- *Acacia pendula* population in the Hunter catchment – Endangered
- *Cymbidium canaliculatum* population in the Hunter Catchment – Endangered
- *Eucalyptus camaldulensis* population in the Hunter catchment – Endangered.

Bionet records for *Eucalyptus camaldulensis* in the Wollar area occurs within the project study area. However, confirmation of these populations within the project construction area requires field survey.

SAII entities

No species that have been recorded within the study area are SAII entities under the BC Act. However, three flora species and one population with a moderate or higher likelihood to occur within project study area are SAII entities under the BC Act.

- *Acacia pendula* population in the Hunter catchment
- *Caladenia arenaria* (Sand-hill Spider Orchid)
- *Indigofera efoliata* (Leafless Indigo)
- *Zieria obcordata* (Granite Zieria).

3.4.2.2 Threatened fauna species

Database searches have identified a total of 61 threatened fauna species that are predicted or known to occur within the project study area that are listed on the BC Act.

The results of likelihood of occurrence assessments identified 52 threatened fauna species with a moderate or higher likelihood of occurrence within the project study area (see Appendix B for further detail). Twenty-one of these threatened fauna species were recorded during preliminary surveys or have Bionet records within the project study area (Table 3.7 and Figure 3.4).

The Regent Honeyeater was not recorded in the project study area; however, the project study area crosses areas mapped as important habitat for this species (Figure 3.5), therefore BAM 2020 requires that this species be assumed present for the calculation of species credit requirements. That is, under BAM 2020 the part of the project disturbance area that occurs within the important habitat map forms the species polygon used to generate species credits, the remaining areas are to be assessed for ecosystem credit.

Table 3.7 Threatened fauna species recorded or assumed present within the Project Disturbance Area

Species name	Common name	BC Act[1]	EPBC Act[2]	SAII[3]
Amphibian				
Mixophyes iteratus	Giant Barred Frog	E	E	No
Birds				
Anthochaera phrygia	Regent Honeyeater	CE	CE	Yes
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	–	No
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	–	No
Chthonicola sagittata	Speckled Warbler	V	–	No
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	–	No
Daphoenositta chrysoptera	Varied Sittella	V	–	No
Glossopsitta pusilla	Little Lorikeet	V	–	No
Grantiella picta	Painted Honeyeater	V	V	No
Hieraaetus morphnoides	Little Eagle	V	–	No
Lophoictinia isura	Square-tailed Kite	V	–	No
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	–	No
Ninox strenua	Powerful Owl	V	–	No
Petroica boodang	Scarlet Robin	V	–	No
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	–	No
Stagonopleura guttata	Diamond Firetail	V	–	No

Species name	Common name	BC Act[1]	EPBC Act[2]	SAII[3]
Mammals				
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	No
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	–	Yes
Phascolarctos cinereus	Koala	V	E	No
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	–	No
Vespadelus troughtoni	Eastern Cave Bat	V	–	Yes

(1) BC Act – BC Act status: V=Vulnerable, E=Endangered, under the Biodiversity Conservation Act (BC Act)
(2) EPBC Act – EPBC Act status: V=Vulnerable, E=Endangered, under the Commonwealth *Environment Protection and Biodiversity Conservation Act* (EPBC Act).
(3) SAII = Serious and Irreversible Impact
(4) Regent Honeyeater was not recorded within the project by field survey; however proposed study area crosses important habitat mapping for this species, therefore BAM (2020) requires assumed presence.

SAII entities

Two species that have been recorded within the project study area are SAII entities under the BC Act. These are:

- Eastern Cave Bat (*Vespadelus troughtoni*)
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*).

An additional three fauna species with a moderate or higher likelihood to occur within project study area are SAII entities under the BC Act.

- Regent Honeyeater (*Anthochaera phrygia*)
- Swift Parrot (*Lathamus discolor*)
- Little Bent-winged Bat (*Miniopterus australis).*

3.4.3 *FM Act listed Endangered Ecological Communities*

No Endangered Ecological Communities listed under the FM Act have potential to occur within the project study area.

3.4.4 *National Parks, State Forests, and Conservation areas*

Within the project study area and broader locality, important biodiversity values are known to occur within a range of conservation areas including National Parks, State Forest, and other protected areas, which are shown on Figure 3.6. An overview of recorded conservation areas is provided below.

3.4.4.1 NSW National Parks

The south-western edge of the Goulburn River National Park at Ulan and Wilpinjong and the Durridgere State Conservation Area at Cassilis is located within the project study area. However, the design of the project has been developed to avoid direct impacts to this national park and numerous other National Parks estates situated in region (Figure 3.6).

Other National Park estates located outside of, but in proximity to the project study area include:

- Munghorn Gap Nature Reserve
- Durridgere State Conservation Area
- Yarrobil National Park
- Goodiman State Conservation Area
- Cobbora State Conservation Area
- Goonoo State Conservation Area
- Lake Burrendong State Park
- Goulburn River State Conservation Area
- Dapper Nature Reserve.

3.4.4.2 Mining Offset Areas

The project study area crosses two mining offset areas that are part of the offset strategies for Moolarben Coal Complex and Peabody Wilpinjong Coal Mine.

Three conservation areas that form part of the offset strategy for the Peabody Wilpinjong Coal Mine and areas nominated for regeneration under their offset strategy are proximate to the south-eastern section of the project study area. The project disturbance area intersects with 98.38 ha of the Peabody Wilpinjoing Coal Mine Conservation Areas. Offset areas associated with the Peabody Wilpinjong Coal Mine that have been transferred to national park estate are located outside of the project study area.

Two offset areas protected under YanCoal's Moolarben Coal Complex offset strategy are located within the south-eastern section of the project study area. A further twelve offset areas that form part of this offset strategy are located within 10 kilometres of the south-eastern section of the project study area. The project disturbance area intersects with 29.29 ha of the Moolarben Coal Complex Offset Areas.

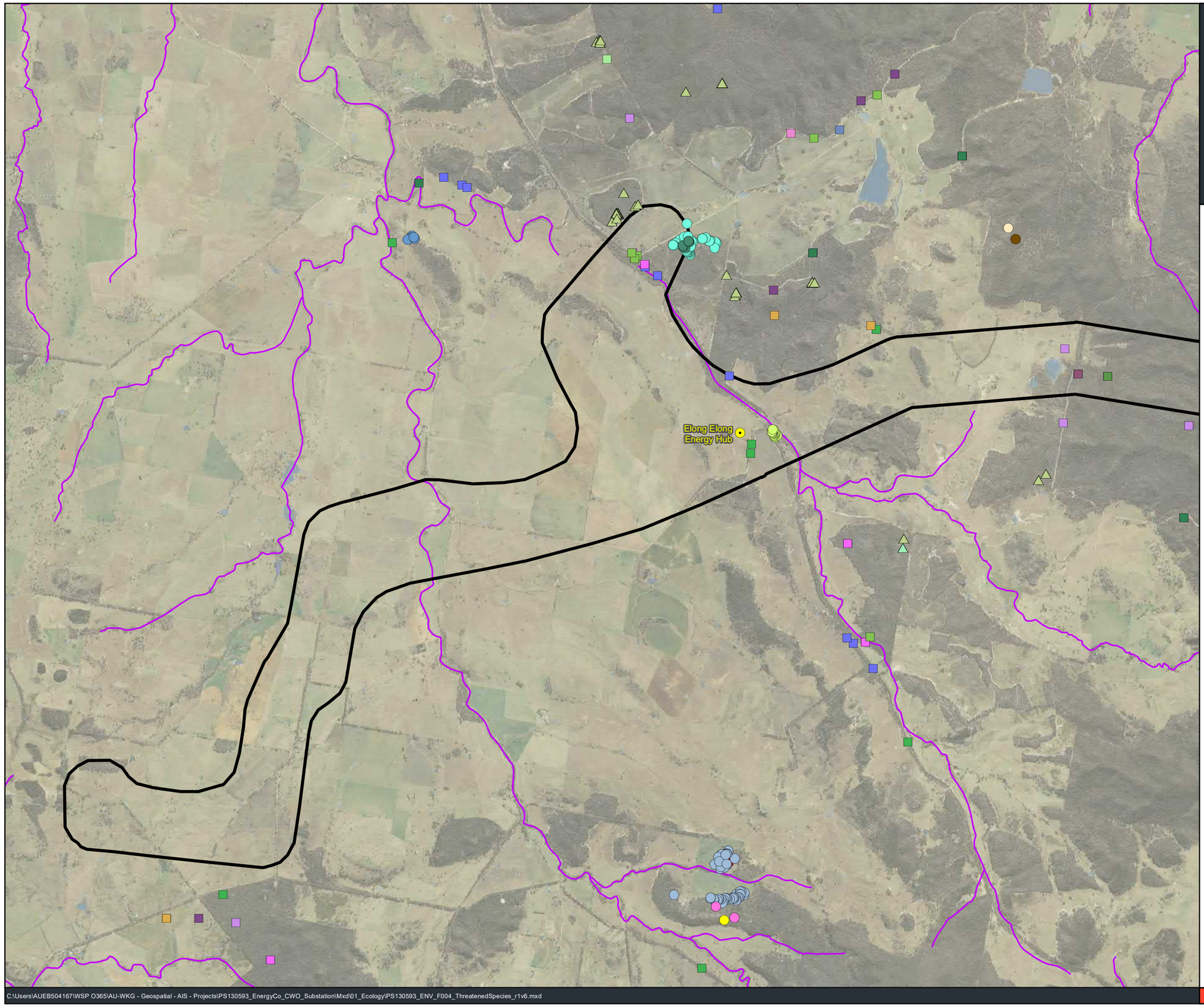
3.4.4.3 NSW State Forests

NSW State Forests located within/adjacent to the project study area and depending on the proposed alignment they may be impacted by project. These include:

- Tuckland State Forest
- Cope State Forest.

Central-West Orana REZ Transmission

Figure 3.4 - Map 1 of 12
Threatened species in the study area



Legend

- Existing Substation
- Energy hub/switching station indicative location
- Existing Transmission Line
- Project Study Area
- Railway
- Road
- Watercourse

Threatened Freshwater Species

- Eel-tailed Catfish
- Southern Purple-spotted Gudgeon

WSP Threatened / Significant Species (Spring 2021)

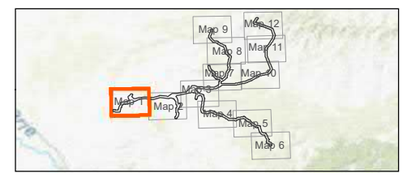
- Ausfeld's Wattle
- Brown Treecreeper (eastern subspecies)
- Brown Treecreeper (eastern subspecies)
- Fairy Bells
- Grey-crowned Babbler (eastern subspecies)
- Keith's Zieria
- Little Lorikeet
- Pine Donkey Orchid
- Silky Swainson-pea
- Speckled Warbler

Threatened Flora Species Records (BioNet)

- Homoranthus darwinioides (Fairy Bells)
- Zieria ingramii (Keith's Zieria)

Threatened Fauna Species Records (BioNet)

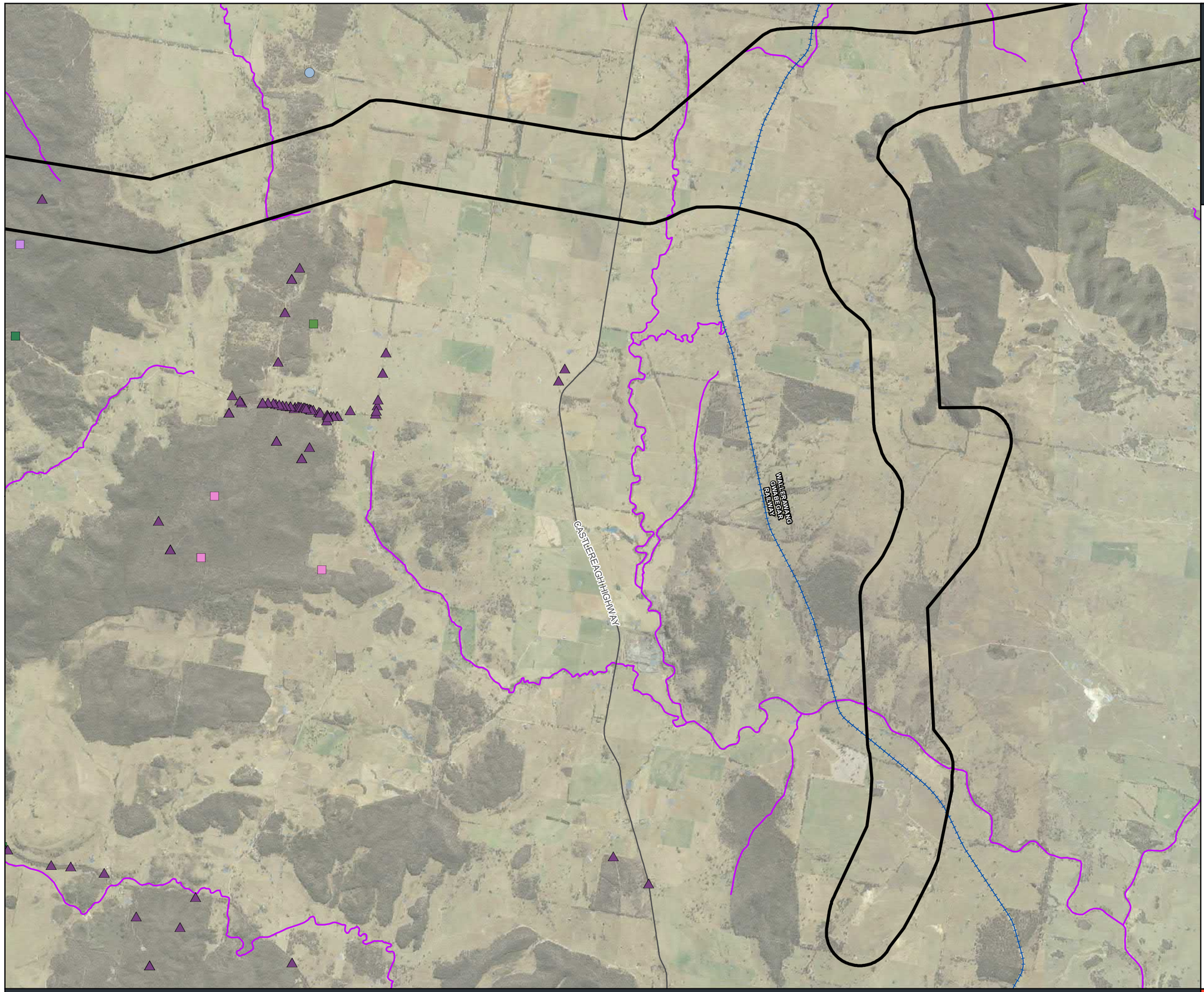
- Barking Owl
- Brown Treecreeper (eastern subspecies)
- Diamond Firetail
- Glossy Black-Cockatoo
- Grey-crowned Babbler (eastern subspecies)
- Hooded Robin (south-eastern form)
- Large Bent-winged Bat
- Large-eared Pied Bat
- Little Pied Bat
- Powerful Owl
- Regent Honeyeater
- Speckled Warbler
- Turquoise Parrot
- Varied Sittella
- White-fronted Chat
- Yellow-bellied Sheathtail-bat



0 1,000 2,000 Meters

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A3
1:55,000 Date: 6/09/2022

Data sources: WSP 2022



Central-West Orana REZ Transmission

Figure 3.4 - Map 2 of 12
Threatened species in the study area

Legend

- Existing Substation
- Energy hub/switching station indicative location
- Existing Transmission Line
- Project Study Area
- Railway
- Road
- Watercourse

Threatened Freshwater Species

- Eel-tailed Catfish
- Southern Purple-spotted Gudgeon

WSP Threatened / Significant Species (Spring 2021)

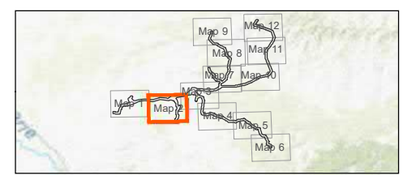
- Ausfeld's Wattle

Threatened Flora Species Records (BioNet)

- Acacia ausfeldii (Ausfeld's Wattle)

Threatened Fauna Species Records (BioNet)

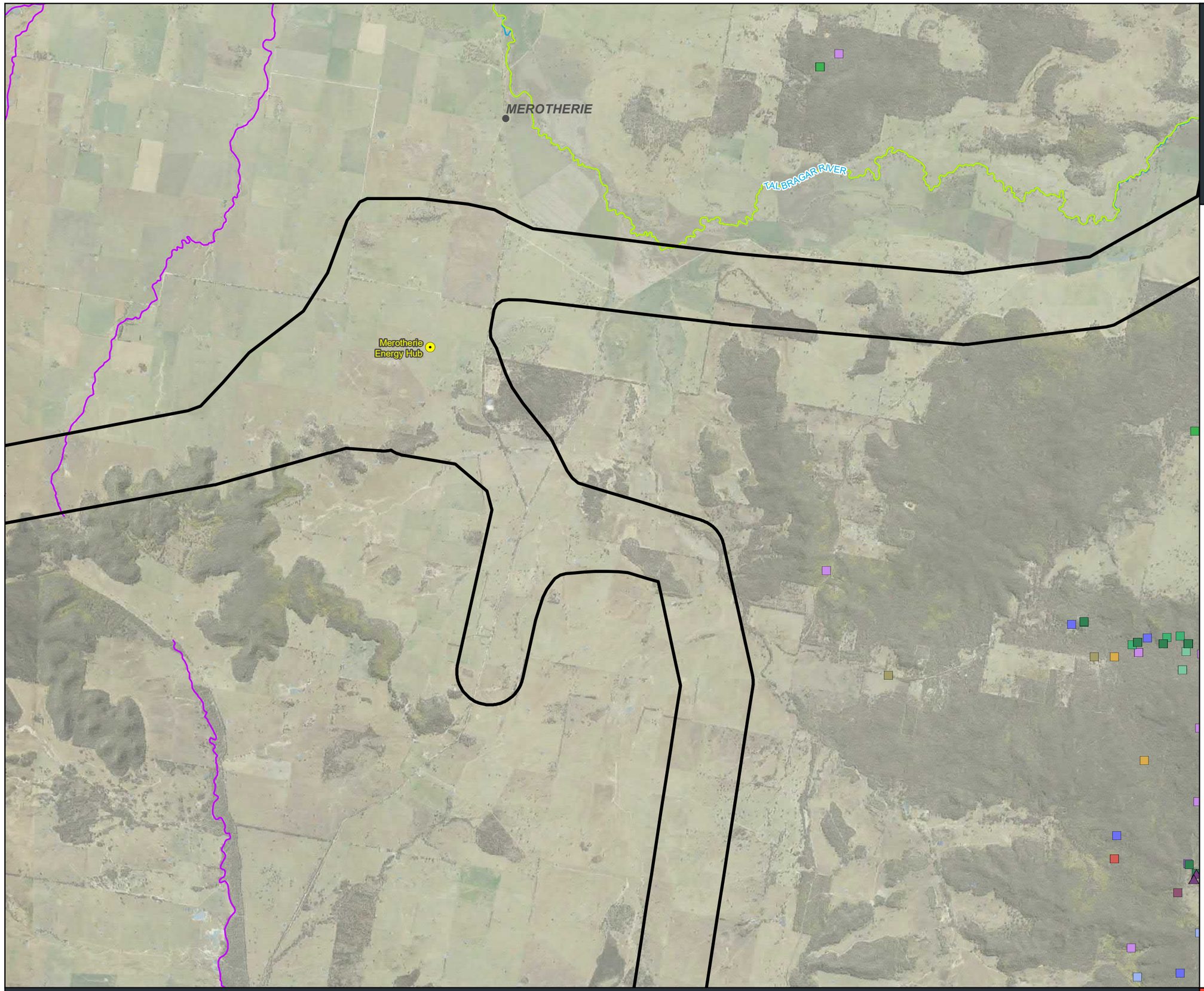
- Glossy Black-Cockatoo
- Grey-crowned Babbler (eastern subspecies)
- Large Bent-winged Bat
- Little Pied Bat
- Powerful Owl
- Regent Honeyeater



0 1,000 2,000 Meters

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A3
1:55,000 Date: 6/09/2022

Data sources: WSP 2022



Central-West Orana REZ Transmission

Figure 3.4 - Map 3 of 12
Threatened species in the study area

Legend

- Existing Substation
- Energy hub/switching station indicative location
- Existing Transmission Line
- Project Study Area
- Railway
- Road
- Watercourse

Threatened Freshwater Species

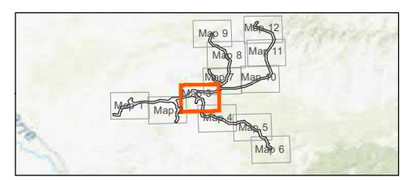
- Eel-tailed Catfish
- Southern Purple-spotted Gudgeon

Threatened Flora Species Records (BioNet)

- Acacia ausfeldii (Ausfeld's Wattle)

Threatened Fauna Species Records (BioNet)

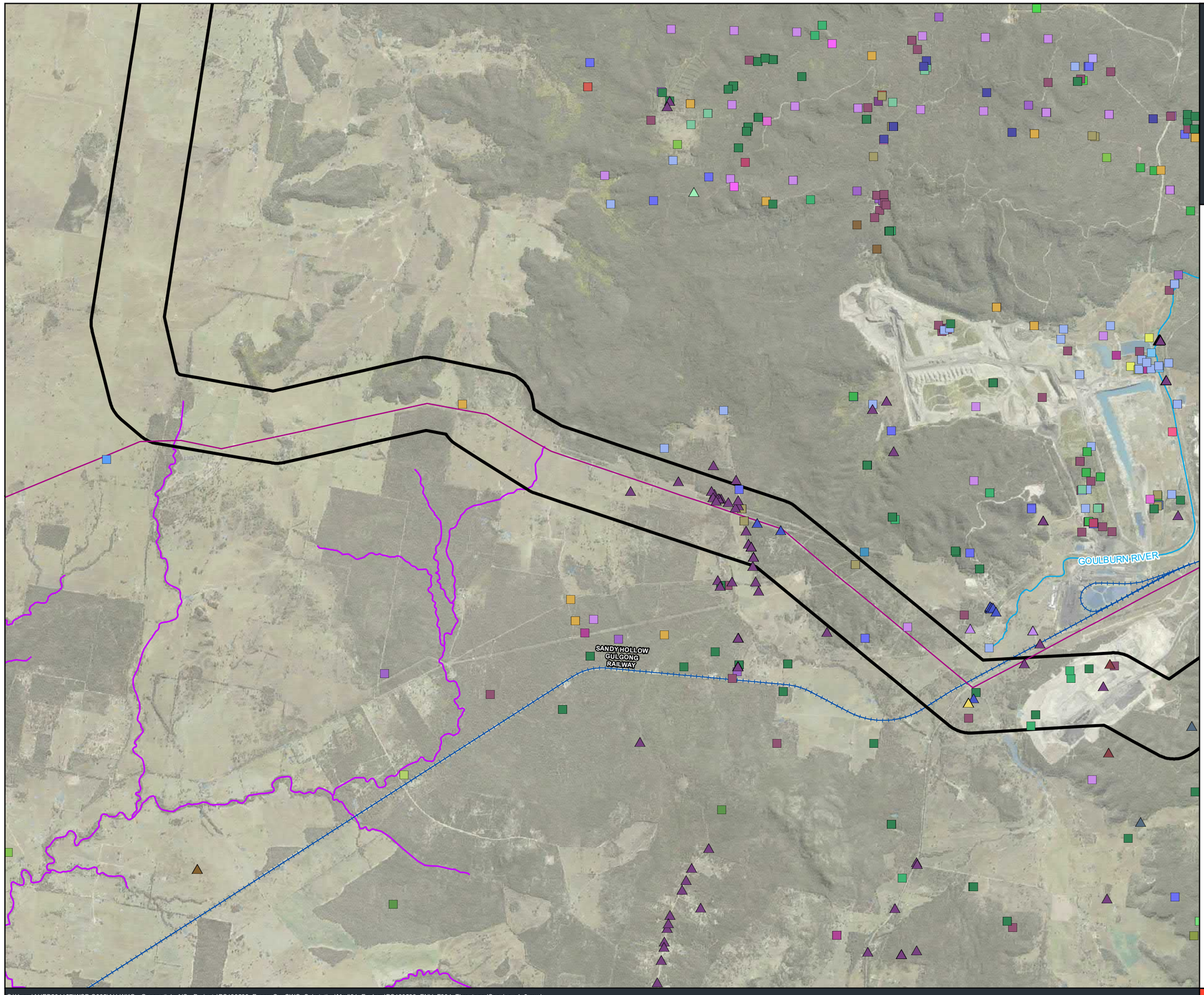
- Black-chinned Honeyeater (eastern subspecies)
- Brown Treecreeper (eastern subspecies)
- Dusky Woodswallow
- Glossy Black-Cockatoo
- Grey-crowned Babbler (eastern subspecies)
- Large Bent-winged Bat
- Large-eared Pied Bat
- Little Lorikeet
- Painted Honeyeater
- Scarlet Robin
- Speckled Warbler
- Varied Sittella
- Yellow-bellied Sheathtail-bat



0 1,000 2,000 Meters

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A3
1:55,000 Date: 6/09/2022

Data sources: WSP 2022



Central-West Orana REZ Transmission

Figure 3.4 - Map 4 of 12
Threatened species in the study area

Legend

- Existing Substation
- Energy hub/switching station indicative location
- Existing Transmission Line
- Project Study Area
- Railway
- Road
- Watercourse

Threatened Freshwater Species

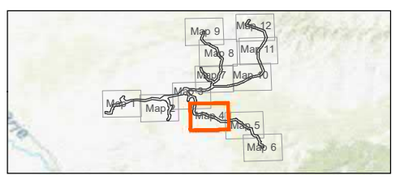
- Eel-tailed Catfish
- Southern Purple-spotted Gudgeon

Threatened Flora Species Records (BioNet)

- Acacia ausfeldii (Ausfeld's Wattle)
- Diuris tricolor (Pine Donkey Orchid)
- Eucalyptus cannonii (Capertee Stringybark)
- Homoranthus darwinioides (Fairy Bells)
- Leucochrysum albicans var. tricolor (Hoary Sunray)
- Pomaderris queenslandica (Scant Pomaderris)
- Prasophyllum petilum (Tarengo Leek Orchid)
- Swainsona sericea (Silky Swainson-pea)

Threatened Fauna Species Records (BioNet)

- Barking Owl
- Black Falcon
- Black-chinned Honeyeater (eastern subspecies)
- Blue-billed Duck
- Brown Treecreeper (eastern subspecies)
- Brush-tailed Rock-wallaby
- Bush Stone-curlew
- Diamond Firetail
- Dusky Woodswallow
- Eastern Cave Bat
- Flame Robin
- Freckled Duck
- Gang-gang Cockatoo
- Glossy Black-Cockatoo
- Grey-crowned Babbler (eastern subspecies)
- Hooded Robin (south-eastern form)
- Koala
- Large Bent-winged Bat
- Large-eared Pied Bat
- Little Eagle
- Little Lorikeet
- Masked Owl
- Painted Honeyeater
- Powerful Owl
- Regent Honeyeater
- Scarlet Robin
- Speckled Warbler
- Spotted Harrier
- Squirrel Glider
- Swift Parrot
- Turquoise Parrot
- Varied Sittella
- White-bellied Sea-Eagle
- White-fronted Chat
- Yellow-bellied Sheathtail-bat

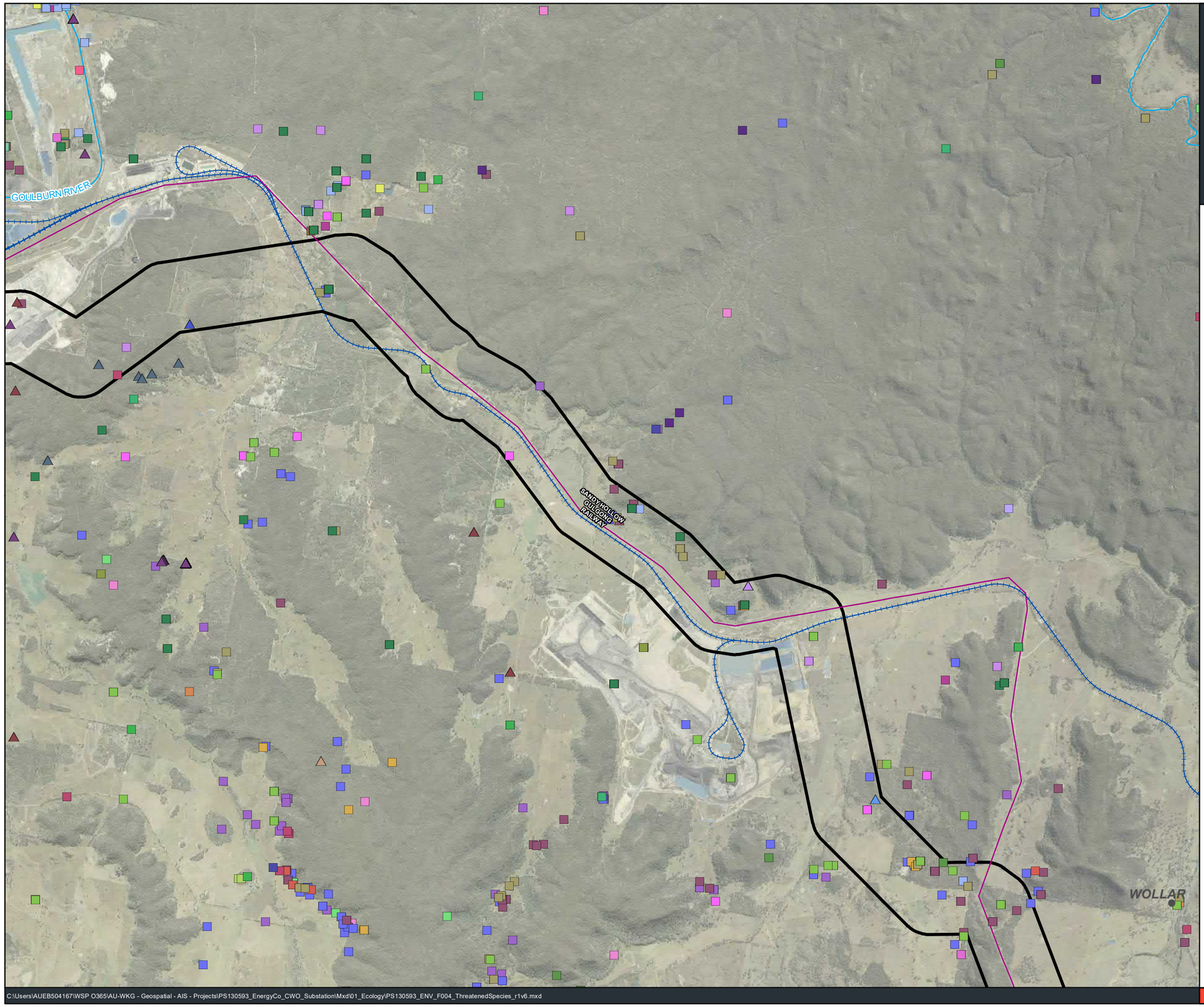


0 1,000 2,000 Meters

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A3
1:55,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F004_ThreatenedSpecies_r1v6.mxd



Central-West Orana REZ Transmission

Figure 3.4 - Map 5 of 12
Threatened species in the study area

Legend

- Existing Substation
- Energy hub/switching station indicative location
- Existing Transmission Line
- Project Study Area
- Railway
- Road
- Watercourse

Threatened Freshwater Species

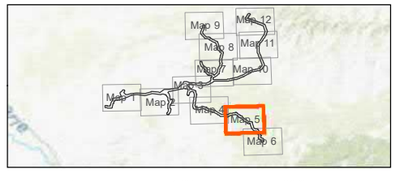
- Eel-tailed Catfish
- Southern Purple-spotted Gudgeon

Threatened Flora Species Records (BioNet)

- Acacia ausfeldii (Ausfeld's Wattle)
- Eucalyptus camaldulensis (Eucalyptus camaldulensis population in the Hunter catchment)
- Eucalyptus cannonii (Capertee Stringybark)
- Leucochrysum albicans var. tricolor (Hoary Sunray)
- Pomaderris queenslandica (Scant Pomaderris)
- Prasophyllum petilum (Tarengo Leek Orchid)
- Pultenaea glabra (Smooth Bush-Pea)

Threatened Fauna Species Records (BioNet)

- Barking Owl
- Black-chinned Honeyeater (eastern subspecies)
- Blue-billed Duck
- Brown Treecreeper (eastern subspecies)
- Brush-tailed Rock-wallaby
- Bush Stone-curlew
- Corben's Long-eared Bat
- Diamond Firetail
- Dusky Woodswallow
- Eastern Cave Bat
- Flame Robin
- Freckled Duck
- Gang-gang Cockatoo
- Giant Barred Frog
- Glossy Black-Cockatoo
- Grey-crowned Babbler (eastern subspecies)
- Hooded Robin (south-eastern form)
- Koala
- Large Bent-winged Bat
- Large-eared Pied Bat
- Little Eagle
- Little Lorikeet
- Masked Owl
- Painted Honeyeater
- Powerful Owl
- Regent Honeyeater
- Scarlet Robin
- Speckled Warbler
- Spotted Harrier
- Square-tailed Kite
- Squirrel Glider
- Swift Parrot
- Turquoise Parrot
- Varied Sittella
- White-bellied Sea-Eagle
- White-fronted Chat
- Yellow-bellied Sheathtail-bat



0 1,000 2,000 Meters

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A3
1:55,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F004_ThreatenedSpecies_r1v6.mxd

WOLLAR

SANDY HOLLOW GILGONG RAILWAY

Wollar Substation

New Wollar Switching Station

Central-West Orana REZ Transmission

Figure 3.4 - Map 6 of 12
Threatened species in the study area

Legend

- Existing Substation
- Energy hub/switching station indicative location
- Existing Transmission Line
- Project Study Area
- Railway
- Road
- Watercourse

Threatened Freshwater Species

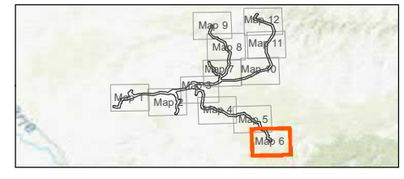
- Eel-tailed Catfish
- Southern Purple-spotted Gudgeon

Threatened Flora Species Records (BioNet)

- Ozothamnus tesselatus

Threatened Fauna Species Records (BioNet)

- Black Falcon
- Black-chinned Honeyeater (eastern subspecies)
- Brown Treecreeper (eastern subspecies)
- Diamond Firetail
- Dusky Woodswallow
- Eastern Cave Bat
- Flame Robin
- Gang-gang Cockatoo
- Grey-crowned Babbler (eastern subspecies)
- Hooded Robin (south-eastern form)
- Koala
- Large Bent-winged Bat
- Large-eared Pied Bat
- Little Eagle
- Little Lorikeet
- Painted Honeyeater
- Powerful Owl
- Regent Honeyeater
- Speckled Warbler
- Square-tailed Kite
- Swift Parrot
- Turquoise Parrot
- Varied Sittella
- White-bellied Sea-Eagle
- White-fronted Chat



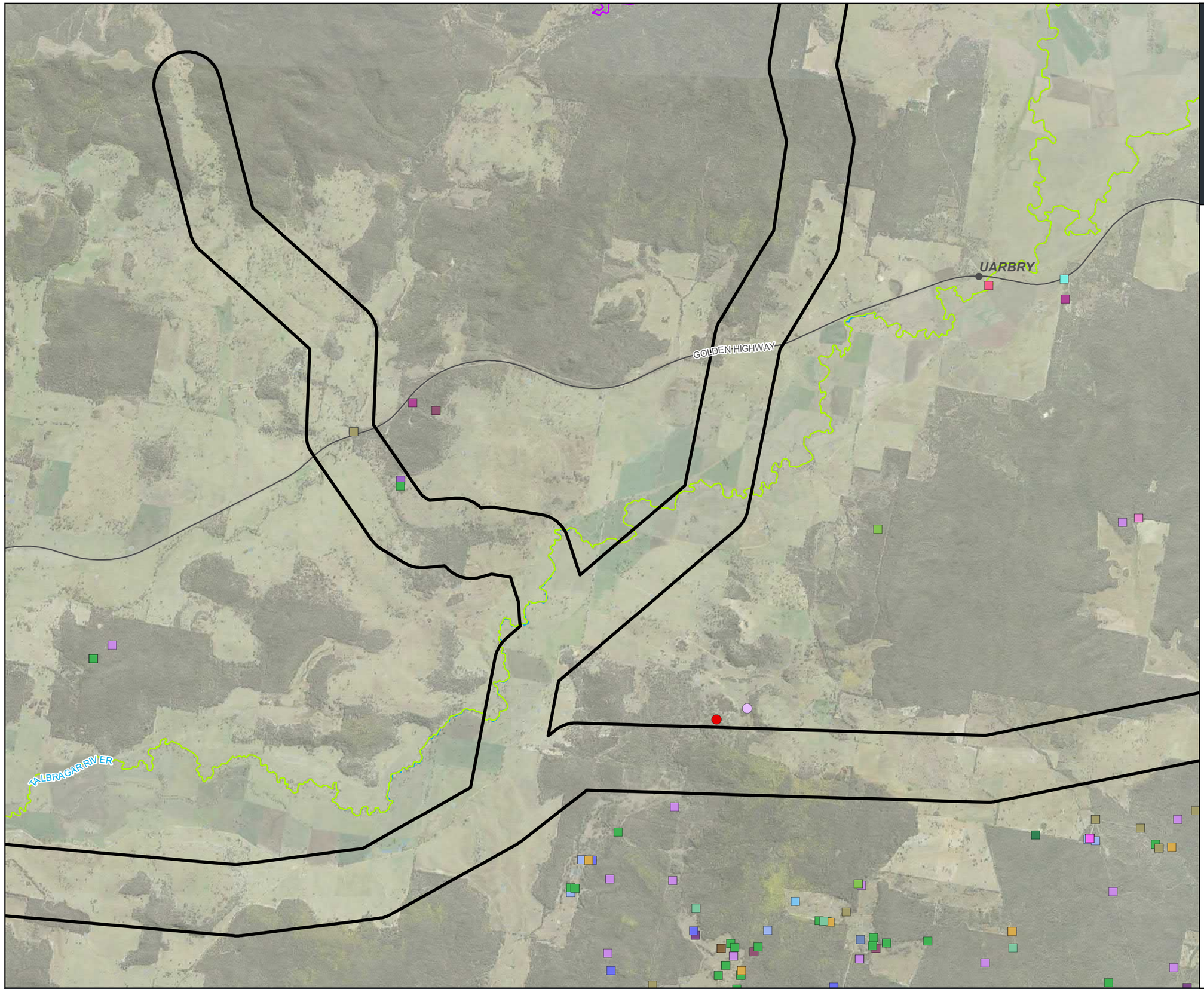
0 1,000 2,000
Meters

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A3
1:55,000 Date: 6/09/2022

Data sources: WSP 2022

Central-West Orana REZ Transmission

Figure 3.4 - Map 7 of 12
Threatened species in the study area



Legend

- Existing Substation
- Energy hub/switching station indicative location
- Existing Transmission Line
- Project Study Area
- Railway
- Road
- Watercourse

Threatened Freshwater Species

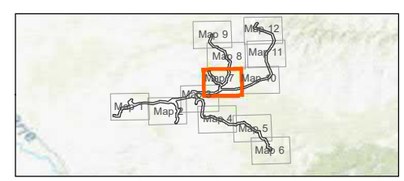
- Eel-tailed Catfish
- Southern Purple-spotted Gudgeon

WSP Threatened / Significant Species (Spring 2021)

- Grey-crowned Babbler (eastern subspecies)
- Grey-crowned Babbler (eastern subspecies)

Threatened Fauna Species Records (BioNet)

- Barking Owl
- Blue-billed Duck
- Brown Treecreeper (eastern subspecies)
- Diamond Firetail
- Dusky Woodswallow
- Gang-gang Cockatoo
- Glossy Black-Cockatoo
- Grey-crowned Babbler (eastern subspecies)
- Hooded Robin (south-eastern form)
- Large Bent-winged Bat
- Little Eagle
- Little Lorikeet
- Painted Honeyeater
- Plains-wanderer
- Powerful Owl
- Scarlet Robin
- Speckled Warbler
- Spotted Harrier
- Swift Parrot
- Turquoise Parrot
- Varied Sittella



0 1,000 2,000 Meters

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A3
1:55,000 Date: 6/09/2022

Data sources: WSP 2022

Central-West Orana REZ Transmission

Figure 3.4 - Map 8 of 12
Threatened species in the study area

TALBRAGAR RIVER

Legend

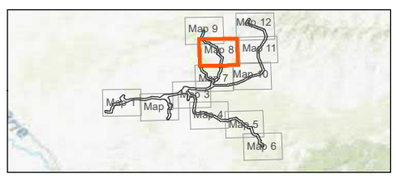
- Existing Substation
- Energy hub/switching station indicative location
- Existing Transmission Line
- Project Study Area
- Railway
- Road
- Watercourse

Threatened Freshwater Species

- Eel-tailed Catfish
- Southern Purple-spotted Gudgeon

Threatened Fauna Species Records (BioNet)

- Barking Owl
- Brown Treecreeper (eastern subspecies)
- Dusky Woodswallow
- Glossy Black-Cockatoo
- Koala
- Masked Owl
- Scarlet Robin
- Speckled Warbler

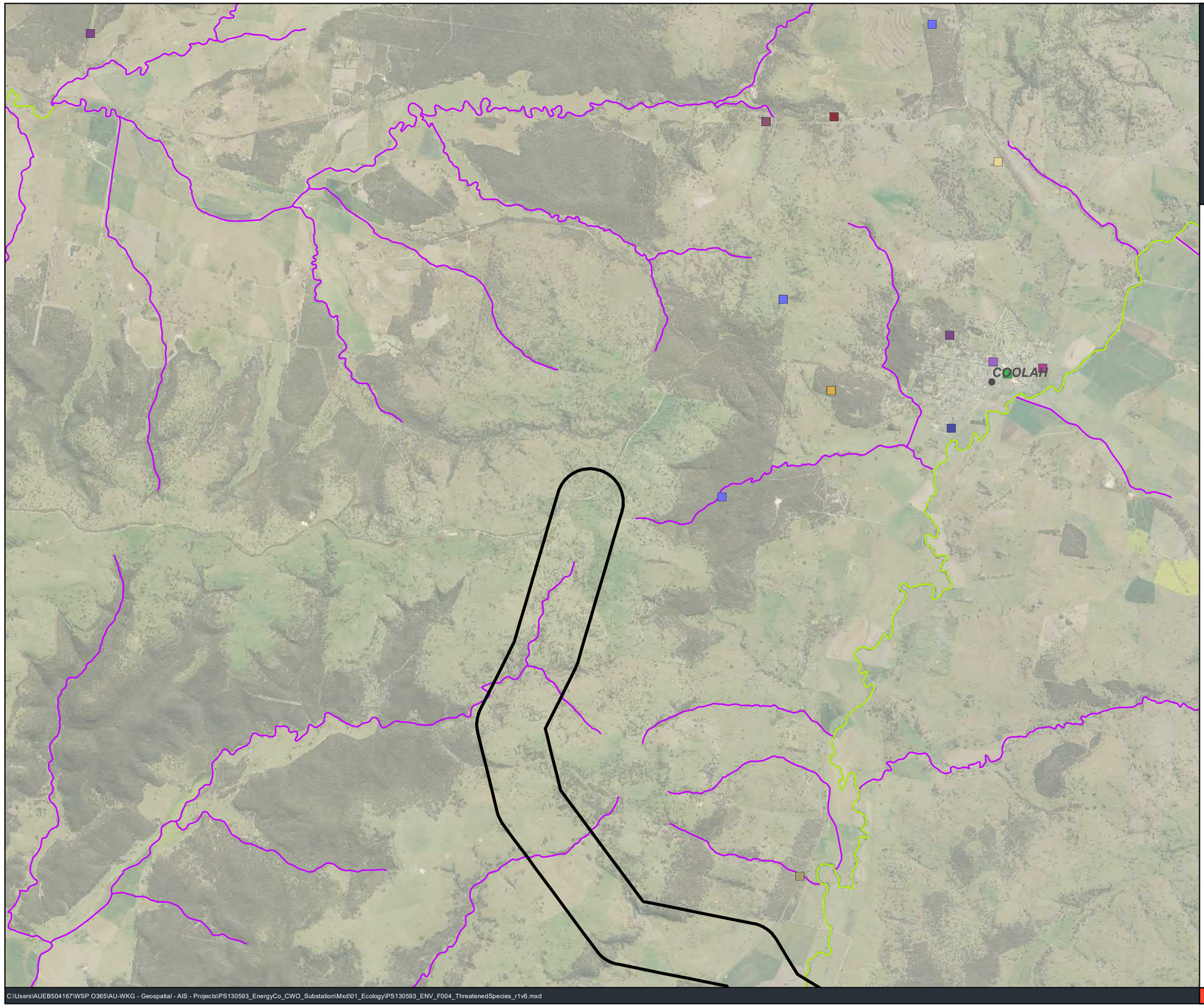


0 1,000 2,000
Meters

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A3
1:55,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F004_ThreatenedSpecies_r1v6.mxd



Central-West Orana REZ Transmission

Figure 3.4 - Map 9 of 12
Threatened species in the study area

Legend

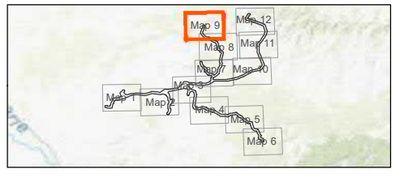
- Existing Substation
- Energy hub/switching station indicative location
- Existing Transmission Line
- Project Study Area
- Railway
- Road
- Watercourse

Threatened Freshwater Species

- Eel-tailed Catfish
- Southern Purple-spotted Gudgeon

Threatened Fauna Species Records (BioNet)

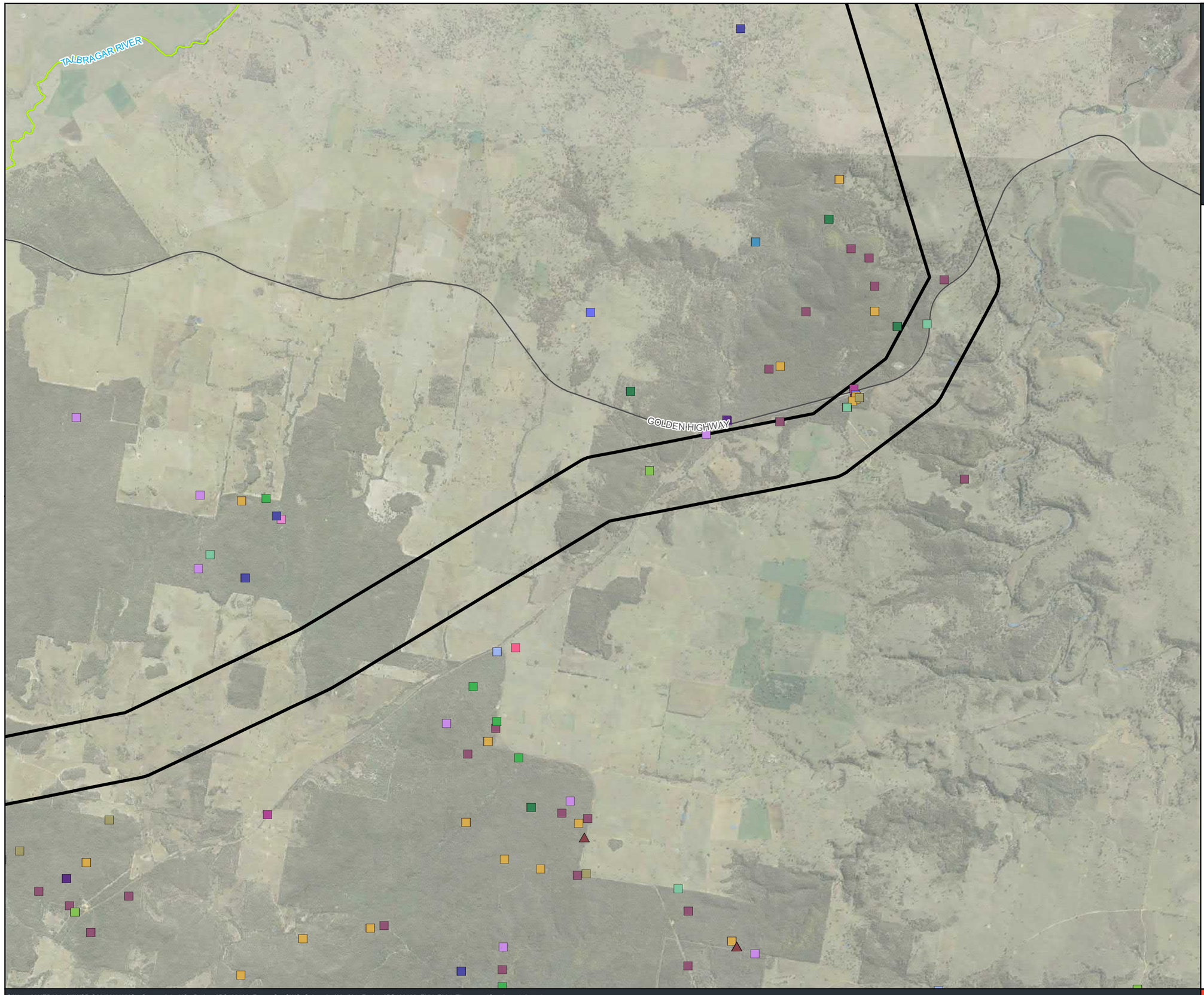
- Barking Owl
- Brown Treecreeper (eastern subspecies)
- Dusky Woodswallow
- Grey-crowned Babbler (eastern subspecies)
- Little Eagle
- Little Lorikeet
- Speckled Warbler
- Spotted-tailed Quoll
- Squirrel Glider
- Superb Parrot
- Varied Sittella



0 1,000 2,000 Meters

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A3
1:55,000 Date: 6/09/2022

Data sources: WSP 2022



wsp

Central-West Orana REZ Transmission

Figure 3.4 - Map 10 of 12
Threatened species in the study area

Legend

- Existing Substation
- Energy hub/switching station indicative location
- Existing Transmission Line
- Project Study Area
- Railway
- Road
- Watercourse

Threatened Freshwater Species

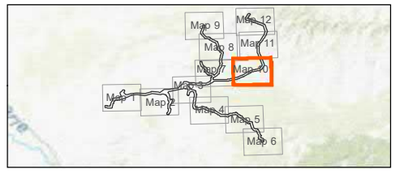
- Eel-tailed Catfish
- Southern Purple-spotted Gudgeon

Threatened Flora Species Records (BioNet)

- Eucalyptus cannonii (Capertee Stringybark)

Threatened Fauna Species Records (BioNet)

- Barking Owl
- Brown Treecreeper (eastern subspecies)
- Corben's Long-eared Bat
- Diamond Firetail
- Dusky Woodswallow
- Glossy Black-Cockatoo
- Grey-crowned Babbler (eastern subspecies)
- Large Bent-winged Bat
- Little Eagle
- Little Lorikeet
- Painted Honeyeater
- Powerful Owl
- Scarlet Robin
- Speckled Warbler
- Spotted Harrier
- Squirrel Glider
- Varied Sittella
- Yellow-bellied Sheathtail-bat

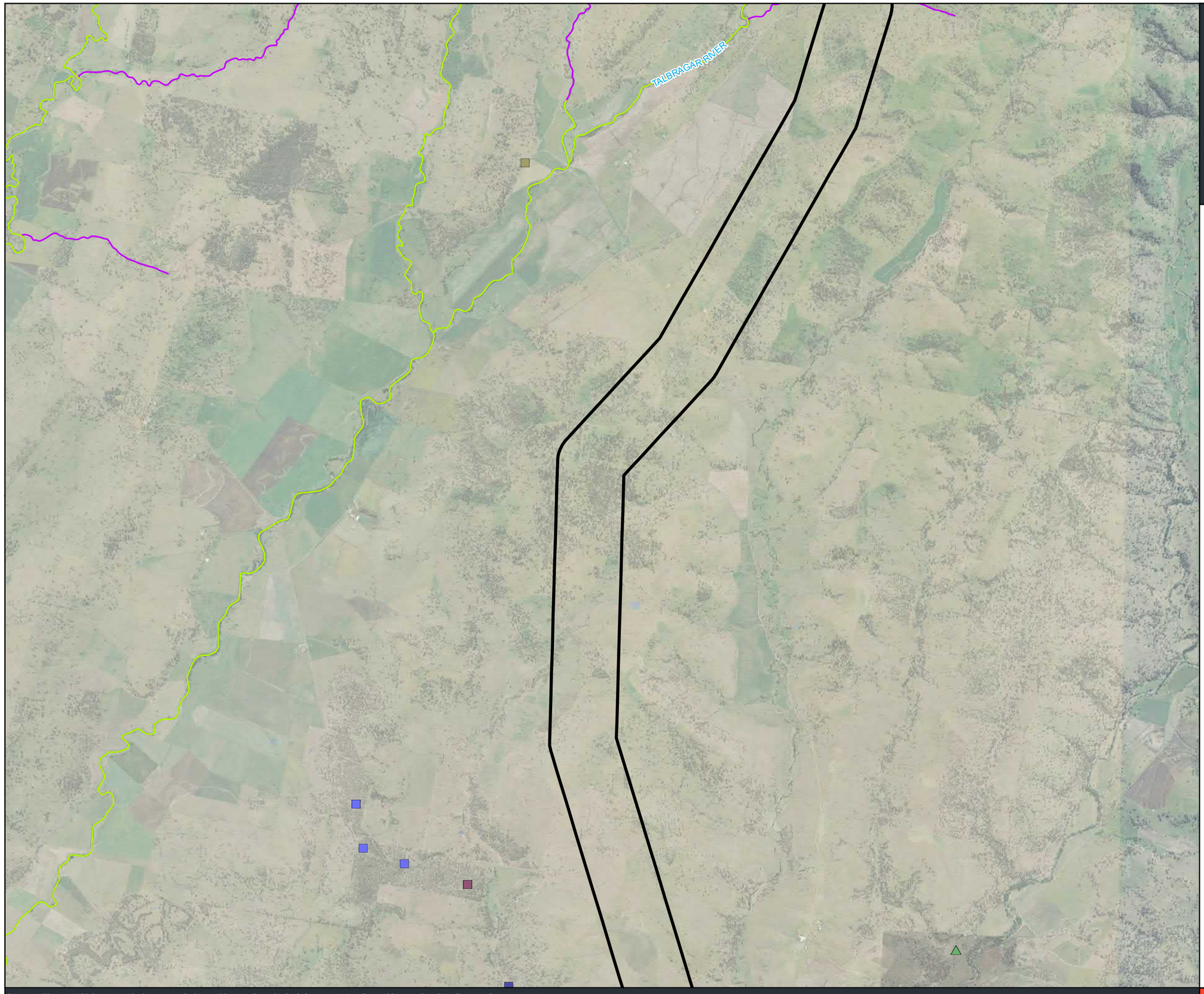


0 1,000 2,000 Meters

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A3
1:55,000 Date: 6/09/2022

Data sources: WSP 2022

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F004_ThreatenedSpecies_r1v6.mxd



wsp

Central-West Orana REZ Transmission

Figure 3.4 - Map 11 of 12
Threatened species in the study area

Legend

- Existing Substation
- Energy hub/switching station indicative location
- Existing Transmission Line
- Project Study Area
- Railway
- Road
- Watercourse

Threatened Freshwater Species

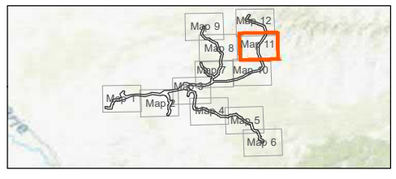
- Eel-tailed Catfish
- Southern Purple-spotted Gudgeon

Threatened Flora Species Records (BioNet)

- Thesium australe (Austral Toadflax)

Threatened Fauna Species Records (BioNet)

- Brown Treecreeper (eastern subspecies)
- Dusky Woodswallow
- Speckled Warbler
- Squirrel Glider



0 1,000 2,000 Meters

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A3
1:55,000 Date: 6/09/2022

Data sources: WSP 2022

Central-West Orana REZ Transmission

Figure 3.4 - Map 12 of 12
Threatened species in the study area

TALBRAGAR RIVER

Legend

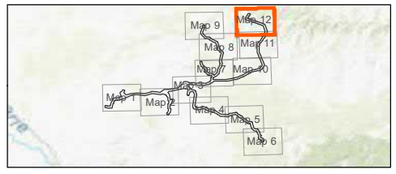
- Existing Substation
- Energy hub/switching station indicative location
- Existing Transmission Line
- Project Study Area
- Railway
- Road
- Watercourse

Threatened Freshwater Species

- Eel-tailed Catfish
- Southern Purple-spotted Gudgeon

Threatened Fauna Species Records (BioNet)

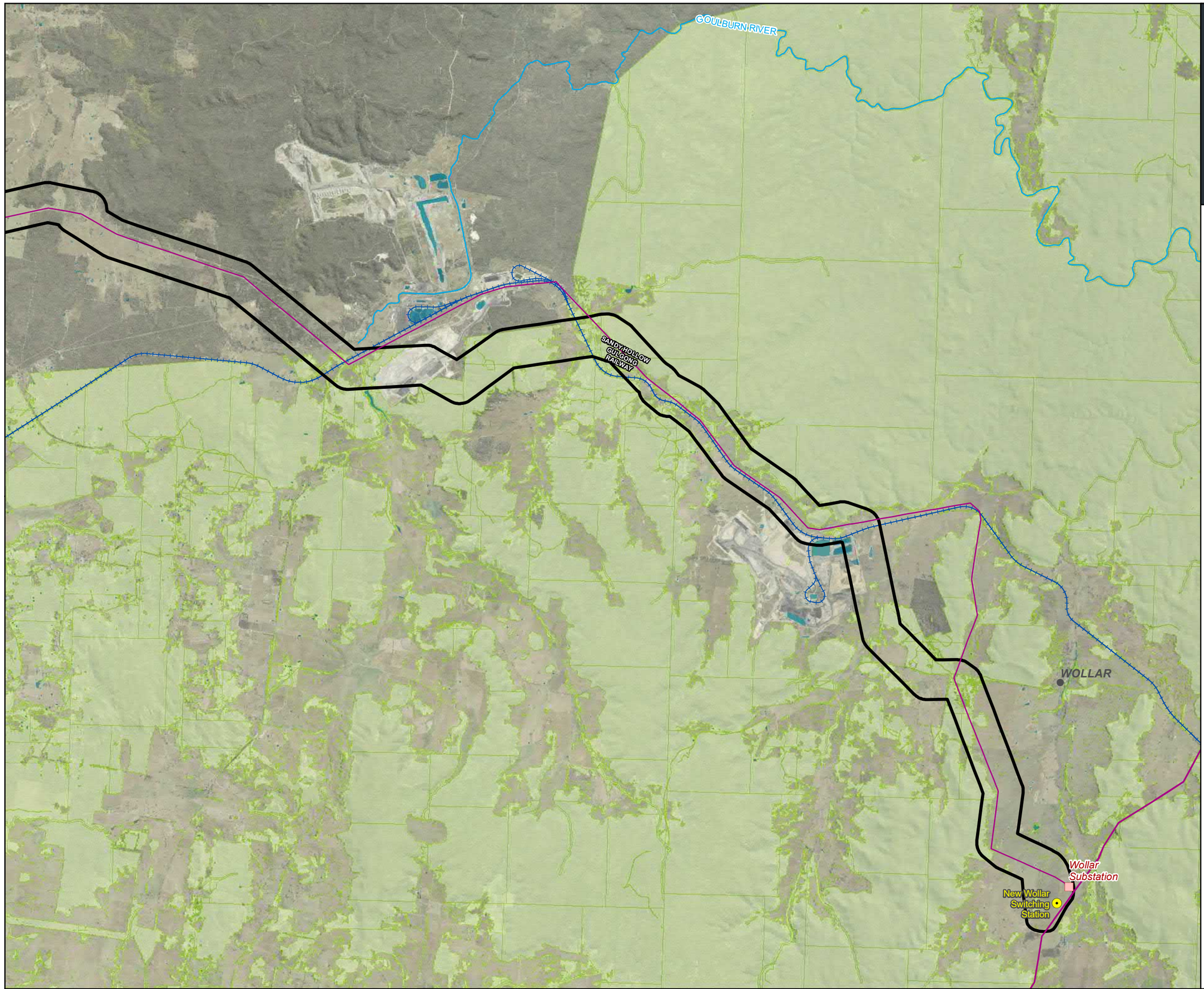
- Brown Treecreeper (eastern subspecies)
- Dusky Woodswallow
- Koala
- Little Lorikeet
- Scarlet Robin
- Speckled Warbler
- Spotted Harrier
- Turquoise Parrot
- Varied Sittella



0 1,000 2,000
Meters

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A3
1:55,000 Date: 6/09/2022

Data sources: WSP 2022



wsp

Central-West Orana REZ Transmission

Figure 3.5
Regent Honeyeater Important Habitat Map

Legend

- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Waterbodies
- Regent Honeyeater Important Habitat
- Project Study Area

0 2,000 4,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:100,000 Date: 6/09/2022

Data sources: WSP 2022

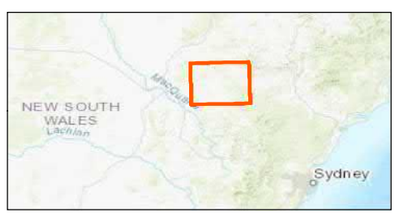
C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\01_Ecology\PS130593_ENV_F006_RegentHoneyeater_r1v5.mxd

Central-West Orana REZ Transmission

Figure 3.6
National Reserves, State Forests, Conservation Areas and other Important Areas

Legend

- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Project Study Area
- Peabody Wilpinjong Coal Mine Conservation Areas
- Peabody Wilpinjong Coal Mine Offset Areas
- Moolarben Coal Complex Offset Areas
- Forestry
- Protected Riparian Land
- CCA Zone 1 National Park
- CCA Zone 3 State Conservation Area
- National Park
- Nature Reserve
- State Conservation Area



0 6,000 12,000 Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:300,000 Date: 6/09/2022

Data sources: WSP 2022

3.5 Matters of National Environmental significance

3.5.1 *Threatened ecological communities*

Based on preliminary field verification surveys and broad-scale SVTM two candidate threatened ecological communities listed under the EPBC Act are likely to occur. These are:

- Grey Box (*Eucalyptus macrocarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (Grey Box Grassy Woodland and DNG) – Endangered
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box-Gum Woodland and DNG) – Critically Endangered.

An overview of each candidate TEC, its listing status, associated PCTs and broad location within the project disturbance area is presented in Table 3.8. TECs recorded during preliminary field surveys and/or predicted using broad scale mapping are shown in Figure 3.3 above.

Preliminary assessments of significance to determine if these MNES are likely to be significantly impacted by the project is provided in Appendix C. These assessments have been carried out according to the significant impact guidelines (DoE 2013).

Nine additional EPBC-listed TECs were identified in the PMST in the project study area and locality that have lower likelihood of occurring in the project disturbance area. No PCTs mapped by SVTM in the project disturbance area are linked to these TECs. Field survey is required to determine their presence in the project disturbance area. These include:

- Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion – Endangered
- River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria – Critically Endangered
- Poplar Box Grassy Woodland on Alluvial Plains – Endangered
- Central Hunter Valley eucalypt forest and woodland – Critically Endangered
- Coolibah – Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions – Endangered
- Weeping Myall Woodlands – Endangered
- Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland – Critically Endangered
- Natural Temperate Grassland of the South Eastern Highlands – Critically Endangered
- Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland – Endangered.

Further detailed field surveys are required to understand the full extent of all candidate and potential EPBC Act threatened ecological communities within the project disturbance area.

Table 3.8 Threatened ecological communities listed under the EPBC Act and associated PCTs

Threatened ecological community	BC Act[1]	Associated Plant Community Type	Indicative project disturbance area (ha)
Grey Box (*Eucalyptus macrocarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	E	Aligns (in part) with the following PCT mapped within the project disturbance area: — PCT 81	5.5
White Box – Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grassland	CE/SAII	Aligns (equivalent to) with the following PCTs recorded within the project disturbance area: — PCT 484 — PCT 1330 The following PCTs align partly align to this TEC: — PCT 266 — PCT 268 — PCT 277 — PCT 281 — PCT 395 — PCT 433 — PCT 434 — PCT 437 — PCT 483 — PCT 488 — PCT 511 — PCT 796 — PCT 800	3660.66

(1) E (Endangered) and CE (Critically Endangered) under the Commonwealth Environment Protection and Biodiversity Conservation Act (EPBC Act).

3.5.2 *Threatened flora*

Database searches have identified a total of 26 threatened flora species, listed under the EPBC Act, that are predicted or known to occur within the locality of the project study area .

The results of likelihood of occurrence assessments have identified a total of 13 threatened flora species to have a moderate or higher likelihood of occurrence within the project study area (see Appendix A for further detail). Of these, one threatened flora species has Bionet (2022b) records within the project study area (Table 3.9).

Table 3.9 Threatened flora species recorded within the project disturbance area

Species name	Common name	BC Act[1]	EPBC Act[2]	SAII[3]
Prasophyllum petilum	Tarengo Leek Orchid	E	E	No

(1) BC Act – BC Act status: V=Vulnerable, E=Endangered, under the *Biodiversity Conservation Act* (BC Act)
(2) EPBC Act – EPBC Act status: V=Vulnerable, E=Endangered, under the *Commonwealth Environment Protection and Biodiversity Conservation Act* (EPBC Act).
(3) SAII = Serious and Irreversible Impact

3.5.3 *Threatened fauna*

Database searches have identified a total of 32 threatened fauna species, listed under the EPBC Act, that are predicted or known to occur within the project study area. The results of likelihood of occurrence assessments have identified a total of 19 threatened fauna species to have a moderate or higher likelihood of occurrence within the project study area (see Appendix B for further detail). Of these, five threatened fauna species listed under the EPBC Act were recorded during field surveys or have Bionet records within the project study area (Table 3.10).

Table 3.10 Threatened fauna species recorded within the project disturbance area

Species name	Common name	BC Act[1]	EPBC Act[2]	SAII[3]
Amphibians				
Mixophyes iteratus	Giant Barred Frog	E	E	No
Birds				
Anthochaera phrygia	Regent Honeyeater	CE	CE	Yes
Grantiella picta	Painted Honeyeater	V	V	No
Mammals				
Phascolarctos cinereus	Koala	V	E	No
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Yes

(1) BC Act – BC Act status: V=Vulnerable, E=Endangered, CE= Critically Endangered, under the *Biodiversity Conservation Act* (BC Act)
(2) EPBC Act – EPBC Act status: V=Vulnerable, E=Endangered, M=migratory, under the *Commonwealth Environment Protection and Biodiversity Conservation Act* (EPBC Act).
(3) SAII = Serious and Irreversible Impact

The Regent Honeyeater important habitat mapping intersects with 315.93 ha of an indicative project disturbance within the project study area (refer to Figure 3.5).

Preliminary assessment to determine if this MNES is likely to be significantly impacted by the project is provided in Appendix C. This assessment of significance has been carried out according to significant impact guidelines (DoE 2013).

3.5.4 *Migratory bird species*

Database searches have identified a total of 12 migratory bird species, listed under the EPBC Act, that are predicted or known to occur within the locality of the project study area.

The results of likelihood of occurrence assessments for these migratory bird species identified seven species that have a moderate or higher likelihood of occurrence within the project study area (see Appendix B for further detail).

3.5.5 *World and national heritage*

No world or national heritage areas were identified within the project study area.

3.5.6 *Wetlands of national and international importance*

Wetlands are important habitat for a diverse range of animals including waterbirds, amphibians, invertebrates, and fish species as well as aquatic and water loving plants such as sedges and rushes. Tree species such as River Red Gum also rely on these environments. Wetlands crucially provide strategic refuge during drought and frequently support threatened species. Most of the migratory bird species listed under international convention agreements within Australia may be found in these wetlands.

3.5.6.1 Nationally important wetlands

No nationally important wetlands were identified within the project study area.

3.5.6.2 Ramsar wetlands

Five Ramsar wetlands or Wetlands of International importance were identified by database searches. These are identified in Table 3.11 below.

Table 3.11 Ramsar wetlands identified during database searches

Ramsar site no.	Ramsar Wetland name	Approximate distance to project study area
24	Hunter Estuary	150–200 km upstream from Ramsar site
28	The Macquarie Marshes	150–200 km upstream from Ramsar site
29	Riverland	700–800 km upstream from Ramsar site
63	Banrock Station Wetland Complex	800–900 km upstream from Ramsar site
25	The Coorong, and Lakes Alexandrina and Albert Wetland	900–1000 km upstream from Ramsar site

4 Biodiversity constraints

Biodiversity values identified as known, predicted or likely to occur within the project study area have been assigned to a three-tier biodiversity constraint hierarchy. These biodiversity values have been mapped (Figure 4.1) based on desktop assessment and preliminary field surveys. This hierarchy has been developed to assist with addressing the principle of avoid and minimise as required under section 8 of the BAM and inform project development and alignment options during EIS preparation. Biodiversity constraints ranking have been based on the following criteria:

4.1 Tier 1 biodiversity constraint – Areas to avoid

Tier 1 biodiversity constraints are areas of very high environmental sensitivity, with environmental approvals considered unlikely or unachievable. Tier 1 constraints are:

- Ramsar Wetlands
- World Heritage Areas
- National Parks, ecological conservation areas (including flora reserves, state conservation areas, Biobanks; wilderness protection areas).

4.2 Tier 2 biodiversity constraint – Areas to be avoided if reasonable, or minimise impact

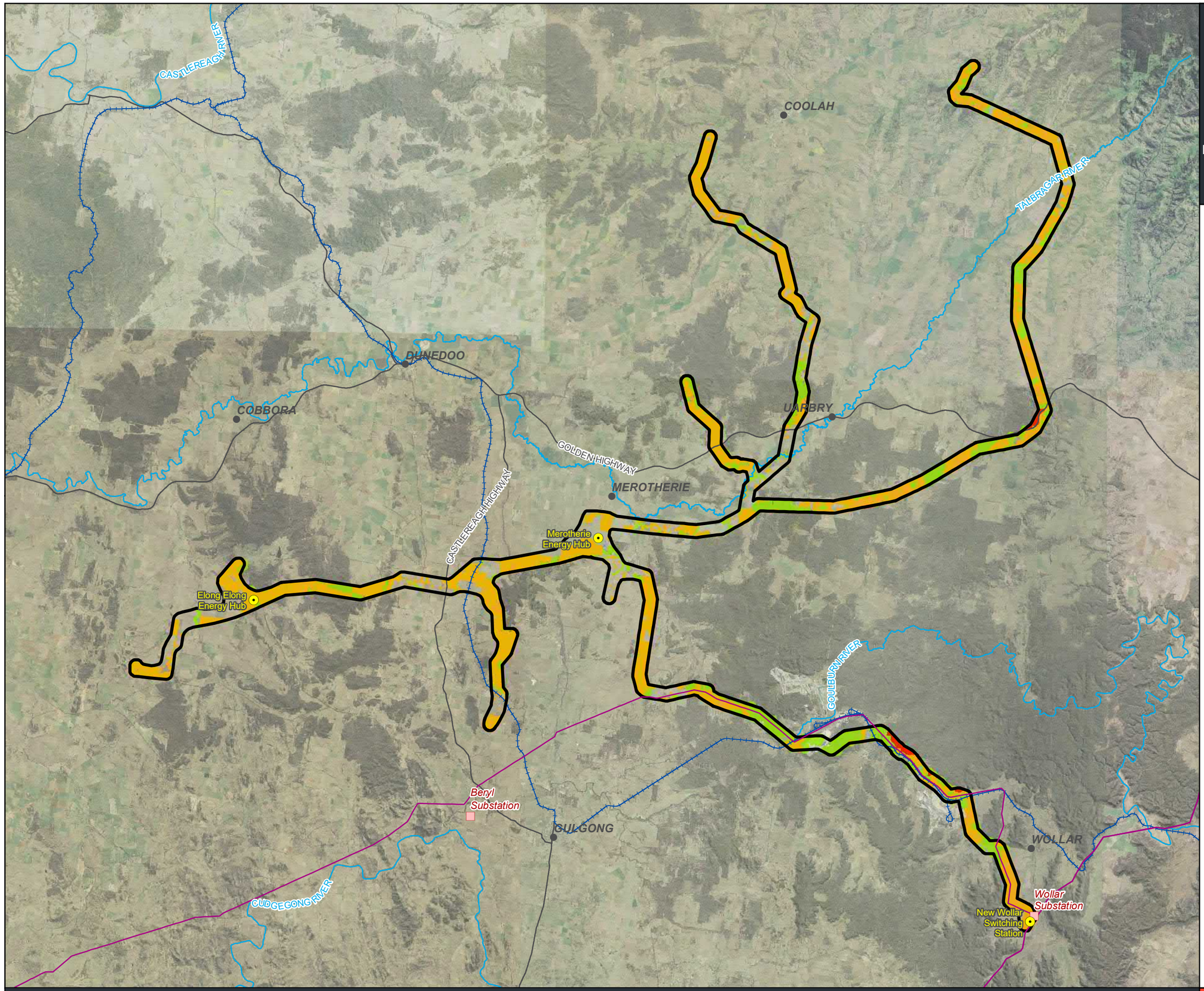
Tier 2 biodiversity constraints are areas of high environmental sensitivity with environmental approvals considered complex and uncertain. This will require additional triggers for biodiversity offsets and further demonstration of avoiding and minimising impacts on such biodiversity values. If unavoidable, these may require significant, expensive, and perhaps unattainable offsets obligations. Tier 2 biodiversity constraints are:

- threatened ecological communities listed under the EPBC Act
- threatened ecological communities listed under the BC Act as SAII entities
- biodiversity stewardship sites of high ecological value
- other important wetlands and water sources for migratory birds protected by international agreements.

4.3 Tier 3 biodiversity constraint – Areas to minimise impact

Tier 3 biodiversity constraints are areas of high environmental sensitivity, with environmental approvals considered complex and uncertain. Avoiding and minimising impact recommended as biodiversity offsets will apply to unavoidable impacts that in some cases would require significant, expensive, and perhaps unattainable offsets obligations. Tier 3 biodiversity constraints are:

- threatened species (flora/fauna) listed under the BC Act and EPBC Act
- large, contiguous/intact areas of moderate or better-quality woodland vegetation (only patch sizes of > 5 hectares) (only within 3 km of existing alignment)
- threatened ecological communities listed under the BC Act (non-SAII)
- key fish habitat as outline in Section 3.3 which includes most permanent and semi-permanent freshwater habitats including Strahler 4/5 order streams
- GDEs as outline in Section 3.3.5
- riparian corridors (Strahler 4/6 order streams) that require a 40m riparian buffer on these features as outlined under Table 14 of the BAM.



wsp

Central-West Orana REZ Transmission

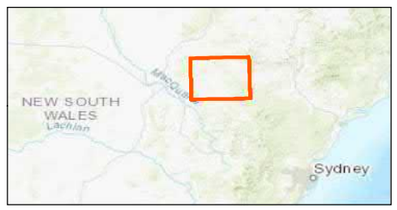
Figure 4.1
Biodiversity Constraints within Project Study Area

Legend

- Towns
- Energy hub/switching station indicative location
- Existing Substation
- Railway
- Road
- Watercourse
- Existing Transmission Line
- Project Study Area

Biodiversity Constraints

- Tier 1
- Tier 2
- Tier 3



0 6,000 12,000
Meters

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

1:300,000 Date: 6/09/2022

Data sources: WSP 2022

5 Further assessment proposed to support the project

5.1 Application for native vegetation regulatory Category 1 mapped land exemption

In accordance with section 6.8 (3) of the BC Act, the BAM excludes the assessment of impacts on Category 1-exempt land (within the meaning of Part 5A of the Local Land Services Act 2013), other than any impacts prescribed by the regulations under section 6.3.

Category 1-exempt land has not currently been mapped for use in NSW and as such an application will be made to DPE for the identification of Category 1 land to be excluded from the BAM for this project in accordance with the Native vegetation regulatory map: method statement (2017). The confirmation of these lands would enable a reduced survey area for the BDAR.

Assessment of the potential Category 1 land within the project study area will be undertaken using native vegetation regulatory mapping and analysis of available datasets such as:

- Historical and current land use component – NSW Landuse 2013 (https://data.nsw.gov.au/data/dataset/nsw-landuse-2013).
- Detectable woody vegetation clearing component – NSW Woody Vegetation Extent 2011 (https://datasets.seed.nsw.gov.au/dataset/nsw-woody-vegetation-extent-2011c0569).

Results of this assessment will be further refined using high resolution aerial photographic interpretation, latest satellite imagery and/or field verification.

Following this refinement, the proposed Category 1-exempt land will be submitted to DPE for confirmation.

5.2 Native vegetation assessment

Detailed native vegetation survey and mapping will be undertaken in accordance with section 5 of the BAM and Commonwealth requirements. This will include stratifying the vegetation types and broad condition states to define vegetation zones that will be sampled using vegetation integrity survey plots in accordance with section 5.3.4 of the BAM. These native vegetation surveys will determine the vegetation integrity scores for each vegetation zone that will run the BAM Credit Calculator and inform impacts and potential biodiversity offset requirements.

5.3 Threatened species surveys

Targeted threatened flora and fauna surveys will be required for species credit species listed under the BAM within seasonal requirements in the project study area. Targeted surveys will also be undertaken with due consideration of Commonwealth survey requirements. These surveys will address section 6 of the BAM and Commonwealth survey requirements and will consider each species individual seasonality requirements, including through the BAM Credit Calculator or directly from the Threatened Biodiversity Data Collection.

The targeted flora surveys will continue to be undertaken in accordance with the NSW Guide to Surveying Threatened Plants (EES 2020b) and any Commonwealth requirements, incorporating random meander searches and/or parallel traverses undertaken for candidate species within their known or potential habitat.

Targeted fauna surveys will continue to be undertaken in accordance with the State and Commonwealth fauna survey guidelines for candidate species within their known or potential habitat.

5.4 Preliminary recommendations for avoidance

Based on preliminary field surveys and desktop assessment within the project study area the preliminary recommendations regarding the project include:

- Avoid and minimise areas of ecological constraints identified as Tier 1-3 in Section 4.
- Avoidance wherever possible of areas that have been identified with threatened ecological communities under both BC Act and EPBC Act, as part of any revised or final alignment design.
- It is recommended that avoidance of all threatened flora species recorded wherever possible is implemented as part of any revised or final alignment design. Of particular importance, will be to maximise avoidance of impacts to the Critically Endangered species as part of the final project design. Where alignment changes are proposed, it is recommended that these areas are also inspected to ensure no threatened flora species occur.
- It is recommended to avoid or minimise impacts on threatened microbats and minimise offset obligations. Where alignment changes are proposed, it is recommended that these areas are surveyed to ensure no other threatened fauna species occur.
- Further survey will be required to confirm the presence of threatened entities listed under the BC and/or EPBC Acts.

6 Conclusion

The project study area traverses a range of native vegetation formations including forested wetlands, freshwater wetlands, native grasslands, dry sclerophyll forests, open waterbodies and partially to wholly cleared agricultural land.

Based on a combination of broad scale vegetation mapping and limited preliminary field investigations within the project study area, several of the native plant community types (PCTs) identified are likely to conform to threatened ecological communities. These PCTs are considered to potentially form three threatened ecological communities listed under the BC Act and two ecological communities listed under the EPBC Act.

The project has been identified to have potential impacts on the following TECs listed under the BC Act:

- Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions – Endangered.
- Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions – Endangered.
- White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregion – Critically Endangered.

Two threatened ecological communities listed under the EPBC Act could be impacted by the project and have been recorded during preliminary surveys:

- Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia – Endangered
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland – Critically Endangered.

Database searches resulted in 22 flora and 61 fauna threatened species listed under the BC Act, and 26 flora and 32 threatened fauna species listed under the EPBC Act, as predicted to occur within the locality of the project study area (20 km buffer). Of these, six threatened flora species and 21 threatened fauna species listed under the BC act were recorded by field survey in Spring 2021 or have historic records from Bionet (2022b) within the project disturbance area.

This preliminary assessment has identified two SAII entities that are listed under the BC Act, which may occur within project study area, comprising only fauna species.

Twelve migratory bird species listed under the EPBC Act were predicted to occur in the locality of the project study area by the PMST.

Other important biodiversity values identified within the study area include National Parks, Nature Reserves, Protected Areas, wetlands, and Regent Honeyeater Important Areas Mapping.

A Biodiversity Development Assessment Report would need to be prepared as part of the EIS, which would further identify and clarify the potential significance of biodiversity impacts associated with the project. The BDAR would be prepared in accordance with BC Act and BAM 2020. Targeted threatened species seasonal survey will be required to ensure compliance with the BAM along with vegetation integrity plot based native vegetation surveys.

Potential measures would be identified to avoid and minimise any adverse biodiversity effects and further detailed design would reduce the overall amount of vegetation required to be removed.

7 Limitations

7.1 Scope of services

This biodiversity impact assessment report (the report) has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the client and WSP (scope of services). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

7.2 Reliance on data

In preparing the report, WSP has relied upon data, surveys, analyses, designs, plans and other information provided by the client and other individuals and organisations, most of which are referred to in the report (the data). Except as otherwise stated in the report, WSP has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. WSP will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP.

7.3 Environmental conclusions

In accordance with the scope of services, WSP has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

On all sites, varying degrees of non-uniformity of the vertical and horizontal soil or groundwater conditions are encountered. Hence no monitoring, common testing or sampling technique can eliminate the possibility that monitoring or testing results/samples are not totally representative of soil and/or groundwater conditions encountered. The conclusions are based upon the data and the environmental field monitoring and/or testing and are therefore merely indicative of the environmental condition of the site at the time of preparing the report, including the presence or otherwise of contaminants or emissions. Also, it should be recognised that site conditions, including the extent and concentration of contaminants, can change with time.

Within the limitations imposed by the scope of services, the monitoring, testing, sampling and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

7.4 Report for benefit of client

The report has been prepared for the benefit of the client (and no other party), but may be relied upon by determining authorities for consideration. WSP assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of WSP or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Except as provided below parties other than the client should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

7.5 Other limitations

WSP will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

The scope of services did not include any assessment of the title or ownership of the properties, buildings and structures referred to in the report nor the application or interpretation of laws in the jurisdiction in which those properties, buildings and structures are located.

References

Atlas of Living Australia (2022) accessed in August 2022 from Atlas of Living Australia – Open access to Australia's biodiversity data (ala.org.au)

Australian Bureau of Meteorology (2022). Atlas of Groundwater Dependent Ecosystems (GDE) accessed August 2022.

Cropper, S.C. (1993) Management of Endangered Plants. CSIRO Australia, Melbourne.

DAWE – see Department of the Agriculture, Water and the Environment , as of July 1st 2022 changed to Department of Climate Change, Energy, the Environment and Water (DCCEEW)

Department of Agriculture Water and the Energy. (2022a). Australian Faunal Directory. Retrieved from Australian Faunal Directory (biodiversity.org.au)

Department of Agriculture Water and the Environment. (2022a). *Anthochaera phrygia* — Regent Honeyeater in Species Profile and Threats Database. Retrieved from https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=82338

Department of agriculture Water and the Environment. (2022b). Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia in Species Profile and Threats Database. Retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=86

Department of Climate Change, Energy, the Environment and Water (2022) Protected Matters Search Tool. Accessed August 2022 at Protected Matters Search Tool - DCCEEW

Department of Environment Climate Change and Water NSW. (2010). *National Recovery Plan, White Box Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland, a critically endangered ecological community* Retrieved from http://www.environment.gov.au/system/files/resources/386f395f-b2c6-4e10-8fc3-e937ad277bfe/files/white-and-yellow-box.pdf

Department of Planning and Environment (2022a) Bionet Vegetation Classification. Accessed in August 2022 at BioNet Vegetation Classification (nsw.gov.au)

Department of Planning and Environment (2022b) NSW Bionet Atlas. Accessed in August 2022 at BioNet Atlas (nsw.gov.au)

Department of Planning and Environment (2022c). NSW BioNet Threatened Biodiversity Data Collection. Retrieved from http://www.bionet.nsw.gov.au/

Department of Planning Industry and Environment. (2021). Serious and irreversible impacts of development on biodiversity. Retrieved from https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity-offsets-scheme/local-government-and-other-decision-makers/serious-and-irreversible-impacts-of-development

Department of Primary Industries (2013) Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management (2013 update). Fisheries NSW, Wollongbar.

Department of Primary Industries (2022a) Fisheries Spatial Data Portal accessed August 2022 at Fisheries Spatial Data Portal (nsw.gov.au)

Department of Primary Industries (2022a) Threatened species lists. Retrieved from Threatened species lists (nsw.gov.au)

Department of Primary Industries (2022b) Register of critical habitat. Accessed August 2022 at Register of critical habitat (nsw.gov.au)

Department of the Environment and Energy (2016). An Interim Biogeographic Regionalisation of Australia (IBRA) – Version 7. Canberra, Department of the Environment and Energy

Department of the Environment Water Heritage and the Arts. (2010a). *Approved Conservation Advice for the Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-east Australia.* . Retrieved from Canberra, ACT: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/86-conservation-advice.pdf

Department of the Environment, Water, Heritage and the Arts (2010) Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the Environmental Protection and Biodiversity Conservation Act 1999. Retrieved from Survey guidelines for Australia's threatened birds (dcceew.gov.au)

Department of the Environment. (2013). *Matters of National Environmental Significance – Significant impact guidelines 1.1 Environmental Protection and Biodiversity Conservation Act 1999*. Retrieved from http://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf

Department of the Environment. (2016). *National Recovery Plan for the Regent Honeyeater (Anthochaera phrygia)*. Retrieved from Canberra ACT: http://www.environment.gov.au/biodiversity/threatened/recovery-plans/national-recovery-plan-regent-honeyeater-anthochaera-phrygia-2016

DEWHA – see Department of the Environment, Water, Heritage and the Arts

DoE – see Department of the Environment

DPE – see Department of Planning and Environment

DPIE (2019a) Biodiversity Assessment Method (BAM) Operational Manual Stage 2. State of NSW and Department of Planning, Industry and Environment. Dated September 2019.

DPIE (2019a). State Vegetation Type Map: Upper Hunter v1.0. VIS_ID 4894. Retrieved from State Vegetation Type Map: Upper Hunter v1.0. VIS_ID 4894 | Anzlic_Dataset | SEED (nsw.gov.au)

DPIE (2019b). State Vegetation Type Map: Central West/Lachlan Region v1.4 VIS_ID 4468. Retrieved State Vegetation Type Map: Central West / Lachlan Region Version 1.4. VIS_ID 4468 | Anzlic_Dataset | SEED (nsw.gov.au)

DPIE (2022) Biodiversity Values Map: Biodiversity offset scheme threshold

DPIE (2022) NSW Sharing and Enabling Environmental Data (SEED) portal https://www.seed.nsw.gov.au

Eamus, D., Froend, R., (2006). Groundwater-dependent ecosystems: the where, what and why of GDEs. Aust. J. Bot. 54, 91–96.

EES – see Environment Energy and Science

Environment Energy and Science (2020a). Biodiversity Assessment Method 2020 Operational Manual – Stage 1. Published by Department of Planning, Industry and Environment.

Environment Energy and Science (2020b). Surveying threatened plants and their habitats. NSW survey guide for the Biodiversity Assessment Methodology. April 2020, Paramatta.

Fairfull, S. and Witheridge, G. (2003) Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings. NSW Fisheries, Cronulla, 16 pp

Hatton, T., Evans, R., (1998). Dependence of ecosystems on groundwater and its significance to Australia. Land and Water Resources Research and Development Council (LWRRDC) Occasional Paper No 12/98. Canberra.

Niche (2021) Preliminary Ecological Assessment Central-West Orana REZ. Report prepared for AECOM, 9 June 2021.

NSW TSSC – see NSW Threatened Species Scientific Committee

Pennay, M, Law, B, Reinhold, L. (2004) Bat calls of New South Wales: region-based guide to the echolocation of microchiropteran bats. Hurstville NSW: Depart. Of Environment and Conservation.

Pennay, M., Law, B., & Reinhold, L. (2004). *Bat calls of NSW. Region based guide to the echolocation calls of microchiropteran bats*. Retrieved from Sydney:

Royal Botanic Gardens. (2022). Plantnet – The Plant Information Network System of Botanic Gardens Trust Version 2.0. Retrieved from https://plantnet.rbgsyd.nsw.gov.au/

Smith, M, L. (2003) Aquatic Ecology in Environmental Impact Assessment – EIA Guideline Series. Prepared on behalf of Department of Planning.

Threatened Species Scientific Committee. (2006). *Commonwealth Listing Advice on White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland.* Retrieved from http://www.environment.gov.au/biodiversity/threatened/communities/box-gum.html

Threatened Species Scientific Committee. (2010). *Commonwealth Listing Advice on Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia. Department of the Environment, Water, Heritage and the Arts.* Retrieved from Canberra, ACT: DPI – see Department of Primary Industries

TSSC – see Threatened Species Scientific Committee

Appendix A

Threatened flora in the locality of the project, likelihood of occurrence

Table A.1 Threatened flora likelihood of occurrence

Scientific name	Common name	BC Act[1]	EPBC Act[2]	SAII	Habitat	Source[4]	Months of survey	Likelihood of occurrence
Acacia ausfeldii	Ausfeld's Wattle	V	–	No	Occurs north from Mudgee, in Mudgee – Ulan – Gulgong area, predominantly in the northern part of the Central Western Slopes. Associated species include *Eucalyptus albens, E. blakelyi* and *Callitris* spp., with an understorey dominated by *Cassinia* spp. and grasses.	Bionet, ALA	August – October	Present. Recorded within the locality by WSP in 2021. Also recorded within the 220 m wide project disturbance area on Bionet Atlas .
Acacia pendula	*Acacia pendula* population in the Hunter catchment	E	–	Yes	This Hunter population is known to occur naturally as far east as Warkworth and extends northwest to Muswellbrook and to the west of Muswellbrook at Wybong. Within the Hunter catchment the species typically occurs on heavy soils, sometimes on the margins of small floodplains, but also in more undulating locations.	Bionet	All year	Low-Moderate. Occurs within known/predicted distribution, potential habitat occurs in project study area.
Androcalva procumbens	–	–	V	–	*Rulingia procumbens* is endemic to NSW and is known from the Dubbo–Medooran–Gilgandra region, the Cobar region, and the upper Hunter Valley. The species occurs in sandy soils, often in disturbed habitats such as road verges, quarry boundaries, gravel stockpiles, and power line easements. *R. procumbens* is often found in communities of *Eucalyptus dealbata–E. sideroxylon* woodland, *Melaleuca uncinata* shrubland, and mallee eucalypt with *Calytrix tetragona* understorey. Associated species include *Acacia triptera, Callitris endlicheri, Eucalyptus melliodora, Allocasuarina diminuta, Philotheca salsolifolia, Xanthorrhoea* spp., *Exocarpos cupressiformis, Leptospermum parvifolium*, and *Kunzea parvifolia*.	PMST	-	Moderate. Potential habitat occurs in the project study area.
Androcalva rosea	Sandy Hollow Commersonia (Previously *Commersonia rosea*)	E	E	Yes	Only known from four localities in the Sandy Hollow district of the upper Hunter Valley, New South Wales, all within an eight kilometre radius of Sandy Hollow. No populations are within a conservation reserve. Commersonia rosea occupies relatively small areas at its known sites and has a total population of less than 200 plants. Observed flowering in August, November, January and February. Occurs on skeletal sandy soils in scrub or heath vegetation with occasional emergents of Narrow-leaved Ironbark (Eucalyptus crebra), Black Cypress Pine (Callitris endlicheri) or E. caleyi subsp. caleyi.	PMST	All year	Low. Recorded in Goulbourn River National Park but habitat within the project study area is considered marginal
Austrostipa wakoolica	–	E	E	No	Confined to the floodplains of the Murray River tributaries of central-western and south-western NSW, with localities including Manna State Forest, Matong, Lake Tooim, Merran Creek, Tulla, Cunninyeuk and Mairjimmy State Forest (now part of South West Woodland Nature Reserve). Grows on floodplains of the Murray River tributaries, in open woodland on grey, silty clay or sandy loam soils; habitats include the edges of a lignum swamp with box and mallee; creek banks in grey, silty clay; mallee and lignum sandy-loam flat; open Cypress Pine forest on low sandy range; and a low, rocky rise. Flowers from October to December, mainly in response to rain.	PMST	October – December	Low. Study area is not within the know distribution of this species, and is considered marginal for this species
Caladenia arenaria	Sand-hill Spider Orchid	E	E	Yes	*Caladenia arenaria* is found mostly on the south west plains and western south west slopes of NSW. Occurs in woodland with sandy soil, especially that dominated by White Cypress Pine (*Callitris glaucophylla*).	Bionet	September	Moderate. Potential habitat present in project study area.
Commersonia procumbens	–	V	V	No	Endemic to NSW, mainly confined to the Dubbo-Mendooran-Gilgandra region, but also known in the Pilliga, Mount Kaputar National Park, north east of Gulgong and near Denmen. Additional populations have been found in Goonoo SCA in response fires. Grows in sandy sites, often along roadsides.	Bionet	August – May	Moderate. Potential habitat present in project study area.

Scientific name	Common name	BC Act[1]	EPBC Act[2]	SAII	Habitat	Source[4]	Months of survey	Likelihood of occurrence
Commersonia rosea	–	E	E	Yes	Only known from four localities in the Sandy Hollow district of the upper Hunter Valley, New South Wales, all within an eight kilometre radius of Sandy Hollow. Occurs on skeletal sandy soils in scrub or heath vegetation with occasional emergents of Narrow-leaved Ironbark (*Eucalyptus crebra*), Black Cypress Pine (*Callitris endlicheri*) or *E. caleyi subsp. caleyi*.	Bionet	All year	Low. Preferred habitat not present in Project Study. Area
Cymbidium canaliculatum	*Cymbidium canaliculatum* population in the Hunter Catchment	E	–	No	The Hunter population is known to occur naturally as far south as Weston and Pokolbin in the Lower Hunter, which represents its south-eastern geographic limit, but appears to be more centred in the Upper Hunter, predominantly north of Singleton. In this area it is chiefly known from an area bounded by Ravensworth, Muswellbrook, Denman and Sandy Hollow, but extends northwards to the Aberdeen – Scone – Wingen districts. Isolated occurrences are also known from the Merriwa plateau, Bylong valley and the Gungal area near Goulburn River (including the Goulburn River National Park). Within the Hunter Catchment, *Cymbidium canaliculatum* is most commonly found in *Eucalyptus albens* (White Box) dominated woodlands (including those dominated by the intergrade *E. albens-moluccana*), much of which may constitute the endangered ecological community (EEC) 'White Box Yellow Box Blakely's Red Gum Woodland'. It has been found, less commonly, to grow on *E. dawsonii* (Slaty Box), *E. crebra* (Narrow-leaved Ironbark), *E. moluccana* (Grey Box), *Angophora floribunda* (Rough-barked Apple), *Acacia salicina* (Cooba) and on some other species, including dead stags. It is also known to use man-made structures, such as fence posts and wooden bridges as its host.	Bionet	All year	Moderate. Potential habitat occurs in project study area.
Dichanthium setosum	Bluegrass	V	V	No	Flowering time is mostly in summer. Associated with heavy basaltic black soils and red-brown loams with clay subsoil. Often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture. (Often collected from disturbed open grassy woodlands on the northern tablelands, where the habitat has been variously grazed, nutrient-enriched and water-enriched). It is open to question whether the species tolerates or is promoted by a certain amount of disturbance, or whether this is indicative of the threatening processes behind its depleted habitat. Associated species include *Eucalyptus albens, Eucalyptus melanophloia, Eucalyptus melliodora, Eucalyptus viminalis, Myoporum debile, Aristida ramosa, Themeda triandra, Poa sieberiana, Bothriochloa ambigua, Medicago minima, Leptorhynchos squamatus, Lomandra aff. longifolia, Ajuga australis, Calotis hispidula* and *Austrodanthonia, Dichopogon, Brachyscome, Vittadinia, Wahlenbergia* and *Psoralea* species. Locally common or found as scattered clumps in broader populations. The extensive distribution and wide environmental tolerances make predictions about suitable habitat difficult.	Bionet, PMST	November – May	Moderate. May occur as habitat preferences are difficult to predict, however site does not support higher nutrient soils (typically basalt-derived) in which this species typically occurs.
Diuris tricolor	Pine Donkey Orchid	V	–	No	Sporadically distributed on the western slopes of NSW, extending from south of Narrandera all the way to the north of NSW. The Pine Donkey Orchid grows in sclerophyll forest among grass, often with native Cypress Pine (Callitris spp.). It is found in sandy soils, either on flats or small rises. Also recorded from a red earth soil in a Bimble Box community in western NSW.	Bionet	September – October	Present. Recorded in grassy woodland within locality by WSP during 2021 surveys. Also recorded within the 220 m wide project disturbance area on the BioNet Atlas.
Eucalyptus camaldulensis	*Eucalyptus camaldulensis* population in the Hunter catchment	E	–	No	In NSW, Eucalyptus camaldulensis occurs along the western flowing rivers but is known from only one coastal catchment, the Hunter. May occur with *Eucalyptus tereticornis, Eucalyptus melliodora, Casuarina cunninghamiana subsp. cunninghamiana* and *Angophora floribunda*. Most of the occurrences are on private land and there are no known occurrences in conservation reserves.	Bionet, ALA	All year	Present. Recorded within the project study area. on Bionet Atlas.

Scientific name	Common name	BC Act[1]	EPBC Act[2]	SAII	Habitat	Source[4]	Months of survey	Likelihood of occurrence
Eucalyptus cannonii	Capertee Stringybark	V	–	No	The Capertee Stringybark is predominantly restricted to the central tablelands and slopes of NSW between the Golden Highway in the north, and the Mitchell Highway in the south. Capertee Stringybark has a broad altitudinal range, from around 450 m to 1,050 m. Within this range, the species appears to tolerate most situations except the valley floors. Associated eucalypt species are diverse: *Eucalyptus viminalis, Eucalyptus mannifera, Eucalyptus polyanthemos, Eucalyptus rossii, Eucalyptus blakelyi, Eucalyptus oblonga, Eucalyptus sparsifolia, Eucalyptus bridgesiana, Eucalyptus dalrympleana, Eucalyptus melliodora, Eucalyptus dives* and *Angophora floribunda*.	Bionet	All year	Present. Recorded within the 220 m wide project disturbance area on BioNet Atlas.
Euphrasia arguta	–	CE	CE	Yes	Euphrasia arguta was rediscovered in the Nundle area of the NSW north western slopes and tablelands in 2008 after not being collected for 100 years. Historic records of the species noted the following habitats: 'in the open forest country around Bathurst in sub humid places', 'on the grassy country near Bathurst', and 'in meadows near rivers'. Plants from the Nundle area have been reported from eucalypt forest with a mixed grass and shrub understorey; here, plants were most dense in an open disturbed area and along the roadside, indicating the species had regenerated following disturbance.	PMST	November – March	Low. Species has very restricted distribution and not known to occur in area.
Homoranthus darwinioides	Fairy Bells	V	V	No	Rare in the central tablelands and western slopes of NSW, occurring from Putty to the Dubbo district. It is found west of Muswellbrook between Merriwa and Bylong, and north of Muswellbrook to Goonoo SCA. The species has been collected from Lee's Pinch, but not relocated at its original locality north of Mt Coricudgy above the headwaters of Widden Brook. Grows in various woodland habitats with shrubby understoreys, usually in gravely sandy soils. Landforms the species has been recorded growing on include flat sunny ridge tops with scrubby woodland, sloping ridges, gentle south-facing slopes, and a slight depression on a roadside with loamy sand.	Bionet, PMST, ALA	March – December	High. Recorded by WSP within the project study area in 2021 growing in Dry Sclerophyll Forest shrubby formation. Additional records from BioNet occur within and near to Goulburn River National Park. project disturbance area is likely contain habitat.
Indigofera efoliata	Leafless Indigo	E	E	Yes	Very rare and was presumed extinct with the last known collection made in 1955 with three unvouchered reports from Goonoo State Forest in 1963. In spring 2021 the species was rediscovered near Geurie. *Indigofera efoliata* was only known only from a few collections in the Dubbo area. Known sites were located along the Dubbo to Minore railway line and road, on Wallaringa and Geurie properties and in Goonoo State Forest. Recorded in Goonoo State Forest in *Eucalyptus crebra* and *Callitris glaucophylla* dry sclerophyll forest, and in *Eucalyptus microcarpa* and *Callitris glaucophylla* tall woodland. Herbarium records note the species as growing on slight rises amongst ironstone formation in stony red-brown sandy loam.	Bionet	September – October	Moderate. Potential habitat present in the project study area.
Leionema lamprophyllum subsp. fractum	–	–	CE	No	Occurs in sparse heathland or very open low woodland in skeletal sandy soils on exposed rocky terrain. Currently known only from the Broken Back Range near Cessnock, with a historical collection from Munghorn Gap Nature Reserve near Wollar. The total number of mature individuals of Leionema lamprophyllum subsp. fractum are considered to be very low with only 38 individuals currently known. Plants have been found on skeletal sandy soils on a rocky northerly to north-westerly facing outcrop at 515 m above sea level.	PMST	September – November	Low. The project study area is outside the known current distribution of this species. Habitat within the project study area is considered marginal.

Scientific name	Common name	BC Act[1]	EPBC Act[2]	SAII	Habitat	Source[4]	Months of survey	Likelihood of occurrence
Lepidium aschersonii	Spiny Pepper-cress	V	V	No	Endemic to mainland southern Australia, where it is widely but patchily distributed from New South Wales to Western Australia. Found on ridges of gilgai clays dominated by Brigalow (*Acacia harpophylla*), Belah (*Casuarina cristata*), Buloke (*Allocasuarina luehmanii*) and Grey Box (*Eucalyptus microcarpa*). In the south has been recorded growing in Bull Mallee (*Eucalyptus behriana*). Often the understorey is dominated by introduced plants. The species grows as a component of the ground flora, in grey loamy clays. Vegetation structure varies from open to dense, with sparse grassy understorey and occasional heavy litter.	PMST	November – April	Low. Restricted distribution, not known to occur in area.
Lepidium monoplocoides	Winged Pepper-cress	E	E	No	Widespread in the semi-arid western plains regions of NSW, though only recently recorded from the Hay Plain, south-eastern Riverina, and from near Pooncarie. Occurs on seasonally moist to waterlogged sites, on heavy fertile soils, with a mean annual rainfall of around 300-500 mm. Predominant vegetation is usually an open woodland dominated by *Allocasuarina luehmannii* (Bulloak) and/or eucalypts, particularly *Eucalyptus largiflorens* (Black Box) or *Eucalyptus populnea* (Poplar Box). The field layer of the surrounding woodland is dominated by tussock grasses. Recorded in a wetland-grassland community comprising *Eragrostis australasicus, Agrostis avenacea, Austrodanthonia duttoniana, Homopholis proluta, Myriophyllum crispatum, Utricularia dichotoma* and *Pycnosorus globosus*, on waterlogged grey-brown clay. Also recorded from a *Maireana pyramidata* shrubland.	PMST	September – December	Low. Preferred habitat not present in the project study area.
Leucochrysum albicans var. tricolor	Hoary Sunray	–	E	No	The Hoary Sunray occurs from Queensland to Victoria and in Tasmania. In NSW and ACT Hoary Sunray occurs at relatively high elevations in woodland and open forest communities, in an area roughly bounded by Goulburn, Albury and Bega. The Hoary Sunray occurs in a wide variety of grassland, woodland and forest habitats, generally on relatively heavy soils. Plants can be found in natural or semi-natural vegetation and grazed or ungrazed habitat. Bare ground is required for germination.	Bionet, PMST	September – April	High. Potential habitat within project study area. Multiple Bionet records within the project study area near Ulan.
Ozothamnus tesselatus	–	V	V	No	Restricted to a few locations in an east-west zone south of Bunnan and between west Bylong and east Ravensworth. Grows in eucalypt woodland.	Bionet, PMST, ALA	September – October	High. A known population exists proximate to the project study area. Potential habitat within project study area in the Ulan region.
Pomaderris cotoneaster	Cotoneaster Pomaderris	E	E	No	Has been recorded in a range of habitats in predominantly forested country. The habitats include forest with deep, friable soil, amongst rock beside a creek, on rocky forested slopes and in steep gullies between sandstone cliffs.	PMST, ALA	All year	Moderate. This species was recently recorded near the project study area close to Moolarben Creek. Marginal habitat in the Ulan area
Pomaderris queenslandica	Scant Pomaderris	E	–	No	Widely scattered but not common in north-east NSW and in Queensland. It is known from several locations on the NSW north coast and a few locations on the New England Tablelands and North West Slopes, including near Torrington and Coolata. Found in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks.	Bionet, ALA	All year	Present. Records occur within the 220 m wide project disturbance area and on BioNet Atlas.
Pomaderris sericea	Bent Pomaderris	E	V	No	In NSW, Silky Pomaderris is known only from Berrima and from Wollemi National Park. Silky Pomaderris has also been recorded in north-eastern Victoria. There are only two Silky Pomaderris records in NSW that give details of habitat so it is difficult to generalise about the habitat preferences of the species. Both of these records, however, are from open forest on sandstone. The Bundanoon collection was made at the foot of a cliff. In Victoria it grows in low shrubland on rock within the flood level of the river.	PMST	All year	Low. Restricted known distribution and preferred habitat not present in the project study area.

Scientific name	Common name	BC Act[1]	EPBC Act[2]	SAII	Habitat	Source[4]	Months of survey	Likelihood of occurrence
Prasophyllum petilum	Tarengo Leek Orchid	E	E	No	Natural populations are known from a total of five sites in NSW. These are near Boorowa, Queanbeyan area, Ilford, Delegate and a newly recognised population c.10 km west of Muswellbrook. It also occurs at Hall in the Australian Capital Territory. Grows in open sites within Natural Temperate Grassland and in grassy woodland in association with River Tussock *Poa labillardieri*, Black Gum *Eucalyptus aggregata* and tea-trees *Leptospermum* spp. and within the grassy groundlayer dominated by Kangaroo Grass under Box-Gum Woodland.	Bionet, PMST	September – December	Present. Records occur within the 220 m wide project disturbance area and on BioNet Atlas.
Prasophyllum sp. Wybong (C.Phelps ORG 5269)righ	Leek Orchid	–	CE	Yes	Endemic to NSW, it is known from near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell, Tenterfield, Currabubula and the Pilliga area. Most populations are small, although the Wybong population contains by far the largest number of individuals. Known to occur in open eucalypt woodland and grassland.	PMST	September – October	Low. Potential habitat occurs in the project study area though the species has a restricted distribution and not known to occur in area.
Prostanthera discolor	–	V	V	Yes	Restricted to only two known localities in Bylong Valley, with a potential distribution in the Baerami Valley within the Mid-Western Regional local and Musswellbrook local government areas. Grows in dry sclerophyll forest in the side gullies of main creeklines, often on rocky or well-drained alluvial substrates.	PMST	September – October	Low. Although a population is known at Bylong Valley no individuals are recorded further west near the project study area where habitat is considered less suitable
Pultenaea glabra	Smooth Bush-Pea	V	V	No	All known populations occur within the Blue Mountains Local Government Area. This species is primarily associated with riparian or swamp habitat areas in the mid to upper altitudes of the central Blue Mountains on sandstone derived soils. Grows in swamp margins, hillslopes, gullies and creekbanks and occurs within dry sclerophyll forest and tall damp heath on sandstone. Restricted to the higher Blue Mountains.	Bionet, PMST	September – November	Low. The project study area does not support suitable habitat (riparian areas, creeks or drainage lines); site is outside of known range.
Swainsona recta	Small Purple-pea	E	E	No	Populations currently exist in the Queanbeyan and Wellington-Mudgee areas. Over 80% of the southern population grows on a railway easement. It is also known from the ACT and a single population of four plants near Chiltern in Victoria. Before European settlement, this species occurred in the grassy understorey of woodlands and open-forests dominated by Blakely's red gum, yellow box, candle bark gum and long-leaf box. Grows in association with understorey dominants that include kangaroo grass, poa tussocks and spear-grasses. Plants die back in summer, surviving as a rootstocks until they shoot again in autumn.	Bionet, PMST	September – November	Low. Likely associated native species are not present in any abundance.
Swainsona sericea	Silky Swainson-pea	V	-	No	Recorded from the Northern Tablelands to the Southern Tablelands and further inland on the slopes and plains. There is one isolated record from the far north-west of NSW. Its stronghold is on the Monaro. Also found in South Australia, Victoria and Queensland. Found in Natural Temperate Grassland and Snow Gum Eucalyptus pauciflora Woodland on the Monaro. Found in Box-Gum Woodland in the Southern Tablelands and South West Slopes. Sometimes found in association with cypress-pines *Callitris* spp. Habitat on plains unknown.	Bionet	September – November	Present. Recorded by WSP within the 220m project disturbance area during 2021 field surveys.
Thesium australe	Austral Toadflax	V	V	No	Found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Grows in association with Themeda triandra and (less frequently) with Poa spp.	PMST	November – February	Low. Not recorded in the locality and rare in the region, some potential habitat occurs within the project study area.

Scientific name	Common name	BC Act[1]	EPBC Act[2]	SAII	Habitat	Source[4]	Months of survey	Likelihood of occurrence
Tylophora linearis (synonym for *Vincetoxicum forsteri)*	–	V	E	No	Occurs from southern Queensland into central NSW, as far south near Temora with the majority of records occurring in the central western region. Grows in dry scrub and open forest. Recorded from low-altitude sedimentary flats in dry woodlands of *Eucalyptus fibrosa, Eucalyptus sideroxylon, Eucalyptus albens, Callitris endlicheri, Callitris glaucophylla and Allocasuarina luehmannii.* Also grows in association with *Acacia hakeoides, Acacia lineata, Melaleuca uncinata, Myoporum species* and *Casuarina* species.	Bionet, PMST	October – May	Moderate. Potential habitat occurs in the project study area.
Zieria ingramii	Keith's Zieria	E	E	No	Known predominately from Goonoo and Cobbora SCA, about 40 km north-east of Dubbo. Also known to occur west of Tuckland State Forest. One record also occurs within Kings Plains National Park, 48 km south of Inverell. Grows in dry sclerophyll forest on light sandy soils. All known populations have been recorded in Eucalyptus-Callitris woodland or open forest with a shrubby to heathy understorey. Eucalyptus dwyeri appears to be a key predictor of *Z. ingramii* distribution.	Bionet, ALA, PMST	September – February	High. Recorded in the 220 m wide project disturbance area on Bionet Atlas .
Zieria obcordata	Granite Zieria	E	E	Yes	Occurs at two sites with a geographic range of 105 km. These are in the Wuuluman area near Wellington and Crackerjack Rock/Rock Forests area NW of Bathurst. Grows in eucalypt woodland or shrubland dominated by species of Acacia on rocky hillsides. Also occurs in *Eucalyptus* and *Callitris* dominated woodland with an open, low shrub understorey, on moderately steep, mainly west to north-facing slopes in sandy loam amongst granite boulders. The altitude range of sites is 500 to 830 metres.	Bionet, PMST	September – October	Moderate. Potential to occur, although lack of preferred habitat within the 220 m wide project disturbance area.

(1) V = Vulnerable, E = Endangered, CE = Critically Endangered, EX = Presumed Extinct under the BC Act

(2) V = Vulnerable, E = Endangered under the Commonwealth EPBC Act.

(3) Source: PMDS = The Department of the Environment and Energy's EPBC Protected Matters Search Tool, BioNet = ESS's Bionet Atlas of NSW Wildlife

Appendix B

Threatened fauna in the locality of the project, likelihood of occurrence

Table B.1 Threatened fauna within the locality of the project, likelihood of occurrence

Scientific name	Common name	BC Act[1]	EPBC Act[2]	SAII	Habitat	Source[5]	Likelihood of occurrence
Amphibians							
Mixophyes iteratus	Giant Barred Frog	E	E	No	Found in freshwater streams with permanent or semi-permanent water. Moist riparian habitat such as rainforest and wet sclerophyll forest with deep leaf litter is favoured, but species may also occur in other riparian habitats in drier forests, degraded riparian remnants or farm dams.	Bionet, ALA	Present. Recorded within the 220 m wide project disturbance area on BioNet Atlas
Litoria booroolongensis	Booroolong Frog	E	E	No	The Booroolong Frog is found along permanent western flowing streams of the Great Dividing Range through most of NSW and down into northern Victoria. Streams range from small slow-flowing creeks to large rivers and the adults are found on or near cobble banks and other rock structures within stream margins and shelter under rocks or amongst vegetation near the ground on the stream edge. The species occurs along streams in both forested areas and open pasture.	PMST, ALA	Moderate. Site occurs within species known distribution, potential habitat present in the project study area.
Birds							
Actitis hypoleucos	Common Sandpiper	–	M	–	Uses a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity. Mostly found around muddy margins or rocky shores though occasionally on mudflats. Records of the species occur from estuaries and deltas of streams, as well as on banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties.	PMST	Low. The Project Study area does not support suitable habitat that is likely to provide foraging habitat on a basis that is more frequent than extremely rarely.
Anthochaera phrygia	Regent Honeyeater	CE	CE	Yes	Inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes.	Bionet, PMST, ALA	Present. Suitable habitat is present in the study area, and the project study area includes mapping of Regent Honeyeater important areas habitat (BAM 2020). BioNet Atlas records fall within the 220 m wide project disturbance area.
Apus pacificus	Fork-tailed Swift	–	M	–	Non-breeding visitor to all states and territories of Australia. In NSW, the Fork-tailed Swift is recorded in all regions. The species is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. Occurs in a wide variety of habitats though mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh.	PMST, ALA	Moderate. Potential habitat is present in project disturbance area.
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	–	No	Widespread in eastern, southern, and south western Australia. Occurs throughout most of New South Wales, but is sparsely scattered in, or largely absent from, much of the upper western region. Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and groundcover of grasses or sedges and fallen woody debris. Uses paddock trees for nesting.	Bionet, ALA	Present. Recorded in the project disturbance area in Spring 2021 by WSP in Dry Sclerophyll Forest and within the 220 m project disturbance area on Bionet Atlas.
Botaurus poiciloptilus	Australasian Bittern	E	E	No	Widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.).	PMST	Moderate. May occur in study area on occasion.
Burhinus grallarius	Bush Stone-curlew	E	–	No	Occurs throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania – however in the south-east it is rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy ground layer and fallen timber – roosts on the ground in a scrape or small bare patch.	Bionet, ALA	Moderate. Habitat of intact native grassland or good condition derived native grassland occurs in some locations of the project study area.

Scientific name	Common name	BC Act[1]	EPBC Act[2]	SAII	Habitat	Source[5]	Likelihood of occurrence
Calidris acuminata	Sharp-tailed Sandpiper	–	M	–	Occurs in Australia in the non-breeding season mostly to the south-east where they are widespread in both inland and coastal locations and in both freshwater and saline habitats. Prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland. They also occur in saltworks and sewage farms. They use flooded paddocks, sedgelands and other ephemeral wetlands. Roost sites are typically on rocks or in roots or branches of vegetation, especially mangroves.	PMST	Moderate. May occur through the project study area on occasion when migrating.
Callocephalon fimbriatum	Gang-gang Cockatoo	V	E	No	Occurs from southern Victoria through south- and central-eastern New South Wales and ACT. In New South Wales, it occurs from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes – it is rare at the extremities of its range. Occurs in wetter tall mountain forests and woodlands in autumn/winter, and in spring/summer moves to lower altitudes in drier more open eucalypt forests and woodlands particularly box-gum and box-ironbark assemblages. Often found in urban areas. Favours old growth forest and woodland attributes for nesting and roosting.	Bionet, PMST, ALA	Moderate. Potential habitat is present for birds during spring/summer season.
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	–	No	Occurs from central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia.	Bionet, ALA	Present. Recorded within the project study area in Spring 2021 by WSP. Also recorded within the 220 m wide project disturbance area on BioNet Atlas.
Certhionyx variegatus	Pied Honeyeater	V	–	No	Widespread throughout acacia, mallee and spinifex scrubs of arid and semi-arid Australia. Occasionally occurs further east, on the slopes and plains and the Hunter Valley, typically during periods of drought. Highly nomadic, following the erratic flowering of shrubs; can be locally common at times.	PMST, ALA	Moderate. Unverified records exist from 2019 in Durridgere State Conservation Area. Potential habitat is present.
Chthonicola sagittata	Speckled Warbler	V	–	No	Patchy distribution throughout south-eastern Queensland, the eastern half of NSW and into Victoria, as far west as the Grampians. Most frequently reported from the hills and tablelands of the Great Dividing Range. Lives in a wide range of eucalypt dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth, and an open canopy. Large, relatively undisturbed remnants (i.e. >100 ha) are required for the species to persist in an area.	Bionet, ALA	Present. Recorded within the project study area in Spring 2021 by WSP. Also recorded within the 220 m wide project disturbance area on BioNet Atlas.
Circus assimilis	Spotted Harrier	V	–	No	Occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population. Occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	Bionet, ALA	Moderate. Potential habitat occurs in the project study area.
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	–	No	Endemic to eastern Australia and occurs in inland plains and slopes of the Great Dividing Range and less commonly on coastal plains and ranges. Found in eucalypt woodlands (including box-gum woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range.	Bionet, ALA	Present. Recorded within the project study area in Spring 2021 by WSP. Also recorded within the 220 m wide project disturbance area on BioNet Atlas.
Daphoenositta chrysoptera	Varied Sittella	V	–	No	Species is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. Inhabits wide variety of dry eucalypt forests and woodlands, usually with either shrubby under storey or grassy ground cover or both. Usually in areas with rough-barked trees, such as stringybarks or iron barks, but also in paperbarks or mature Eucalypts with hollows.	Bionet, ALA	Present. Recorded within study area in Spring 2021 by WSP. Also recorded within the 220 m wide project disturbance area on BioNet Atlas.

Scientific name	Common name	BC Act[1]	EPBC Act[2]	SAII	Habitat	Source[5]	Likelihood of occurrence
Epthianura albifrons	White-fronted Chat	V	–	No	Found across the southern half of Australia, from southernmost Queensland to southern Tasmania, and across to Western Australia as far north as Carnarvon. In NSW, it occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Usually found foraging on bare or grassy ground in wetland areas.	Bionet ALA	Moderate. Potential habitat is present in project disturbance area.
Erythrotriorchis radiatus	Red Goshawk	CE	V	Yes	Occurs sparsely through northern and eastern Australia from Western Australian Kimberley division to north eastern Queensland and south to far north-eastern NSW with scattered records in central Australia. Inhabit open woodland and forest preferring mosaic of vegetation types. Often found in riparian habitats along or near watercourses or wetlands.	PMST	Low. This species is currently very rarely observed in NSW most of these records are located within the Clarence River Catchment. Habitat within the project study area is not considered suitable.
Falco subniger	Black Falcon	V	–	No	Widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. In New South Wales there is assumed to be a single population that is continuous. Core habitat is arid and semi-arid interior where it uses tree-lined watercourses and isolated stands of trees. Hunts over low vegetation of surrounding plains, grassland, saltbush and bluebush.	Bionet, ALA	High. Potential habitat occurs in the project study area and proximate to project disturbance area.
Gallinago hardwickii	Latham's Snipe	–	M	–	Latham's Snipe is a non-breeding visitor to south-eastern Australia, and is a passage migrant through northern Australia (i.e. it travels through northern Australia to reach non-breeding areas located further south). Has been recorded along the east coast of Australia and range extends inland in NSW to west of the Great Dividing Range. Occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. Usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies) but can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity.	PMST, ALA	Moderate. Potential habitat in the project study area for non-breeding migrants.
Glossopsitta pusilla	Little Lorikeet	V	–	No	Distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range in NSW, extending westwards to the vicinity of Albury, Parkes, Dubbo, and Narrabri. Mostly occur in dry, open eucalypt forests and woodlands.	Bionet, ALA	Present. Recorded within the project study area in Spring 2021 by WSP. Also recorded within the 220 m wide project disturbance area on BioNet Atlas.
Grantiella picta	Painted Honeyeater	V	V	No	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. Painted Honeyeater inhabits Boree/ Weeping Myall (Acacia pendula), Brigalow (A. harpophylla) and Box-Gum Woodlands and Box-Ironbark Forests.	Bionet, PMST, ALA	Present. Also recorded within the 220 m wide project disturbance area on BioNet Atlas.
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	–	No	Distributed around the Australian coastline and inland along rivers and wetlands of the Murray Darling Basin. In New South Wales it is widespread along all major inland rivers and waterways. Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Occurs at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. Terrestrial habitats include grassland, heathland, woodland, and forest.	Bionet, ALA	Moderate. Potential habitat is present in project disturbance area.
Hamirostra melanosternon	Black-breasted Buzzard	V	–	No	Lives in a range of inland habitats, especially along timbered watercourses which is the preferred breeding habitat. Also hunts over grasslands and sparsely timbered woodlands.	Bionet	Moderate. Potential habitat is present in project disturbance area.
Hieraaetus morphnoides	Little Eagle	V	–	No	The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW. Most abundant in lightly timbered areas with open areas nearby. Often recorded foraging in grasslands, crops, treeless dune fields, and recently logged areas. May nest in farmland, woodland, and forest in tall trees.	Bionet, ALA	Present. Recorded within study area in Spring 2021 by WSP. Also recorded within the 220 m wide project disturbance area on BioNet Atlas.

Scientific name	Common name	BC Act[1]	EPBC Act[2]	SAII	Habitat	Source[5]	Likelihood of occurrence
Hirundapus caudacutus	White-throated Needletail	–	V,M	No	The White-throated Needletail is widespread in eastern and south-eastern Australia or common in coastal areas, less so inland. An aerial species found in feeding concentrations over cities, hilltops, and timbered ranges.	Bionet, PMST, ALA	Moderate. Potential habitat is present in project disturbance area.
Lathamus discolor	Swift Parrot	E	CE	Yes	Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen, and associated insects. The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW. This species is migratory, breeding in Tasmania and nomadic, moving about in response to changing food availability. The study area did not occur within important mapped areas.	Bionet, PMST, ALA	Moderate. Potential habitat occurs in the project study area.
Leipoa ocellata	Malleefowl	E	V	No	The Malleefowl occurs in semi-arid parts of mainland Australia, ranging from New South Wales (west of the Great Divide), extending into north-western Victoria and the Riverland of South Australia; on the Eyre Peninsula of South Australia, extending into the Great Victoria Desert; and in southern and western parts of Western Australia. Occurs predominantly in mallee communities, preferring the tall, dense and floristically rich mallee found in higher rainfall (300 – 450 mm mean annual rainfall) areas.	Bionet, PMST	Low. project study area occurs within known distribution, however, no mallee habitat present on or near the project study area; no historical records within the 220 m wide project disturbance area.
Lophoictinia isura	Square-tailed Kite	V	–	No	The Square-tailed Kite ranges along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems and it is a summer breeding migrant to the south-east. Typically inhabits coastal forested and wooded lands of tropical and temperate Australia. In NSW it is often associated with ridge and gully forests dominated by Eucalyptus longifolia, Corymbia maculata, E. elata or E. smithii.	Bionet, ALA	Present. Recorded within the project study area in Spring 2021 by WSP. Also recorded within the 220 m wide project disturbance area on BioNet Atlas.
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	–	No	Common in few places, and rarely found on the coast. It is considered a sedentary species, but local seasonal movements are possible. The south-eastern form (subspecies cucullata) is found from Brisbane to Adelaide and throughout much of inland NSW, with the exception of the extreme north-west. Occupies a wide range of eucalypt woodlands, Acacia shrublands and open forests.	Bionet, ALA	Present. Recorded within the project study area in Spring 2021 by WSP. Also recorded within the 220 m wide project disturbance area on BioNet Atlas.
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	–	No	The eastern subspecies extends south from central Queensland, through NSW, Victoria into south eastern South Australia, though it is very rare in the last state. In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond and Clarence River areas. It has also been recorded at a few scattered sites in the Hunter, Central Coast, and Illawarra regions, though it is very rare in the latter. Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts. Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees.	Bionet, ALA	Moderate. Potential habitat occurs in the project study area.
Monarcha melanopsis	Black-faced Monarch	–	M	–	The Black-faced Monarch is widespread in eastern Australia. Mainly occurs in rainforest ecosystems although it can be found in gullies in mountain areas or coastal foothills, softwood scrub dominated by Brigalow (Acacia harpophylla), coastal scrub dominated by Coast Banksia (Banksia integrifolia) and Southern Mahogany.	PMST	Moderate. Potential habitat occurs in the project study area.

Scientific name	Common name	BC Act[1]	EPBC Act[2]	SAII	Habitat	Source[5]	Likelihood of occurrence
Myiagra cyanoleuca	Satin Flycatcher	–	M	–	The Satin Flycatcher is widespread in eastern Australia and vagrant to New Zealand. Satin Flycatchers inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. Satin Flycatchers are mainly recorded in eucalypt forests, especially wet sclerophyll forest, often dominated by eucalypts such as Brown Barrel, Eucalypt fastigata, Mountain Gum, E. dalrympleana, Mountain Grey Gum, Narrow-leaved Peppermint, Messmate or Manna Gum, or occasionally Mountain Ash, E. regnans. Such forests usually have a tall shrubby understorey of tall acacias, for example Blackwood, Acacia melanoxylon. In higher altitude Black Sallee, E. stellulata, woodlands, they are often associated with tea-trees and tree-ferns.	PMST	Moderate. Potential habitat occurs in the project study area.
Neophema pulchella	Turquoise Parrot	V	–	No	Range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges, and creeks in farmland.	Bionet, ALA	Moderate. Potential habitat occurs in the project study area.
Ninox connivens	Barking Owl	V	–	No	The Barking Owl is found throughout continental Australia except for the central arid regions. Has declined greatly in southern Australia and now occurs in a wide but sparse distribution in NSW. Core populations exist on the western slopes and plains and in some northeast coastal and escarpment forests. Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey found on these fertile riparian soils.	Bionet, ALA	Moderate. Potential habitat occurs in the project study area.
Ninox strenua	Powerful Owl	V	–	No	Endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains. Occurs at low densities throughout most of its eastern range, rare along the Murray River. Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well.	Bionet, ALA	Present. Recorded within the 220 m wide project disturbance area on BioNet Atlas.
Oxyura australis	Blue-billed Duck	V	–	No	Endemic to south-eastern and south-western Australia. It is widespread in NSW, but most common in the southern Murray-Darling Basin area. Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover.	Bionet	Moderate. Marginal potential habitat present in the project study area.
Pachycephala inornata	Gilbert's Whistler	V	–	No	The Gilbert’s Whistler is sparsely distributed over much of the arid and semi-arid zone of inland southern Australia. The Gilbert’s Whistler occurs in a range of habitats within NSW, though the shared feature appears to be a dense shrub layer. It is widely recorded in mallee shrublands, but also occurs in box-ironbark woodlands, Cypress Pine and Belah woodlands and River Red Gum forests, though at this stage it is only known to use this habitat along the Murray, Edwards and Wakool Rivers.	Bionet, ALA	Low. Project Study area occurs within known distribution however no mallee habitat present on or near the project study area.
Pandion cristatus	Eastern Osprey	V	M	No	Eastern Ospreys are found right around the Australian coast line, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia. There are a handful of records from inland areas. Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water.	PMST	Low. This species is infrequently observed in the locality and marginal potential habitat only found within the project study area.

Scientific name	Common name	BC Act[1]	EPBC Act[2]	SAII	Habitat	Source[5]	Likelihood of occurrence
Pedionomus torquatus	Plains-wanderer	E	CE	Yes	Today, Plains-wanderers are essentially extinct across much of their former range, with only three key areas remaining: the Riverina of south-western NSW, south-western Queensland and north-central Victoria. Live in semi-arid, lowland native grasslands that typically occur on hard red-brown soils. These grasslands support a high diversity of plant species, including a number of state and nationally threatened species.	Bionet ALA	Low. Not known to occur in area. Marginal potential habitat present the project study area.
Petroica boodang	Scarlet Robin	V	–	No	The Scarlet Robin is found from south east Queensland to south east South Australia and also in Tasmania and south west Western Australia. In NSW, it occurs from the coast to the inland slopes. lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Scarlet Robin habitat usually contains abundant logs and fallen timber: these are important components of its habitat.	Bionet, ALA	Present. Recorded within the 220 m wide project disturbance area on BioNet Atlas.
Petroica phoenicea	Flame Robin	V	–	No	Endemic to south eastern Australia, and ranges from near the Queensland border to south east South Australia and also in Tasmania. In NSW, it breeds in upland areas and in winter, many birds move to the inland slopes and plains. It is likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands. Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes and prefers clearings or areas with open understoreys. Occasionally occur in temperate rainforest, and also in herbfields, heathlands, shrublands and sedgelands at high altitudes. In winter, birds migrate to drier more open habitats in the lowlands (i.e. valleys below the ranges, and to the western slopes and plains).	Bionet, ALA	Moderate. Potential habitat occurs in the project study area.
Petroica rodinogaster	Pink Robin	V	–	No	Found in Tasmania and the uplands of eastern Victoria and far south-eastern NSW. Inhabits rainforest and tall, open eucalypt forest, particularly in densely vegetated gullies.	Bionet	Moderate. Rarely occurs so far north though occasional occurrences during winter cannot be discounted.
Polytelis swainsonii	Superb Parrot	V	V	No	The Superb Parrot is endemic to south-eastern Australia. It is found in the Riverina area of New South Wales and Victoria, and, in winter, in northern New South Wales. Inhabits box-gum, box-cypress-pine and boree woodlands and river red gum forest.	Bionet, PMST, ALA	Moderate. Potential habitat occurs in the project study area.
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	–	No	The eastern subspecies (temporalis occurs from Cape York south through Queensland, NSW and Victoria and formerly to the south east of South Australia. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Woodlands on fertile soils in coastal regions.	Bionet, ALA	Present. Recorded within study area in Spring 2021 by WSP. Also recorded within the 220 m wide project disturbance area on BioNet Atlas.
Stagonopleura guttata	Diamond Firetail	V	–	No	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Eucalyptus pauciflora Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Feeds exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects (especially in the breeding season).	Bionet, ALA	Present. Recorded within study area in Spring 2021 by WSP. Also recorded within the 220 m wide project disturbance area on BioNet Atlas.
Stictonetta naevosa	Freckled Duck	V	–	No	The Freckled Duck is found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere.	Bionet	Moderate. May occur throughout the project study area on occasion when migrating.
Tyto novaehollandiae	Masked Owl	V	–	No	Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution. Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides.	Bionet, ALA	Moderate. Marginal potential habitat present in the project study area.

Scientific name	Common name	BC Act[1]	EPBC Act[2]	SAII	Habitat	Source[5]	Likelihood of occurrence
Numenius madagascariensis	Eastern Curlew	–	CE, M	Yes	Spends non-breeding season in Australia where it occurs primarily along the coast and rarely inland. In NSW the species occurs across the entire coast but is mainly found in estuaries such as the Hunter River, Port Stephens, Clarence River, Richmond River and ICOLLs of the south coast. Generally occupies coastal lakes, inlets, bays and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats and sometimes saltmarsh of sheltered coasts.	PMST	Low. Species rarely occurs away from the coast and preferred habitat not present.
Calidris ferruginea	Curlew Sandpiper	E	CE	Yes	Spends non-breeding season in Australia where it occurs around most of the Australian coastline (including Tasmania). It occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. Inland records are probably mainly of birds pausing for a few days during migration. It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes inland.	PMST	Low. Species rarely occurs away from the coast and preferred habitat not present. May have occasional occurrences during migration.
Rostratula australis	Australian Painted Snipe	E	E	No	Mostly occurs in southeast Australia. In NSW many records are from the Murray-Darling Basin including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently, swamps near Balldale and Wanganella. Other important locations with recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	PMST	Moderate. Marginal potential habitat present in the project study area.
Pycnoptilus floccosus	Pilotbird	–	V	–	Lowland Pilotbirds occur in forests from the Blue Mountains west of Newcastle, around the wetter forests of eastern Australia, to Dandenong near Melbourne. Pilotbirds are strictly terrestrial, living on the ground in dense forests with heavy undergrowth. Its natural habitat is temperate wet sclerophyll forests and occasionally temperate rainforest, where there is dense undergrowth with abundant debris.	PMST	Low. Preferred habitat not present in the project study area.
Falco hypoleucos	Grey Falcon	E	V	No	Sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. Also occurs near wetlands where surface water attracts prey.	PMST	Moderate. Potential habitat occurs in the project study area.
Rhipidura rufifrons	Rufous Fantail	–	M	–	The Rufous Fantail is found in northern and eastern coastal Australia, being more common in the north. It is also found in New Guinea, the Solomon Islands, Sulawesi and Guam. Found in rainforest, dense wet forests, swamp woodlands and mangroves, preferring deep shade, and is often seen close to the ground. During migration, it may be found in more open habitats or urban areas.	PMST, ALA	Low. Coastal species. Preferred habitat not present in the project study area.
Calidris melanotos	Pectoral Sandpiper	–	M	–	In New South Wales (NSW), the Pectoral Sandpiper is widespread, but scattered. West of the Great Divide, the species is widespread in the Riverina and Lower Western regions. Usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. The species has also been recorded in swamp overgrown with lignum. They forage in shallow water or soft mud at the edge of wetlands	PMST	Low. Lack of preferred habitat in project study area.
Motacilla flava	Yellow Wagtail	–	M	–	This species migrates from Asia to Australia in spring-summer. It has been recorded in the estuarine areas of the Hunter River in Newcastle NSW and in QLD and the north of NT and WA. Occurs in a range of habitats including estuarine habitats such as sand dunes, mangrove forests and coastal saltmarshes. This species also occurs in open grassy areas including disturbed sites such as sports grounds and has been recorded on the edges of wetlands, swamps, lakes and farm dams.	PMST	Moderate. Potential habitat occurs in project study area.

Scientific name	Common name	BC Act[1]	EPBC Act[2]	SAII	Habitat	Source[5]	Likelihood of occurrence
Mammals							
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	No	Found in well-timbered areas containing gullies Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (Petrochelidon ariel), frequenting low to mid-elevation dry open forest and woodland close to these features. Occurs mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes.	Bionet, ALA	Present. Recorded within the 220 m wide project disturbance area on BioNet Atlas.
Miniopterus australis	Little Bent-winged bat	V	–	Yes	Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	Bionet	Moderate. Potential habitat occurs in the project study area.
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	–	Yes	Occurs along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings, and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. At other times of the year, populations disperse within about 300 km range of maternity caves. Hunt in forested areas, catching moths and other flying insects above the tree tops.	Bionet, ALA	Present. Recorded within study area in Spring 2021 by WSP and also recorded within the 220 m wide project disturbance area on BioNet Atlas.
Nyctophilus corbeni	Corben's Long-eared Bat	V	V	No	The Corben's Long-eared Bat south eastern form has a limited distribution that is restricted around the Murray-Darling Basin in south-eastern Australia. Even in this region its distribution is scattered, and it is rarely recorded. Inhabits a variety of vegetation types, including mallee, bulloke Allocasuarina leuhmanni and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark.	Bionet, PMST	Moderate. project study area occurs within known distribution, however, does not support preferred habitat (mallee, bulloak or box-ironbark-cypress pine woodland).
Petaurus australis australis	Yellow-bellied Glider (south-eastern)	V	V	No	Found in tall mature eucalypt forest, generally in areas with high rainfall and nutrient rich soils. Feed primarily on nectar, sap, honeydew and manna with pollen and insects also taken. Often leave a distinctive V-shaped feeding scar on tree trunks. Den in tree hollows of large trees.	PMST	Low. On the edge of known distribution and project study area does not support preferred habitat.
Petauroides volans	Greater Glider	–	V	No	The greater glider is an arboreal nocturnal marsupial, largely restricted to eucalypt forests and woodlands. It is primarily folivorous, with a diet mostly comprising eucalypt leaves, and occasionally flowers. It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows. The distribution may be patchy even in suitable habitat. The greater glider favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species.	PMST	Low. Occurs within known range though project study area does not support preferred habitat.
Petaurus norfolcensis	Squirrel Glider	V	–	No	The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey.	Bionet, ALA	Moderate. Marginal potential habitat present in the project study area.

Scientific name	Common name	BC Act[1]	EPBC Act[2]	SAII	Habitat	Source[5]	Likelihood of occurrence
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	Yes	The range of the Brush-tailed Rock-wallaby extends from south-east Queensland to the Grampians in western Victoria, roughly following the line of the Great Dividing Range. In NSW they occur from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Found in rocky areas in a wide variety of habitats including rainforest gullies, wet and dry sclerophyll forest, open woodland, and rocky outcrops in semi-arid country. Commonly sites have a northerly aspect with numerous ledges, caves, and crevices.	Bionet, PMST	Low. Occurs within species known range however project study area does not support rocky habitat and is not connected to rocky habitat.
Phascolarctos cinereus	Koala	V	E	No	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size.	Bionet, PMST, ALA	Present. Recorded within the 220 m wide project disturbance area on BioNet Atlas.
Pseudomys novaehollandiae	New Holland Mouse	–	V	No	The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, NSW and Queensland. The species is now largely restricted to the coast of central and northern NSW, with one inland occurrence near Parkes. Across the species' range the New Holland Mouse is known to inhabit open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes.	Bionet, PMST, ALA	Moderate. Potential habitat occurs in the project study area.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	No	Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations. This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, melaleuca swamps and banksia woodlands. Bats commute daily to foraging areas, usually within 15 km of the day roost although some individuals may travel up to 70 km.	Bionet, PMST, ALA	Moderate. Closest known camp >100 km from project study area and preferred habitat not present. Unlikely to occur except on occasion in times of resource shortage.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	–	No	The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range – most of Victoria, south-western NSW and adjacent South Australia – it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes. Roosts in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	Bionet, ALA	Present. Recorded within the 220 m wide project disturbance area on BioNet Atlas.
Scoteanax rueppellii	Greater Broad-nosed Bat	V	–	No	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. This species usually roosts in tree hollows.	Bionet	Moderate. Potential habitat present in project study area.
Vespadelus troughtoni	Eastern Cave Bat	V	–	Yes	The Eastern Cave Bat is found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT. Very little is known about the biology of this uncommon species. A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings. Occasionally found along cliff-lines in wet eucalypt forest and rainforest.	Bionet, ALA	Present. Recorded within the 220 m wide project disturbance area on BioNet Atlas.
Chalinolobus picatus	Little Pied Bat	V	–	No	Found in inland Queensland and NSW (including Western Plains and slopes) extending slightly into South Australia and Victoria. Occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress pine forest and mallee and Bimbil box woodlands. Roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings.	Bionet, ALA	Moderate. Potential habitat present in project study area.

Scientific name	Common name	BC Act[1]	EPBC Act[2]	SAII	Habitat	Source[5]	Likelihood of occurrence
Dasyurus maculatus	Spotted-tailed Quoll	V	E	No	The range of the Spotted-tailed Quoll has contracted considerably since European settlement. It is now found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania. Only in Tasmania is it still considered relatively common. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Quolls use hollow-bearing trees, fallen logs, other animal burrows, small caves and rock outcrops as den sites.	Bionet, PMST, ALA	Moderate. Very large home ranges – may occur through project study area on occasion.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	–	No	Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. Hunts beetles, moths, weevils and other flying insects above or just below the tree canopy. Hibernates in winter. Females are pregnant in late spring to early summer.	Bionet	Low. Not known to occur in area and preferred habitat not present.
Reptiles							
Aprasia parapulchella	Pink-tailed Legless Lizard	V	V	No	The Pink-tailed Legless Lizard is only known from the Central and Southern Tablelands, and the South Western Slopes. Inhabits sloping, open woodland areas with predominantly native grassy ground layers, particularly those dominated by Kangaroo grass. Sites are typically well-drained, with rocky outcrops or scattered, partially buried rocks.	Bionet, PMST, ALA	Moderate. Occurs within known distribution but preferred habitat is limited in project study area.
Delma impar	Striped Legless Lizard	V	V	No	Occurs in the Southern Tablelands, the South West Slopes, the Upper Hunter and possibly on the Riverina. Found in natural temperate grassland, secondary grassland and open box-gum woodland. Habitat is typically dominated by perennial, tussock-forming grasses such as Kangaroo Grass Themeda australis, spear-grasses Austrostipa spp. and poa tussocks Poa spp., and occasionally wallaby grasses Austrodanthonia spp., though can occur in modified grasslands with a significant content of exotic grasses.	PMST	Moderate. Not known to occur in area, some habitat present.

Table B.2 Threatened fish species listed under Fishery Management Act (1994) likelihood of occurrence

Scientific name	Common name	FM Act[4]	EPBC Act[2]	SAII	Habitat	Source[5]	Likelihood of occurrence
Tandanus tandanus	Eel-tailed Catfish	E	–		Eel Tailed Catfish are naturally distributed throughout the Murray-Darling Basin and in the Eastern drainages NSW north of Newcastle. Eel Tailed Catfish numbers in the Murray-Darling Basin have declined due to a range of impacts including invasive species, habitat degradation, cold water pollution and fishing pressures and are now virtually absent from the Murray, Murrumbidgee and Lachlan catchments. The Eel tailed catfish is a non-migratory, benthic (bottom dwelling) species. It is relatively sedentary, and adults typically only move within a 5 km range. They are generally more active at night compared with during the day. They can be found in a diverse range of freshwater environments including rivers, creeks, lakes, billabongs and lagoons. They prefer clear, sluggish or still waters, but can also be found in flowing streams with turbid waters. Substrates range from mud to gravel and rock.	Fisheries NSW Spatial Data Portal	High. Waterways present within the project study area are identified as habitat.
Galaxias rostratus4	Flathead Galaxias	CE	CE	No	Flathead Galaxias are known from the southern part of the Murray Darling Basin. They have been recorded in the Macquarie, Lachlan, Murrumbidgee and Murray Rivers in NSW. Flathead Galaxias are found in still or slow-moving water bodies such as wetlands and lowland streams. The species has been recorded forming shoals. They have been associated with a range of habitats including rock and sandy bottoms and aquatic vegetation.	PMST	Low. No habitat present in the project study area.
Macquaria australasica5	Macquarie Perch	E	E	No	Recent research indicates that there may be at least two distinct forms of Macquarie Perch, one from the western rivers (Murray-Darling Basin form) and one from the eastern rivers (the Shoalhaven and Hawkesbury-Nepean systems) (the coastal form). The species has also been stocked or translocated into a number of reservoirs including Talbingo, Cataract and Khancoban reservoirs and translocated into streams including the Mongarlowe River. Macquarie Perch are found in both river and lake habitats; especially the upper reaches of rivers and their tributaries	PMST	Low. No habitat present in project study area.
Maccullochella macquariensis5	Trout Cod	E	E	No	A single natural population of Trout Cod occurs in the Murray River. Translocated populations also occur in Seven Creeks (a tributary of the Goulburn River) in Victoria and Cataract Dam in coastal NSW (outside the species range). Trout Cod occupy stream positions characterised by a high abundance of large woody debris (or 'snags') in water that is comparatively deep and close to riverbanks. Midstream snags are also an important habitat component.	PMST	Low. No habitat present in in the project study area.
Maccullochella peelii	Murray Cod	–	V	No	Occurs throughout the Murray-Darling Basin in Queensland, NSW, ACT and Victoria up to 1000 m above sea level, as well as several translocated populations. In NSW, translocated populations persist in Cataract Dam and the Nepean River system. Murray Cod utilises a diverse range of habitats from clear rocky streams, such as those found in the upper western slopes of NSW (including the ACT), to slow-flowing, turbid lowland rivers and billabongs.	PMST	Low. No habitat present in the project study area.
Mogurnda adspersa	Southern Purple Spotted Gudgeon	E	–	No	The Southern Purple Spotted Gudgeon occurs in the Murray-Darling basin as well as parts of coastal northern NSW and Queensland. The western population of the Southern Purple Spotted Gudgeon was previously widespread in the Murray, Murrumbidgee and Lachlan River systems and tributaries of the Darling but has experienced a significant decline in recent times. They are now considered to be rare in inland NSW. The species can be found in a variety of habitats such as rivers, creeks, streams and billabongs with slow-flowing or still waters. Cover in the form of aquatic vegetation, overhanging vegetation from riverbanks, leaf litter, rocks or snags are important for the species.	Fisheries NSW Spatial Data Portal	High. Waterways present within the project study area are identified as habitat.

(1) V = Vulnerable, E = Endangered, CE = Critically Endangered, EX = Presumed Extinct under the BC Act
(2) V = Vulnerable, E = Endangered, M = Migratory under the Commonwealth EPBC Act.
(3) Source: PMST = The Department of the Environment and Energy's EPBC Protected Matters Search Tool, BioNet = ESS's Bionet Atlas of NSW Wildlife
(4) Fisheries Management Act 1994

Appendix C

EPBC Significance assessments

C1 Threatened ecological communities

C1.1 White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland

The White Box Yellow Box Blakely's Red Gum Woodland (*Box Gum Woodland*) ecological community is listed Critically Endangered under EPBC Act.

C1.1.1 DESCRIPTION

Box Gum Woodland is characterised by a species-rich understorey of native tussock grasses, herbs and scattered shrubs, and the dominance, or prior dominance, of White Box (*Eucalyptus albens*), Yellow Box (*Eucalyptus* melliodora) and Blakely's Red Gum (*Eucalyptus blakelyi*). Tree-cover is generally discontinuous and consists of widely-spaced trees of medium height.

In its pre-1750 state, this ecological community was characterised by:

- a ground layer dominated by tussock grasses
- an overstorey dominated or co-dominated by White Box, Yellow Box or Blakely's Red Gum, or Grey Box in the Nandewar bioregion
- a sparse or patchy shrub layer.

The Australian Government listing of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland is slightly different to the NSW listing. Areas that are part of the Australian Government listed ecological community must have either:

- an intact tree layer and predominately native ground layer; or
- an intact native ground layer with a high diversity of native plant species but no remaining tree layer.
- *Box Gum Woodland* occurs along the western slopes and tablelands of the Great Dividing Range from southern Queensland through New South Wales and the Australian Capital Territory to Victoria.

Due to the ecological community's occurrence on fertile soils, it has been extensively cleared for agriculture and intact remnants, including both trees and unmodified understorey, are now extremely rare. Clearing and fragmentation for urban, rural residential, agricultural and infrastructure development remain on-going threats to this ecological community, while degradation resulting from inappropriate management and weed invasion by introduced perennial grasses continues to erode the conservation value of remnant areas.

C1.1.2 RELEVANT COMMONWEALTH GUIDELINES AND POLICY STATEMENTS INCLUDING LISTING ADVICE, CONSERVATION ADVICE AND RECOVERY PLAN

A summary of the relevant Commonwealth guidelines and policy statements available for this species is as follows:

- The Species Profile and Threats (SPRAT) database indicates that the extent of this ecological community was included with the Grassy White Box Woodlands ecological community and information on the previously listed ecological community is provided in its Listing Advice (Threatened Species Scientific Committee, 2006)

- The “White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland National Recovery Plan” was developed by New South Wales Department of Environment, Climate Change and Water (2010). Key objectives in this plan include:
  - increasing protection of sites in good condition
  - increasing landscape function of the ecological community through management and restoration of degraded sites
  - increasing transitional areas around remnants and linkages between remnants; and
  - bringing about enduring changes in participating land manager attitudes and behaviours towards environmental protection and sustainable land management practices to increase extent, integrity and function of Box-Gum Grassy Woodland.

C1.1.3 Specific impacts

The following Plant Community Types recorded within the study area were considered to align (were equivalent to) the EPBC Act *Box Gum Woodland* listing:

- PCT 484 – Derived tall spear grass grassland on mainly basalt hills of the Liverpool Plains, Liverpool Range and in the upper Hunter Valley (Merriwa district), south-eastern Brigalow Belt South Bioregion
- PCT 1330 – Yellow Box – Blakelys Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion

The following Plant Community Types recorded within the study area were also considered to align partly to the EPBC Act *Box Gum Woodland* listing:

- PCT 266 – White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
- PCT 268 – White Box – Blakelys Red Gum – Long-leaved Box – Nortons Box – Red Stringybark grass-shrub woodland on shallow soils on hills in the NSW South Western Slopes Bioregion
- PCT 277 – Blakely’s Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion
- PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- PCT 433 – White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub-region, BBS Bioregion
- PCT 434 – White Box grass shrub hill woodland on clay to loam soils on volcanic and sedimentary hills in the southern Brigalow Belt South Bioregion
- PCT 437 – Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion
- PCT 483 - Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley
- PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion
- PCT 511 – Queensland Bluegrass – Redleg Grass – Rats Tail Grass – spear grass – panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion
- PCT 796 – Derived grassland of the NSW South Western Slopes
- PCT 800 – Derived grasslands of the slopes on the Merriwa Plateau.

Based on these assessments, the proposed action is estimated to impact upon of 3660.7 ha of the *Box Gum Woodland* EPBC listed community.

C1.1.4 Significant impact criteria

An action is likely to have a significant impact on a Critically Endangered ecological community if there is a real chance or possibility that it will:

- **REDUCE THE EXTENT OF AN ECOLOGICAL COMMUNITY.**

The proposed action would result in a reduction of the extent of the *Box Gum Woodland*. Approximately 3660.7 ha of this community would be impacted by the proposed action. These potential impacts are considered to significantly reduce the extent of the community within study area, as well as reduce the extent of the community within the region.

- **FRAGMENT OR INCREASE FRAGMENTATION OF AN ECOLOGICAL COMMUNITY, FOR EXAMPLE BY CLEARING VEGETATION FOR ROADS OR TRANSMISSION LINES.**

The proposed action would require the removal and /or disturbance to 3660.7 ha *Box-Gum Woodland* within areas of existing disturbance. This community generally occurs within a fragmented landscape, by other impacts such as agriculture, however given the large extent of clearing of this community the proposed action is likely to significantly increase fragmentation of *Box-Gum Woodland* within the area.

- **ADVERSELY AFFECT HABITAT CRITICAL TO THE SURVIVAL OF AN ECOLOGICAL COMMUNITY**

Box-Gum Woodlands recorded within the survey area occur as fragmented but large patches. Condition of the potential community within the study area has not been assessed via field survey, however, given a precautionary approach, all areas of the associated PCTs are presumed to meet the minimum condition criteria for the community. The "White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland National Recovery Plan" (2010) notes that "g*iven the currently highly fragmented and degraded state of this ecological community, all areas of Box-Gum Grassy Woodland which meet the minimum condition criteria outlined in Section 3 should be considered critical to the survival of this ecological community".*

Based on the recovery plan for this community, all areas that have been assigned are likely to be habitat critical for the community.

- **MODIFY OR DESTROY ABIOTIC (NON-LIVING) FACTORS (SUCH AS WATER, NUTRIENTS, OR SOIL) NECESSARY FOR AN ECOLOGICAL COMMUNITY'S SURVIVAL, INCLUDING REDUCTION OF GROUNDWATER LEVELS, OR SUBSTANTIAL ALTERATION OF SURFACE WATER DRAINAGE PATTERNS.**

Any large-scale excavation that occurs in close proximity to the community or to marginal patches would involve mitigation measures to minimise sedimentation and hydrological impacts. Therefore, the proposed action is considered unlikely to substantially modify or destroy these abiotic factors.

- **CAUSE A SUBSTANTIAL CHANGE IN THE SPECIES COMPOSITION OF AN OCCURRENCE OF AN ECOLOGICAL COMMUNITY, INCLUDING CAUSING A DECLINE OR LOSS OF FUNCTIONALLY IMPORTANT SPECIES, FOR EXAMPLE THROUGH REGULAR BURNING OR FLORA OR FAUNA HARVESTING.**

The proposed action would require the removal and/or disturbance to 3660.7 ha *Box-Gum Woodland* within areas of existing disturbance. The community generally occurs in fragmented nature and is likely to be already modified to a fair extent as a result of existing disturbance practices in the area. No regular burning or flora and fauna harvesting is anticipated to occur as a result of the project.

Therefore, the proposed action is considered unlikely to substantially change the species composition of an occurrence of this community.

- **WILL THE ACTION CAUSE A SUBSTANTIAL REDUCTION IN THE QUALITY OR INTEGRITY OF AN OCCURRENCE OF AN ECOLOGICAL COMMUNITY, INCLUDING, BUT NOT LIMITED TO:**
    1. **assisting invasive species, that are harmful to the listed ecological community, to become established**
    2. **causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community.**

Box-Gum Woodlands within the project area are currently subject to weed and pest invasion. Additionally, the majority of the proposed action occurs within previously disturbed agricultural land. Therefore, it is considered unlikely that the proposed action would substantially reduce the quality or integrity of the community's occurrence or significantly increase the spread of invasive species.

Additionally, mitigation measures put in place for the project, such as weed and pest management, vegetation clearing protocols, sediment and hydrological control measures would be put in place to minimise the likelihood of spread of weeds or pathogens into the site. These mitigation measures would aid in reducing potential impacts associated with the proposed action that may otherwise result in the further reduction of the community's quality.

- **INTERFERE WITH THE RECOVERY OF AN ECOLOGICAL COMMUNITY**

A national recovery plan was written for *Box Gum Woodlands* by the NSW Department of Environment, Climate Change and Water in 2010 and was adopted by the Commonwealth in 2013. The following are the objectives of the National Recovery Plan:

- achieving no net loss in extent and condition of the ecological community throughout is geographic distribution
- increasing protection of sites with high recovery potential
- increasing landscape functionality of the ecological community through management and restoration of degraded sites
- increase transitional areas around remnants and linkages between remnants; and
- bringing about enduring changes in participating land manager attitudes and behaviours towards environmental protection and sustainable land management practices to increase extent, integrity and function of Box Gum Woodlands.

The proposed action is likely to remove 3660.7 ha of this community, which is likely to significantly reduce and fragment the community and interfere with the recovery of Box Gum Woodlands in the region.

- **CONCLUSION**

Approximately 3660.7 ha of the EPBC listed ecological community would be removed. The proposed action would result in a reduction of the extent of the *Box-Gum Woodlands* within the Project study area, all of which is considered habitat critical to the survival of this community. The proposed action would significantly reduce the extent of the community, interfere with the recovery of the community and has the potential to increase fragmentation of *Box-Gum Woodland* within the area.

For these reasons, the proposed action is **likely to have a significant impact** on this community.

C1.2 Grey Box Grassy Woodlands and Derived Native Grasslands

Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (*Grey Box Woodlands*) is listed as an Endangered Ecological Community under the EPBC Act.

C1.2.1 Description

Grey Box Woodlands occupy a position in the landscape that is transitional between the temperate woodlands and forests of the lower slopes and tablelands of south-eastern Australia, and the semi-arid communities further inland. The ecological community typically occurs in landscapes of low-relief on productive soils derived from alluvial or colluvial materials but may occur on a range of substrates. The ecological community tends to occupy drier sites of the belt of grassy woodlands in south-eastern Australia, within a rainfall zone of 375–700 mm/year (Department of the Environment Water Heritage and the Arts, 2010a).

This community includes those woodlands in which the dominant tree species is *Eucalyptus microcarpa* (Inland Grey Box) and is often found in association with *Eucalyptus populnea* subsp. *bimbil* (Bimble or Poplar Box), *Callitris glaucophylla* (White Cypress Pine), *Brachychiton populneus* (Kurrajong), *Allocasuarina luehmannii* (Bulloak) or *Eucalyptus melliodora* (Yellow Box), and sometimes with *Eucalyptus albens* (White Box). Shrubs are typically sparse or absent, although this component can be diverse and may be locally common, especially in drier western portions of the community. A variable ground layer of grass and herbaceous species is present at most sites. At severely disturbed sites the ground layer may be absent. The community generally occurs as an open woodland 15–25 m tall, but in some locations the overstorey may be absent as a result of past clearing or thinning, leaving only an understorey (Department of the Environment Water Heritage and the Arts, 2010a; Threatened Species Scientific Committee, 2010).

C1.2.2 Distribution

Grey Box Woodlands occurs from central-western NSW, through northern and central Victoria into South Australia. Occurring predominantly within the Riverina and South West Slopes regions of NSW down to the Victorian border (Department of the Environment Water Heritage and the Arts, 2010a; Threatened Species Scientific Committee, 2010).

C1.2.3 RELEVANT COMMONWEALTH GUIDELINES AND POLICY STATEMENTS INCLUDING LISTING ADVICE, CONSERVATION ADVICE AND RECOVERY PLAN

A summary of the relevant Commonwealth guidelines and policy statements available for this species is as follows:

- Relevant listing advice: Commonwealth Listing Advice on Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (Threatened Species Scientific Committee, 2010). In effect under the EPBC Act from 01-Apr-2010
- Approved conservation advice: Approved Conservation Advice for the Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-east Australia (Department of the Environment Water Heritage and the Arts, 2010a). In effect under the EPBC Act from 01-Apr-2010.

C1.2.4 Specific impacts

The following Plant Community Type within the Project study area were considered to align (in part) with the EPBC Act *Grey Box Woodlands* listing:

- PCT 81 – Western Grey Box – cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion

Based on these assessments, the proposed action is estimated to impact upon of XXXha of the *Grey Box Woodlands*.

C1.2.5 Significant impact criteria

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- **REDUCE THE EXTENT OF AN ECOLOGICAL COMMUNITY**

The community occurs as very small, scattered remnants within the locality. The proposed action would result in a reduction of the extent of the *Grey Box Woodlands*. Approximately 5.5 ha of this community would be impacted by the proposed action. These potential impacts are considered to reduce the extent of the community within the region.

- **FRAGMENT OR INCREASE FRAGMENTATION OF AN ECOLOGICAL COMMUNITY, FOR EXAMPLE BY CLEARING VEGETATION FOR ROADS OR TRANSMISSION LINES**

The proposed action involves the installation of a transmission line and would require the removal and/or disturbance to 5.5 ha *Grey Box Woodlands* within areas of existing disturbance. *Grey Box Woodlands* generally occurs within a fragmented landscape, modified over time by land use such as agriculture, but the bisection of patches for linear clearing will marginally increase fragmentation of *Grey Box Woodlands* within the locality.

- **ADVERSELY AFFECT HABITAT CRITICAL TO THE SURVIVAL OF AN ECOLOGICAL COMMUNITY**

No critical habitat has been listed for the *Grey Box Woodlands* ecological community under the EPBC Act (Department of agriculture Water and the Environment, 2022b).

Habitat critical to the survival of ecological communities also refers to areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long-term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community.

Grey Box Woodlands recorded within the project study area currently occurs as patches which have been exposed over time to varying levels of disturbance and condition within the project area is likely varied as a result. Given the extent and distribution of this community, it is unlikely that any areas to be cleared for the proposed action are habitat critical to the survival of this community.

- **MODIFY OR DESTROY ABIOTIC (NON-LIVING) FACTORS (SUCH AS WATER, NUTRIENTS, OR SOIL) NECESSARY FOR AN ECOLOGICAL COMMUNITY'S SURVIVAL, INCLUDING REDUCTION OF GROUNDWATER LEVELS, OR SUBSTANTIAL ALTERATION OF SURFACE WATER DRAINAGE PATTERNS**

The proposed action would require the removal of up to 5.5 ha of *Grey Box Woodlands*.

Any large-scale excavation that occurs in close proximity to *Grey Box Woodlands* or to marginal patches would involve mitigation measures to minimise sedimentation and hydrological impacts. Therefore, the proposed action is considered unlikely to substantially modify or destroy these abiotic factors.

- **CAUSE A SUBSTANTIAL CHANGE IN THE SPECIES COMPOSITION OF AN OCCURRENCE OF AN ECOLOGICAL COMMUNITY, INCLUDING CAUSING A DECLINE OR LOSS OF FUNCTIONALLY IMPORTANT SPECIES, FOR EXAMPLE THROUGH REGULAR BURNING OR FLORA OR FAUNA HARVESTING.**

The proposed action would require the removal and /or disturbance to 5.5 ha *Grey Box Woodlands* within areas of existing disturbance. The community generally occurs in fragmented nature and is likely to be already modified to a fair extent as a result of existing disturbance practices in the area. No regular burning or flora and fauna harvesting is anticipated to occur as a result of the project.

Therefore, the proposed action is considered unlikely to substantially change the species composition of an occurrence of this community.

- **WILL THE ACTION CAUSE A SUBSTANTIAL REDUCTION IN THE QUALITY OR INTEGRITY OF AN OCCURRENCE OF AN ECOLOGICAL COMMUNITY, INCLUDING, BUT NOT LIMITED TO:**

  1. **assisting invasive species, that are harmful to the listed ecological community, to become established**
  2. **causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community.**

Grey Box Woodlands within the Project study area is currently subject to weed and pest invasion. Additionally, the majority of the proposed action occurs within previously disturbed land. Therefore, it is considered unlikely that the proposed action would substantially reduce the quality or integrity of the *Grey Box Woodland's* occurrence or significantly increase the spread of invasive species.

Additionally, mitigation measures would be implemented during construction to minimise the likelihood of spread of weeds or pathogens into the project study area and minimise sedimentation and hydrological impacts.

- **INTERFERE WITH THE RECOVERY OF AN ECOLOGICAL COMMUNITY**

To date, no recovery plan has been developed by the Department of Agriculture, Water and the Environment for *Grey Box Grassy Woodlands*. Conservation Advice on *Grey Box Woodlands* recognises the main ongoing threats to this TEC to include: incremental clearance of vegetation; inappropriate grazing regimes; fragmentation; loss and/or decline of mature trees; weed invasion; inappropriate use of fertilisers and herbicides (Department of the Environment Water Heritage and the Arts, 2010a). The Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-Eastern Australia Conservation Advice (Department of the Environment Water Heritage and the Arts, 2010a) also provides a number research priorities, and priority recovery and threat abatement actions aimed at protecting remaining areas of the community. The proposed action would contribute to key threats as it involves clearing of the TEC and therefore the proposed action would interfere with the recovery of this TEC.

- **CONCLUSION**

The community occurs as small, scattered remnants within the locality. The proposed action will clear 5.5 ha of habitat and is likely to fragment this community and reduce the extent within the locality. Where possible the clearing of this community will be avoided during detailed design and mitigation measures would be put in place for the project to reduce impacts.

However, despite these mitigation measures, the proposed action is expected to result in a reduction in the extent of this TEC within the locality and may marginally increase fragmentation at the local scale. Therefore, it is possible that the proposed action **may have a significant impact** on Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands.

C2 Threatened species

C2.1 Regent Honeyeater (*Anthochaera phrygia*)

The Regent Honeyeater is listed as Critically Endangered under the EPBC Act.

C2.1.1 Description

The Regent Honeyeater is a nomadic and partially migratory woodland bird, which has a patchy distribution between south-east Queensland and central Victoria. Some predictable seasonal movements have been observed, and breeding varies between regions and corresponds with flowering of key eucalypt and mistletoe species (Department of Agriculture Water and the Environment, 2022a).

The species is predominantly found along inland slopes of the Great Dividing Range in areas containing moist, fertile soils. It prefers box-ironbark eucalypt woodland and dry sclerophyll forest, but also inhabits riparian vegetation including She-oak (*Casuarina* spp.). Lowland coastal forest may also act as a refuge habitat during periods of drought, and they may also be found in remnant patches of farmland and urban areas (Department of Environment, 2015).

The Regent Honeyeater primarily feeds on nectar which it obtains from eucalyptus flowers and mistletoes, but also feeds on invertebrates and their exudates (lerp, honeydew), and occasionally fruit. This species roosts communally in small groups or large flocks, in trees with dense foliage, and foraging trees are rarely used for roosting (Department of Environment, 2015).

Breeding appears to correspond with the flowering of key eucalypt and mistletoe species and varies between regions, usually occurring from August to January. Cup shapes nests are constructed usually in the canopy of mature trees with rough bark, and a clutch consists of two to three eggs (Department of Environment, 2015).

Listed threats include:

- clearing, fragmentation and degradation of habitat, particularly the removal of large mature trees important for feeding or breeding
- competition for resources with birds such as the Noisy Minor and (*Manorina melanocephala*) and Noisy Friarbird (*Philemon corniculatus*), and nest predation by Pied Currawongs (*Strepera graculina*) (Department of Environment, 2015).

C2.1.2 Relevant commonwealth guidelines and policy statements including listing advice, conservation advice and recovery plan

A summary of the relevant Commonwealth guidelines and policy statements available for this species is as follows:

- The approved *Conservation Advice* Anthochaera phrygia *Regent Honeyeater* (Department of Environment, 2015) was reviewed as part of this assessment.
- The *National Recovery Plan for the Regent Honeyeater* (Anthochaera phrygia) (Department of the Environment, 2016) was reviewed as part of this assessment.

Relevant adopted/made threat abatement plans include:

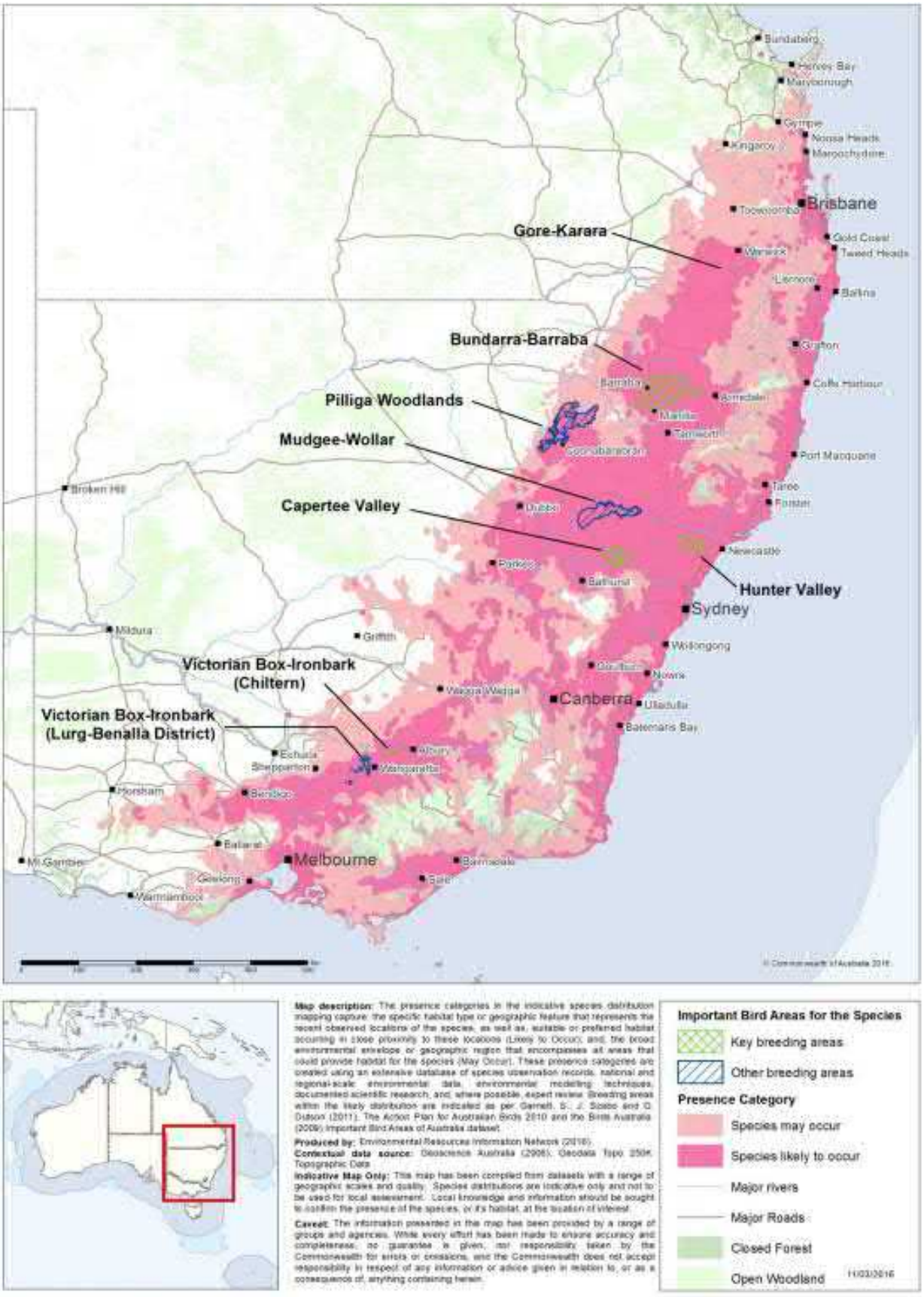
- Threat abatement plan for competition and land degradation by rabbits (Department of Environment and Energy, 2016)

Relevant survey guidelines for this species include:

- *Survey Guidelines for Australia's Threatened Birds* (Department of the Environment Water Heritage and the Arts, 2010b)

C2.1.3 Specific impacts

Regent Honeyeater has potential habitat associations within the project study area within a number of PCTs, which represent potential foraging and breeding habitat for the species. In addition, the *National Recovery Plan for the Regent Honeyeater* (Anthochaera phrygia) (Department of the Environment, 2016) outlines that critical habitat for the Regent Honeyeater includes any breeding or foraging habitat in areas where the species is likely to occur (as defined by the distribution map (see Figure C.1 below) and any newly discovered breeding or foraging locations. Key areas identified as important habitat in the recovery plan include the Bundarra-Barraba, Pilliga Woodlands, Mudgee-Wollar and the Capertee Valley and Hunter Valley areas in New South Wales, and the Chiltern and Lurg-Benalla regions of north-east Victoria. The development footprint associated with the proposed action overlaps with 315.9 ha of key habitat mapping for the Regent Honeyeater, specifically the Mudgee-Wollar area, identified as a key breeding area for the species. The project therefore has the potential to remove 315.9 ha of key habitat for the species, with the potential to trigger Serious and Irreversible Impact to the Regent Honeyeater (Department of Planning Industry and Environment, 2021). The project will also impact foraging habitat for the species, in particular removing up to 3660.7 ha of the EPBC listed *Box Gum Woodlands*, a known foraging habitat resource for the species.



Source: (Department of the Environment, 2016)

Figure C.1 Distribution map provided in the national recovery plan for the Regent Honeyeater

C2.1.4 Significant impact criteria

An action is likely to have a significant impact on a Critically Endangered Species if there is a real chance or possibility that it will:

- **LEAD TO A LONG-TERM DECREASE IN THE SIZE OF A POPULATION**

The project is likely to impact 315.9 ha of important breeding habitat for the Regent Honeyeater, including the Mudgee-Wollar area, identified in the national recovery plan for the species as a location the species is known to occur (Department of the Environment, 2016), as well as significant areas of foraging habitat for the species within the project area. As a population of the species is known to occur in the area and the project is likely to substantially reduce the amount of foraging and breeding habitat available to this species within the location, it is possible that the project would significantly contribute to a long-term decline in the size of a population of these species.

- **REDUCE THE AREA OF OCCUPANCY OF THE SPECIES**

The project is likely to impact 315.9 ha of important breeding habitat as well as a large amount of foraging habitat available to the species within the locality. As the project will impact on a known area of occupied breeding habitat for the species, the project would reduce the area of occupancy for Regent Honeyeater.

- **FRAGMENT AN EXISTING POPULATION INTO TWO OR MORE POPULATIONS**

The Project study area is already largely fragmented, and habitat remaining occurs as disjunct remnant patches and as scattered paddock trees within the locality. Regent Honeyeater is a highly mobile species and is known to disperse widely (Higgins, Peter, & Steele, 2001), and consequently is unlikely that the proposed action would present a significant barrier to this species, although the project is likely to remove a large amount of foraging habitat and key breeding habitat which would impact on known populations. Nevertheless, it is considered unlikely that the proposed action would fragment an existing population into two or more populations given the ecology of the species, the existing fragmented state of potential foraging habitat, and that the clearing would occur at the edge of important breeding habitat.

- **ADVERSELY AFFECT HABITAT CRITICAL TO THE SURVIVAL OF A SPECIES**

The *National Recovery Plan for the Regent Honeyeater* (Anthochaera phrygia) (Department of the Environment, 2016) states that habitat critical to the survival of the regent honeyeater includes: 1) Any breeding or foraging areas where the species is likely to occur and 2) Any newly discovered breeding or foraging locations.

Key areas of critical habitat listed for the species includes the Bundarra-Barraba, Pilliga Woodlands, Mudgee-Wollar and the Capertee Valley and Hunter Valley areas in New South Wales, and the Chiltern and Lurg-Benalla regions of north-east Victoria, inclusive of a number of subsidiary areas within these regions.

The project study area footprint occurs within a mapped area of important breeding habitat for the Regent Honeyeater, the Mudgee-Wollar area and is anticipated to clear up to 315.9 ha of this mapped habitat. The project would also clear a large amount of potential foraging habitat for the species.

Consequently, the project is likely to adversely impact habitat critical to the survival of the Regent Honeyeater.

- **DISRUPT THE BREEDING CYCLE OF A POPULATION**

The proposed action is likely to impact on 315.9 ha of mapped breeding habitat for the Regent Honeyeater. Removal of this habitat would reduce the breeding opportunities available to individuals occurring in this area, which is known to be utilised by populations of the species. Consequently, the proposed action is likely to disrupt the breeding cycle of a population.

- **MODIFY, DESTROY, REMOVE OR ISOLATE OR DECREASE THE AVAILABILITY OR QUALITY OF HABITAT TO THE EXTENT THAT THE SPECIES IS LIKELY TO DECLINE**

The proposed action is likely to impact on 315.9 ha of mapped breeding habitat for the Regent Honeyeater and a large amount of potential foraging habitat including up to 3660.7 ha of the EPBC listed *Box Gum Woodland*. Removal of these foraging and breeding resources for the Regent Honeyeater are likely to reduce breeding opportunities and result in a significant reduction in the overall habitat available to the species within the locality, likely reducing the overall area of occupancy of the species. Given the overall extent of habitat impacted by the proposed action, it is likely that the project would modify, destroy, remove or isolate habitat for this species to the extent that is likely to cause the species to decline.

- **RESULT IN INVASIVE SPECIES THAT ARE HARMFUL TO A CRITICALLY ENDANGERED OR ENDANGERED SPECIES BECOMING ESTABLISHED IN THE ENDANGERED OR CRITICALLY ENDANGERED SPECIES' HABITAT**

Adhering to mitigation measures which would be put in place for the project such as pest management, weed and pathogen controls, would prevent potentially harmful invasive weeds and vertebrate pests such as rabbits, cats and foxes establishing in Regent Honeyeater habitat.

- **INTRODUCE DISEASE THAT MAY CAUSE THE SPECIES TO DECLINE**

It is unlikely that disease would be increased by the project. Mitigation measures such as weed and pathogen control would be implemented by the project to minimise the likelihood of spread of disease or pathogens that could be potentially harmful to this species.

- **INTERFERE SUBSTANTIALLY WITH THE RECOVERY OF THE SPECIES**

The *National Recovery Plan for the Regent Honeyeater* (*Anthochaera phrygia*) (Department of the Environment, 2016) outlines to key recovery objectives for the species being:

- reverse the long-term population trend of decline and increase the numbers of regent honeyeaters to a level where there is a viable, wild breeding population, even in poor breeding years; and to
- enhance the condition of habitat across the regent honeyeaters range to maximise survival and reproductive success and provide refugia during periods of extreme environmental fluctuation.

The plan also outlines a number of recovery strategies to meet these objectives including:

- improve the extent and quality of regent honeyeater habitat
- bolster the wild population with captive-bred birds until the wild population becomes self-sustaining
- increase understanding of the size, structure, trajectory and viability of the wild population
- maintain and increase community awareness, understanding and involvement in the recovery program.

Based on the potential impacts of the proposed action on this species, as discussed above, it is likely that the proposed action would be in conflict with the objectives and the first strategy of the recovery plan by reducing the extent of Regent Honeyeater habitat and impacting on the breeding opportunities and habitat condition for the species.

- **CONCLUSION**

The project is likely to impact on 315.9 ha of mapped breeding habitat, outlined in the *National Recovery Plan for the Regent Honeyeater* (Anthochaera phrygia) (Department of the Environment, 2016) as habitat critical to the survival of the species as well as a large amount of potential foraging habitat that occurs within the project study area. The removal of this habitat is likely to impact on both foraging and breeding resources for the species and impact on known areas of occurrence, likely reducing the overall area of occupancy of the species. Considering the above information, the proposed action is **considered likely to have a significant impact** on the Regent Honeyeater.

About Us

WSP is one of the world's leading professional services consulting firms. We are dedicated to our local communities and propelled by international brainpower. We are technical experts and strategic advisors including engineers, technicians, scientists, planners, surveyors and environmental specialists, as well as other design, program and construction management professionals. We design lasting solutions in the Transport & Water, Property & Buildings, Earth & Environment, and Mining & Power sector as well as offering strategic Advisory, Engagement & Digital services. With approximately 6,100 talented people in more than 50 offices in Australia and New Zealand, we engineer future ready projects that will help societies grow for lifetimes to come. www.wsp.com/en-au/.

Appendix D

Preliminary heritage assessment

Appendix D: Preliminary Aboriginal and historical heritage assessment

Central-West Orana Renewable Energy Zone Transmission Project

Prepared for WSP Australia on behalf of Energy Corporation NSW

August 2022

Appendix D: Preliminary Aboriginal and historical heritage assessment

Central-West Orana Renewable Energy Zone Transmission Project

WSP Australia on behalf of Energy Corporation NSW

E220326 RP#1

August 2022

Version	Date	Prepared by	Approved by	Comments
Final	26 August 2022	Morgan Wilcox, Pamela Kottaras, Amelia O'Donnell	Alan Williams	-

Approved by

Dr Alan Williams FSA FRSA MAACAI
National Technical Leader, Aboriginal Heritage
26 August 2022

Ground floor 20 Chandos Street
St Leonards NSW 2065
PO Box 21
St Leonards NSW 1590

Executive Summary

The NSW Government is leading the development of Renewable Energy Zones (REZ) across NSW. REZs are modern day power stations which combine renewable energy generation (such as wind and solar) and energy storage systems (such as batteries and pumped hydro), supported by transmission infrastructure (high voltage (HV) poles and wires). A REZ groups new wind and solar power generation, undertaken by private developers into locations where it can be efficiently stored and transmitted across NSW and the National Energy Market (NEM), requiring the coordination of power generation and transmission infrastructure by the Energy Corporation of NSW (EnergyCo). EnergyCo is the NSW Government-controlled statutory authority that will lead the delivery of REZs in NSW.

Five REZs have been announced in NSW, including the Central-West Orana REZ. This Preliminary Aboriginal and historical heritage assessment is in respect of a project to facilitate the Central-West Orana REZ which has an intended network capacity of at least 3,000 megawatts. As the existing transmission network is not capable of transferring this amount of new electricity generation in the Central-West Orana REZ, new transmission infrastructure is needed to connect the new electricity generation and storage projects in the REZ to the NEM.

This preliminary Aboriginal and historical heritage assessment identifies the location and significance of known or anticipated cultural heritage within the project study area. The project study area is generally a 1 km wide corridor in which the infrastructure would be located, and which extends north to south from Coolah to Wollar and east to west from Cassilis to Goolma. It crosses through the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter Local Government Areas (LGAs). A refined corridor for the project would be identified in the Environmental Impact Statement (EIS).

Key findings of the assessment included:

- Aboriginal heritage
    - The project study area has only been subject to localised investigation as a result of surrounding extractive, solar and wind farm activities. This demonstrates that:
        - In the vicinity of Wollar, Wilpinjong and Moorlarben, there is high potential for rockshelter site types in areas where sandstone outcropping and steep relief occur. This may also be the case for other parts of the project east of Uarbry.
        - To the west encompassing areas around Merotherie, Elong Elong and Uarbry, the archaeological record is dominated by stone artefacts of typically low densities. These are found in a wide range of environments and landforms, although more extensive deposits are found in proximity to major tributaries. Artefacts are typically found on the surface and may also be shallowly buried. Also within these environments, sites such as grinding grooves and culturally modified trees have also been documented, where environmental conditions are met.
        - Cultural sites are also documented in the region. Currently, these are poorly understood and typically reflect visually dominant features in the landscape, such as hills and ranges. However, other site types, such as the birthing tree at Wollar may also be encountered elsewhere in the region.
    - A review of the Heritage NSW AHIMS database identified some 2,847 previously documented Aboriginal sites. These were dominated by stone artefactual sites (2,295, ~81%), PADs (313, ~11%), culturally modified trees (148, ~5%), and grinding grooves (65, ~2%). Of these, 295 are documented within the project study area, and which reflect the main site types across the broader assemblage, including stone artefactual sites (262, ~89%), PADs (27, ~9%), and culturally modified trees (11,

~4%). Of note is a site identified as the 'UIan Wilpinjong Creek bora ground' (#36-3-0044), which may reflect an important location of past ceremonial activity and would form a focus of subsequent investigation.

- Historical heritage

  - A review of heritage registers was undertaken to ascertain the number of items that occur in, within 5 km of and within 20 km of the project study area to provide a broader context of the cultural landscape within which the project is situated.

  - Some 264 listed heritage items occur within 20 km of the project study area. Of these, three are within the project study area and 22 are within 5 km (Figure 5.1; Annexure A). These can be characterised as residential and rural properties extending over the last 250 years and focussing on urban conurbations, such as Wollar, Coolah, Gulgong and Cassilis. The three heritage items that occur in the project study area are of local heritage significance and are listed in local environmental plans; they include rural homestead complexes and the Goulburn River National Park. There are no previously identified items within the project study area listed on the State Heritage Register, State Heritage Inventory, Section 170 Registers, National Heritage List, Commonwealth Heritage List and Register of National Estate.

  - A preliminary field survey identified a previously recorded, but unlisted, family cemetery and a former inn site (also referred to as a Cobb & Co site in some literature), within the project study area in the vicinity of the Elong Elong Energy Hub.

  - The Department of Planning and Environment mapping incorrectly maps an item known as 'Homestead' (Mid-Western Regional LEP, Item 367) as overlapping with the Wandoona Homestead curtilage. This item is instead located approximately 3 km south of the Wollar substation and is outside of the project study area. The correct location of item 367 (I367) is shown on Figure 5.1 in this report.

  - Parts of the Goulburn River National Park are being considered for inclusion on the National Heritage List (NHL: 105696 – Nominated Place) as part of an extension to the Greater Blue Mountains Area (NHL: 105999 and World Heritage List – WHL:105127).

This preliminary assessment has identified a general lack of previous historical heritage investigations within the project study area, which has generally only been indirectly considered by surrounding extractive, wind and solar farm projects that have occasionally investigated lands within the project study area. There is also a need for further consideration of both Aboriginal and historical cultural landscapes, which have not formed a focus of previous investigations but are becoming increasingly important.

The preliminary Aboriginal and historic heritage assessments contained in this report have identified a number of recommended assessments to be considered as part of the EIS, including:

Development of an Aboriginal Cultural Heritage Assessment (ACHA) in broad accordance with Heritage NSW guidelines, which includes:

- consultation with Aboriginal stakeholders in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010.* The aims of the consultation process are to identify relevant stakeholders, provide a means of communication and information exchange, and identify areas and sites of known cultural significance to the Aboriginal community;

- a desktop review of existing Aboriginal heritage datasets, relevant reports, topographic maps, aerial photographs and geological and soil landscape mapping within the project study area;

- development of a landscape-based predictive model of the archaeological resource using relevant and comparable local and regional data, and map areas of relative predicted archaeological sensitivity across the project study area. This will inform areas to target in subsequent survey and test excavation stages;

- completion of archaeological field assessment of the project study area with the participation of Aboriginal stakeholder representatives. Archaeological field assessment will include survey of the proposed route alignment(s) (approximately 200-220 m wide), in addition to test excavation of proposed impact areas (ie tower locations) where/if they are found to interact with areas of PAD, or previously recorded and newly recorded Aboriginal sites;

- provide input into the project design refinement process and develop an assessment of potential impacts on Aboriginal heritage cultural values and sites by the project; and

- develop appropriate management and mitigation strategies which seek to avoid or minimise impacts to Aboriginal heritage.

• Development of a historic heritage assessment (archaeological, built and landscape values) and a Statement of Heritage Impact (SoHI) in broad accordance with Heritage NSW guidelines, which includes:

  - targeted documentary research to understand the historical development of the project study area;

  - development of a predictive model of the archaeological resource using relevant and comparable local and regional data, and map areas of relative predicted historic heritage sensitivity to both assist in the identification of potential archaeological sites and surviving built structures or other previously unidentified features;

  - field survey within the project study area to validate the predictive model;

  - significance assessment of the historical values in the project area to guide future project decisions;

  - assessment of the potential impact (direct or indirect) by the project to identified historic heritage values; and

  - development of appropriate management and mitigation strategies which seek to avoid or minimise impacts to historic heritage.

TABLE OF CONTENTS

Annexures

Tables

Figures

1 Introduction

1.1 Background

New South Wales (NSW) is currently undergoing an energy sector transformation that will change how we generate and use energy. The National Energy Market (NEM) (managed by the Australian Energy Market Operator (AEMO)) is transitioning from a system dominated by small number of large coal-fired generators located close to metropolitan centres to one of diverse renewable and distributed energy generation and storage located where the resource and environmental constraints permit.

The NSW Government is leading the development of Renewable Energy Zones (REZ) across NSW. REZs are modern day power stations which combine renewable energy generation (such as wind and solar) and energy storage systems (such as batteries and pumped hydro), supported by transmission infrastructure (high voltage (HV) poles and wires). A REZ groups new wind and solar power generation, undertaken by private developers into locations where it can be efficiently stored and transmitted across NSW and the NEM, requiring the coordination of power generation and transmission infrastructure by Energy Corporation of NSW (EnergyCo). EnergyCo is the NSW Government-controlled statutory authority that will lead the delivery of REZs in NSW.

Five REZs have been announced in NSW. This Preliminary Aboriginal and historical heritage assessment is in respect of a project (described in Section 1.2) to facilitate the Central-West Orana REZ which has an intended network capacity of at least 3,000 megawatts. As the existing transmission network is not capable of transferring this amount of new electricity generation in the Central-West Orana REZ, new transmission infrastructure is needed to connect the new electricity generation and storage projects in the REZ to the National Energy Market (NEM).

1.2 Project overview

EnergyCo is proposing the construction and operation of new high voltage electricity transmission infrastructure and new energy hubs and switching stations required to connect new energy generation and storage projects within the Central-West Orana REZ to the existing electricity network (the project). The project would enable at least 3,000 megawatts of new network capacity to be unlocked by the mid-2020s and enable generators within the Central-West Orana REZ to export electricity to the rest of the network. The development of renewable energy generation and storage projects in the Central-West Orana REZ are subject to separate approvals.

An overview of the project is shown in Figure 1.1 and key features include:

- a new switching station at Wollar, to connect the project to Trangrid's existing Wollar Substation and onto the National Electricity Market.
- new twin double circuit 500 kV transmission lines and associated infrastructure to connect to the NEM and single and double circuit 330 kV single lines to connect energy generation and storage projects within the Central-West Orana REZ to the energy hubs
- energy hubs at Merotherie and Elong Elong, to connect energy generation and storage projects within the Central-West Orana REZ to the new 500 kV network infrastructure

- switching stations along the 330 kV network infrastructure to transfer the energy generated from the energy generation projects onto the 330 kV network infrastructure
- establishment and upgrade of access tracks and public roads, and other ancillary works such as laydown and staging areas, earthwork material sites with crushing and screening plants, concrete batching plants, brake/winch sites, site offices and workforce accommodation camps
- utility adjustments require for construction of the new network infrastructure.

It is expected that construction of the project would commence in the second half of 2024 and take approximately three years to complete with initial operations commencing as early as mid-2027.

The project includes a southern extension of the transmission network between Elong Elong and Mumbil with a connection to the NSW transmission network. This section is under investigation and will be subject to a separate planning approval.

The project study area is generally a 1 kilometre (km) wide corridor in which the proposed transmission line, energy hubs and switching stations would be located. A refined corridor for the project would be identified in the EIS. Additional locations that may be required for specific uses (such as access tracks, construction compounds and workforce accommodation camps) outside the project study area would also be identified in the EIS.

1.3 Purpose of this assessment

The principal objectives of this report are to:

- identify known and potential Aboriginal cultural heritage sites and landscapes within the project study area;
- identify known and potential historical heritage places and landscapes within the project study area; and
- provide foundational information for future investigations required for project approval (as outlined in Table 1.1) and outline the assessments that would be recommended as part of the EIS for the project.

1.4 Legislative context

Table 1.1 summarises the Commonwealth and State legislation that manage heritage in the project study area and how it applies to the project.

Table 1.1 Commonwealth and State legislation relevant to the project

Legislation	Description	Relevant to the project?	Details
Commonwealth			
Environment Protection and Biodiversity Conservation Act 1999	Recognises sites with universal value on the World Heritage List (WHL). Protects heritage places with outstanding heritage value to the nation on the National Heritage List (NHL), and significant heritage value	No	There are no heritage places within the project study area that are listed on the WHL, NHL, or the CHL.

Table 1.1 Commonwealth and State legislation relevant to the project

Legislation	Description	Relevant to the project?	Details
	on the Commonwealth Heritage List (CHL).		
Native Title Act 1993	Administers rights and interests over lands and waters by Aboriginal people. Provides for negotiation and registration of Indigenous Land Use Agreements (ILUAs). Often used in NSW to identify relevant stakeholders for consultation.	Yes	The project study area includes lands which are currently subject to the following active native title claims: - Gomeroi People (NC2011/006) - Warrabinga-Wiradjuri #7 (NC2018/002)
Aboriginal and Torres Strait Islander Heritage Protection Act 1984	Preserves and protects areas and objects of particular significance to Aboriginal people that are under threat from injury or desecration.	No	There are no areas or objects within the project study area subject to a Declaration under the Act.
State			
Environmental Planning and Assessment Act 1979	Requires environmental impacts, including to heritage, to be considered in land use planning. Provides for the development of environmental planning instruments, including State Environmental Planning Policies and Local Environmental Plans.	Yes	The project has been declared Critical State Significant Infrastructure (CSSI) project and is subject to Part 5, Division 5.2, of this Act. The Secretary's Environmental Assessment Requirements (SEARs) for the project are expected to require an Aboriginal heritage impact assessment is (in accordance with standard Heritage NSW procedures and guidelines) to assess whether the project has the potential to impact on Aboriginal objects, sites, or places of Aboriginal heritage significance.
Heritage Act 1977	Primary piece of State legislation affording protection to items of environmental heritage (natural and cultural) in NSW. Items on the State Heritage Register (SHR) cannot be change without approval under Section 6 of the Heritage Act 1977. Permits are also required to disturb or excavate relics (archaeological resources of local or State significance) and are issued by the NSW Heritage Council under Section 140 of the Heritage Act 1977.	Yes	As a CSSI project, activity-specific approval is not required for change to SHR listed items or relics but typically the SEARs stipulate that change will be managed in accordance with the *NSW Heritage Manual* (which is a collection of guidelines in keeping with the Heritage Act.
National Parks and Wildlife Act 1974	Provides blanket protection for all Aboriginal objects and declared Aboriginal places. The Act includes processes and mechanisms for development where Aboriginal objects	Yes	All Aboriginal sites identified within the project study area will be protected under the NPW Act. While an Aboriginal heritage impact permit to harm tangible Aboriginal cultural heritage under this Act is not required for CSSI projects, the SEARs apply guidelines prepared

Table 1.1 Commonwealth and State legislation relevant to the project

Legislation	Description	Relevant to the project?	Details
	are present, or where Aboriginal Places are proposed for harm.		under this Act relating to consultation and assessment of impacts of CSSI projects on cultural heritage.
Aboriginal Land Rights Act 1983	Establishes Local Aboriginal Land Councils (LALCs). It allows the transfer of ownership of vacant crown land to a Local Aboriginal Land Council. The Office of the Registrar, Aboriginal Land Rights Act 1983 (ORALRA), registers Aboriginal land claims and maintains the Register of Aboriginal Owners. Often used in NSW to identify relevant stakeholders for consultation.	No	A request to search the Register of Aboriginal Owners was made to the ORALRA. No response has been received, however consultation with all LALCs encompassing the project study area has been initiated and is ongoing.

1.5 Report terminology

The following terms are used in reporting:

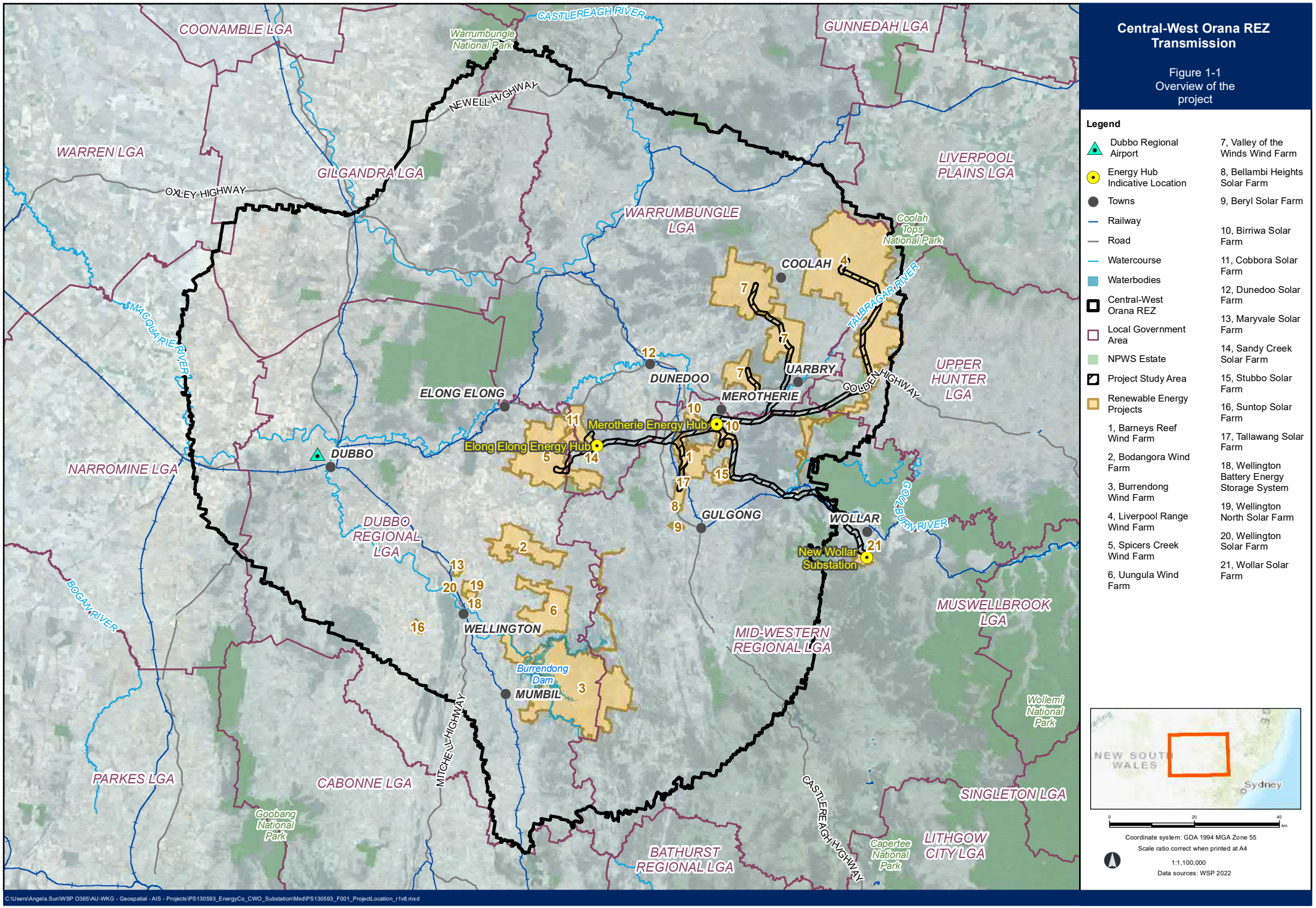
- Renewable Energy Zone (REZ): A geographic area with high-quality variable renewable energy resources (such as wind and solar), suitable topography and land use designations for development, and demonstrated interest from project developers.
- Central-West Orana REZ: A geographic area of approximately 20,000 square kilometres centred by Dubbo and Dunedoo and extending west to Narromine and east beyond Mudgee and to Wellington in the south and Gilgandra in the north, that will combine renewable energy generation, storage and HV transmission infrastructure to deliver energy to electricity consumers.
- The project: New HV electricity transmission infrastructure, consisting of new 500 kV and 330 kV transmission lines and related infrastructure, that would allow renewable energy generators and storage projects in the Central-West Orana REZ to connect to the existing transmission network.
- Energy hub: An energy hub is a substation where energy exported from renewable energy generators or storage is aggregated, transformed to 500 kV (where required) and exported to the transmission network.
- Project study area: Extends north to south from Coolah to Wollar and east to west from Cassilis to Goolma (refer to Figure 1.1). The project study area is generally a one-kilometre-wide corridor in which the proposed transmission line would be located. A refined study area for the transmission line will be identified in the EIS. Additional locations that may be required for specific uses (such as access tracks, construction compounds and workforce accommodation camps) outside the study area will also be identified in the EIS.
- Single circuit transmission lines: A set of three conductors carried by a single set of towers.
- Double circuit transmission lines: A set of six conductors carried by a single tower set.
- Twin transmission lines: A pair of single or double circuit transmission lines running parallel.

- Substation: A facility used to increase or decrease voltages between incoming and outgoing lines (e.g. 330 kV to 500 kV).
- Switching station: A facility used to connect two or more distinct transmission lines of the same designated voltage.
- Transmission line easement: an area surrounding and including the transmission lines which is a legal 'right of way' and allows for ongoing access and maintenance of the lines. Landowners can typically continue to use most of the land within transmission line easements, subject to some restrictions for safety and operational reasons.

1.6 Limitations

EMM provides predictions in this report regarding the probability of subsurface archaeological material occurring within the place, based on surface indications, predictive modelling, and environmental context. However, it is possible that materials may occur in areas without surface indications and in any environmental context. Liaison and consultation with the local Aboriginal community is vital to the identification of areas and places of cultural value within or in the vicinity of the project. Consultation has not been conducted for the purposes of this preliminary assessment.

Historical (non-Aboriginal) values in the form of archaeological and built sites as well as significant landscapes have been investigated through desktop research limited to items listed on heritage registers, and some preliminary on-site investigations. Additional sites and places may be discovered through more detailed research and field survey.



Central-West Orana REZ Transmission

Figure 1-1
Overview of the project

Legend

- Dubbo Regional Airport
- Energy Hub Indicative Location
- Towns
- Railway
- Road
- Watercourse
- Waterbodies
- Central-West Orana REZ
- Local Government Area
- NPWS Estate
- Project Study Area
- Renewable Energy Projects
  - 1, Barneys Reef Wind Farm
  - 2, Bodangora Wind Farm
  - 3, Burrendong Wind Farm
  - 4, Liverpool Range Wind Farm
  - 5, Spicers Creek Wind Farm
  - 6, Uungula Wind Farm
  - 7, Valley of the Winds Wind Farm
  - 8, Bellambi Heights Solar Farm
  - 9, Beryl Solar Farm
  - 10, Birriwa Solar Farm
  - 11, Cobbora Solar Farm
  - 12, Dunedoo Solar Farm
  - 13, Maryvale Solar Farm
  - 14, Sandy Creek Solar Farm
  - 15, Stubbo Solar Farm
  - 16, Suntop Solar Farm
  - 17, Tallawang Solar Farm
  - 18, Wellington Battery Energy Storage System
  - 19, Wellington North Solar Farm
  - 20, Wellington Solar Farm
  - 21, Wollar Solar Farm

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:1,100,000
Data sources: WSP 2022

C:\Users\Angela.Sun\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\PS130593_F001_ProjectLocation_r1v8.mxd

2 Assessment methodology

This assessment was prepared through desktop investigation of the relevant heritage registers, a review of the historical context of the project study area, and the results from some preliminary field survey. The information gathered through these sources has been assessed through the lens of the statutory framework and the guidelines relevant to each discipline (Aboriginal and historical), including the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011), *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010). *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010), NSW *Heritage Manual* (NSW Heritage Office and Department of Urban Affairs and Planning NSW), and *Burra Charter (*ICOMOS 2013).

The preliminary heritage assessment comprised the following tasks:

- compilation of existing environmental, historical, and archaeological information for the project study area and surrounds, by identifying and summarising known and previously recorded Aboriginal heritage sites, cultural values areas and landforms of archaeological interest in its immediate surrounds. Consideration of the general region surrounding the project study area was also undertaken to provide a broader context of the cultural heritage that may be present and may be directly or indirectly impacted by the project;
- Identifying and mapping the type, nature, and extent of any previously recorded historic items, Aboriginal sites, objects, archaeological deposits, potential archaeological deposits, and cultural values areas within the project study area including predictive modelling of heritage constraints. Consideration of the general region surrounding the project study area was also undertaken to provide a broader context of the cultural heritage that may be present and may be directly or indirectly impacted by the project;
- a review of previous reports and databases for both Aboriginal and historical heritage, including:
    - Australian Government
        - World Heritage List (WHL).
        - National Heritage List (NHL).
        - Commonwealth Heritage List (CHL).
        - Register of National Estate.
    - State Government
        - NSW State Heritage Register (SHR).
        - Section 170 registers (s170 register) maintained as a requirement of the *Heritage Act 1977.*
        - State Heritage Inventory (SHI).
        - Heritage NSW's Historical Heritage Information Management System (HHIMS).
        - Heritage NSW's Aboriginal Heritage Information Management System (AHIMS).
        - National Parks and Wildlife Historical Heritage Information Management System (HHIMS).
    - Local Government
        - Schedule 5 of Dubbo Regional LEP 2022 (DLEP).

    - Schedule 5 of the Mid-Western Regional LEP 2012 (MLEP).
    - Schedule 5 of the Upper Hunter LEP 2013 (ULEP).
    - Schedule 5 of the Warrumbungle LEP 2013 (WLEP).
- assessing and identifying heritage constraints and opportunities to assist in the continued development of the project design to avoid and/or minimise potential impacts (both direct and indirect) to heritage values as a result of the project; and
- outline the requirements for future assessments to support the EIS.

3 Historical overview of the region

3.1 Aboriginal ethnography

Information about the socio-cultural structure of Aboriginal society prior to European contact largely comes from ethno-historical accounts made by colonial settlers. These accounts and observations were often made after significant social disruption due to disease and displacement. As a result, this information is often contentious, particularly in relation to language group boundaries. Therefore, it is likely that language group boundaries were far more diffuse than the arbitrary demarcations drawn by colonial observers.

The project study area is primarily associated with Wiradjuri people, however, this area sits at the boundary of the Wiradjuri, Gamilaroi (also Kamilaroi, Gomeroi and Gamilaraay; Tindale (1974) recorded over 30 spellings), and Wailwan (also Weilwan Wayilwan) nations. Territories were marked by natural features in the landscape and Tindale (1974) records Wiradjuri Country covering an area of 127,000 km^2 between the Great Dividing range and Willandra Lakes region, with the northern boundary extending from beyond Mudgee and the southern boundary marked by the Murray River. The territory of the Gamilaroi to the north is estimated to cover 75,000 km^2 between Singleton to the Warrumbungle mountains, Quirindi and Nindigully in southern Queensland. Wailwan County to the west covers 13,000 km^2 from the Barwon River near Walgett to Coonamble in the south. Archaeological evidence from the Willandra Lakes region indicates Wiradjuri Country was occupied from at least 38,000 years ago (Go Green Services 2002, 41). Closer to the project study area, a site at Botobolar has confirmed Aboriginal occupation in this area of the mid-western New South Wales from at least 5,500 years ago (Monitor Heritage Consultants 2019, 11; Pearson 2004, G-6).

The Central Tablelands region has a high number of ceremonial sites including Bora rings, carved trees, rock art and burial sites. The Wiradjuri and neighbouring groups held common belief in the central importance of Baiamai (also Baiame, Bayme) as the supreme creator of past, present and future (Go Green Services 2002, 13). The landscape was transformed, life forms created, and laws and custodianship of the land were given over during *Ballanda,* the creation period (Go Green Services 2002, 13; Greenwood 2013, 6). Ceremonies connected people to the land and members of their community (Go Green Services 2002, 16).

There are gaps in knowledge regarding ceremonies because Aboriginal people were often unwilling to have Europeans present at the ceremonies, therefore, records of the events tend to be disjointed. Carved trees are known to have been important markers for ceremonial grounds and burials whereas ringed trees marked territory (Greenwood 2013, 38). The most well recorded ceremony in the region is corroborees, gatherings where dancing, singing and storytelling occurred, which took place in the historical period. A corrobboree was recorded in the hills around Mudgee in the 1850s and in Coolah prior to the 1870s (Former Mudgee Shire Heritage Committee 2004, 69; Monitor Heritage Consultants 2019, 38). The male initiation ceremony, which was performed at “bora” grounds marked by carved trees, was also of interest to European settlers (Greenwood 2013, 6). During his 1817 expedition Oxley recorded young men around the Wellington Valley were covered in longitudinal scars and had their noses pierced with a bone; only some men had a front tooth removed (OzArk Environmental & Heritage Management 2007, 29–30).

The lifeways of the Wiradjuri varied across the nation’s vast territory. It is believed the nation was divided into three major groups based around the rivers of the region— Murrumbidgee, Gulari (Lachlan), and Wambuul (Macquarie) (Greenwood 2013, 3). The hills and grasslands of the project study area offered a wealth of terrestrial food and material resources with freshwater aquatic foods, such as fish, yabbies, muscle, tortoises and birds, found in rivers, creeks and floodplains (Greenwood 2013). Tools utilised to hunt or collect food resources included

woven nets, Coolamon, digging sticks, grinding stones, and baskets and bags woven of grasses and fur, as well as, canoes, spears, woomeras, boomerangs, Boondi (wooden club), Bullroarer and ground stone axes (Greenwood 2013). Wooden shields were also part of men's material culture and were used in ceremonies and during conflict.

Wiradjuri people lived in small family groups of up to 50 individuals and primarily occupied open camp sites comprising either lean-to, mia-mia or gunyahs around a central hearth (Greenwood 2013, 12). Groups of the region travelled around country throughout the year, moving to a new area when resources diminished, seasons changed or if there was a death and smaller groups came together for ceremonies and trade (Niche Environment and Heritage Pty Ltd 2015, 20). At the time of European settlement in the NSW Central Tablelands, Wiradjuri groups had established a regional network linking the Blue Mountains to the eastern coastal plains (Extent Heritage Advisors 2017, 25). Reports from European observers suggest that the pathways linking Wiradjuri groups socially and economically continued to be used throughout the first fifty years of European colonisation (Extent Heritage Advisors 2017, 25).

3.2 Colonial arrival

George Evans led the first European expedition into the Central Tablelands of New South Wales in 1813 (Former Mudgee Shire Heritage Committee 2004, 70). The burgeoning colony was in desperate need of good agricultural land, however, Governor Macquarie kept strict control of the region west of the Blue Mountains, designating it Government land and only releasing grants to select individuals (Former Mudgee Shire Heritage Committee 2004, 70). Governor Darling redefined the limits of the colony in 1820 and the Tablelands were open for free settlement (Kass 2003, 40). Settlers had reached Mudgee by 1822 and in that year Henry Lawson led an expedition from Mudgee along the Upper reaches of the Goulbourn River (Niche Environment and Heritage Pty Ltd 2015, 21). Alan Cunningham surveyed the Upper Goulbourn River the following year and noted the richness of the country (Niche Environment and Heritage Pty Ltd 2015, 21).

William Lee was the first settler in the Upper Goulburn River region occupying Bylong in the mid-1820s (Niche Environment and Heritage Pty Ltd 2015, 21). Squatting runs were taken up over the project study area through the late 1820s and 1830s with initial settlement focusing on reliable water sources (Niche Environment and Heritage Pty Ltd 2015; Kass 2003, 40). Around the project study area, squatters cleared the land for grazing with cattle. The climate, rugged landscape, and prevalence of predators in the region made cattle the most cost-effective stock in the region (Kass 2001, 8). A wool boom in the late 1840s, however, led to the ascendency of sheep farming in the Central Tablelands (Kass 2003, 40). Villages were surveyed and were developed within the large squatting runs through the 1840s, and by the 1850s the majority of suitable grazing land had been claimed (Former Mudgee Shire Heritage Committee 2004, 71).

The Gold Rush of the 1850s boosted the economic growth of the Central Tablelands as the increased need for beef shifted cattle routes between northern New South Wales and Victoria through Dubbo (Kass 2001, 10). Roads were also officially surveyed and constructed during this period (Kass 2001, 13). Settlement growth in the region, however, was slow until the 1861 introduction of the Robinson Land Acts, which allowed subdivided large squatting runs, permitted any person (free selectors) to purchase up to 320 acres on the condition of payment of a deposit and living on the land for three years (Niche Environment and Heritage Pty Ltd 2015, 21).

Pastoralism and small-scale agriculture continued as the primary industries in the Central Tableland until the coming of the railway in the 1870s and 1880s (Monitor Heritage Consultants 2019, 58). A railway line was constructed from Lithgow reaching Bathurst in 1876, Wellington the following year, and arriving in Mudgee in

1884 (Former Mudgee Shire Heritage Committee 2004, 71). The line was not extended to smaller townships, such as Gulgong and Dunedoo until c.1910 (Former Mudgee Shire Heritage Committee 2004, 71). The coming of the railway not only offered a cheap transport route for famers of the Central Tablelands, but also coincided with the collapse of the wheat industry east of the Great Dividing Range leaving a gap in the market that needed to be filled (Kass 2001, 10). As such, wheat became a primary industry in the region over the late nineteenth century with flour mills and storage silos constructed in villages and townships (Monitor Heritage Consultants 2019, 58; Kass 2001, 24). Butter companies were also established through western New South Wales from 1888 and dairying was an important industry around the project study area (Pearson 2004, G-8).

In the early twentieth century families at Dripstone near Wellington, began producing fruit for the Sydney market (Kass 2001, 24). Moreover, coal and shale seams had been discovered in the region at this time. The intermittent mining of coal began in Ulan, to the north, in 1930 and shale deposits were mined on Barigan Station from 1932 (Niche Environment and Heritage Pty Ltd 2015, 23). Shale seams were also mined at Wollar/Wilpinjong between 1929 to 1933. Mining and pastoral pursuits continue to as important industries in the area today.

3.3 Contact history

The first European explorations of the Central Tablelands occurred from 1813 but the Wiradjuri had already felt the effects of colonisation (Go Green Services 2002, 40). Oxley and Cunningham recorded their friendly interactions with Aboriginal groups though the Wellington Valley noting all were familiar with steel hatchets although interactions led the explorers to conclude that only some groups had previous knowledge of white men (OzArk Environmental & Heritage Management 2007, 29–30).

Disease and warfare, most notably the massacres between 1824 and 1826 known as the Bathurst War, rapidly depleted Wiradjuri numbers (Former Mudgee Shire Heritage Committee 2004, 69; Gapps, 2022; Niche Environment and Heritage Pty Ltd 2015, 21). Settler/Aboriginal violence, however, was not contained to Bathurst. In early September 1824, William Cox's overseer, two stockmen and an Aboriginal guide killed sixteen Aboriginal men at Mudgee, approximately 30 km south of the project study area (Ryan et al. 2022). An Aboriginal Mission Station was established within the decommissioned Wellington convict settlement by the Church Missionary Society in 1831 (Kass 2001, 6). Missionaries William Watson and James Gunther, who later established a competing Mission at Nanima Reserve, attempted to convert Wellington Wiradjuri to Christianity focusing on divorcing children from the influence of their parents and elders (Kass 2001, 6). Many Wiradjuri exploited the mission for food and tobacco but continued to practice traditional lifeways as long as they were able (Kass 2001, 6).

Intensification of settlement throughout the project study area over the 1830s and 1840s further pushed Wiradjuri from their traditional lands restricting access to traditional water and food sources leading to a reliance on European handouts for survival (Kass 2001, 6; 2003, 10). By the 1840s many Wiradjuri family groups and communities had attached themselves to "friendly" stations offering a reliable pool of workers in return for access to Country, which in turn allowed the continuation of traditional lifeways within the European world (Monitor Heritage Consultants 2019, 20). In 1869 a correspondent noted the prevalence of Aboriginal workers near Dubbo:

> On the stations to which I am alluding, there is no European—no white man—either as shepherd or stockman. The blacks are employed even at sheep washing. Their food consists only of about two ozs. of tea, a little sugar, and about six lbs of flour weekly. They find their own beef somehow (*Empire* 1869, 2).

The subdivision of large stations and influx of selectors in the 1870s eradicated these camps (Kass 2001, 6).

From 1883 Wiradjuri camps were broken up by the Aborigines Protection Board and people were forcibly removed from their country to reserves in Eugowra (AR 9386, from 1889), Forbes (AR 43462/3, 1909-1915), Wellington (AR 45426/7 and AR 87975, from 1910), or Spring Flat (AR 80144, 1957-1964) (Extent Heritage Advisors 2017, 30). These reserves were segregated on the outskirts of townships (Kass 2003, 11). A small community of Aboriginal people, including families of police trackers, were living at the Wollar Police Paddock in 1900 and associated with the events of Jimmy and Joe Governor, and Jacky Underwood (Foster 2019, 307).

The Governor story is relatively well known and crosses through this general region. Jimmy, an Aboriginal man, committed the murders of a family in Breelong in mid-1900, and went on the run with his brother (Joe) and Jack Underwood (Moore and Williams 2001). The last individuals to be identified as 'outlaws' in NSW, over a six-month period, the group gained public attention and committed several more crimes before being captured or killed in late 1900. Of relevance to the project study area is both the relationship that Jimmy and Joe had to Wollar, with several of their activities occurring in the general area (along Goulbourn River), and a number of their family members living in or near the township. These family members were taken into custody by the police during the events to avoid an insurrection, initially housed at Wollar, and then moved to Mudgee, before ultimately transported to a mission in Brewarrina. A situation that gained considerable attention at the time (Niche, 2015). As such, it is likely that both post-contact camp sites, and buildings or locales within or near the Wollar township have a relationship with these events (eg Joe Governor attended Wollar School; and the police buildings are frequently mentioned as an unofficial Aboriginal reserve, families living at the police paddock, east of the Wollar River), and which are likely of regional and potentially national importance.

By the early 1900s many reports from European observers noted the population of the Wiradjuri had been greatly reduced and traditional activities were no longer practiced (OzArk Environmental & Heritage Management 2007, 32; Kass 2003, 10; *Mudgee Guardian and North-Western Representative* 1904, 22). Through the early to mid-twentieth century Wiradjuri children were removed from their families and residents of reserves were under constant government surveillance (Kass 2003, 11). After the abandonment of segregationist polices in the 1970s and 1980s Wiradjuri communities have fuelled a cultural renaissance built on the legacies of the past (Kass 2003, 10–11).

4 Aboriginal heritage

4.1 Key findings

The project study area only been subject to localised investigation as a result of surrounding extractive, solar and wind farm activities. These demonstrate that:

- In the vicinity of Wollar, Wilpinjong and Moorlarben, there is high potential for rockshelter site types in areas where sandstone outcropping and steep relief occur. This may also be the case for other parts of the project east of Uarbry.
- To the west encompassing areas around Merotherie, Elong Elong and Uarbry, the archaeological record is dominated by stone artefacts of typically low densities. These are found in a wide range of environments and landforms, although more extensive deposits are found in proximity to major tributaries. Artefacts are typically found on the surface and may also be shallowly buried. Also within these environments, sites such as grinding grooves and culturally modified trees have also been documented, where environmental conditions are met.
- Cultural sites are also documented in the region. Currently, these are poorly understood and typically reflect visually dominant features in the landscape, such as hills and ranges. However, other site types, such as the birthing tree at Wollar may also be encountered elsewhere in the region.

A review of the Heritage NSW AHIMS database identified some 2,847 previously documented Aboriginal sites. These were dominated by stone artefactual sites (2,295, ~81%), PADs (313, ~11%), culturally modified trees (148, ~5%), and grinding grooves (65, ~2%). Of these, 295 are documented within the project study area, and which reflect the main site types across the broader assemblage, including stone artefactual sites (262, ~89%), PADs (27, ~9%), and culturally modified trees (11, ~4%). Of note is a site identified as the 'Ulan Wilpinjong Creek bora ground' (#36-3-0044), which may reflect an important location of past ceremonial activity and would form a focus of subsequent investigation.

4.2 Existing environment

Understanding environmental context assists with predictions of archaeological potential, such as the likelihood of archaeological material being present in the landscape, its spatial distribution and its preservation. Landscape features were an important factor for the choice of camping and transitory and ceremonial areas used by Aboriginal people. Similarly, these landscape features and historical land-use plays a role in the level of preservation and the integrity of archaeological sites. A landscape consisting of suitable topography, hydrology, geology and soils has strong links with natural resources that would have been available to, and sought after, by Aboriginal people. Flora and fauna would have provided food, tools and ceremony (culturally modified trees); proximity to fresh water was necessary for life and growing crops, as well as gathering fish and eels. Landscape features, such as sandstone overhangs, were useful for shelter; stone artefacts were manufactured from raw stone material that was collected from quarry sites; and stone arrangements relied on the landscape.

4.2.1 Landscape overview

The project study area is situated within the Brigalow Belt South (BBS), Sydney Basin (SYB) and NSW South Western Slopes (NSS) Bioregions (IBRA7 2012). These bioregions exhibit a wide variety of landscapes, including extensive foothills and isolated ranges. Much of the diverse topography is derived from basalt and quartz soils. All three of these bioregions have a significant proportion of major river and catchment systems, including the Macquarie, Goulburn and Talbragar Rivers. These bioregions are broken down into subsequent subregions and the attributes of subregions present in the project study area are summarised in Table 4.1.

Historical agricultural, pastoral and mining activities have resulted in significant land clearance within the project study area, starting from the early 1830s (Section 3). This long-term disturbance would have had a significant impact on the surface and subsurface integrity of the soils and archaeological material contained therein.

Table 4.1 Bioregions and subregions within the project study area

Subregion	Summary
Liverpool Range (BBS)	Undulating plateau top with steep margins grading to long footslopes. Cenozoic basalt overlying Jurassic quartz sandstones and shale. Open forest of stringybark with small areas of vine forest on the plateau. Similar vegetation surrounding creeks on the on aspects.
Pilliga (BBS)	Extensive sandstone hills with areas of high basalt peaks. Includes the Great Artesian Basin aquifer. Jurassic age coarse-grained (quartz) Pilliga Sandstone underlies mostly sandy soils. Mainly open Eucalypt woodlands.
Talbragar Valley (BBS)	Smallest subregion included in the project study area, includes the Talbragar River valley. High proportions of agriculture and pastures due to fertile soils. Mesozoic sediments formed from sandstone beds that are covered by Tertiary lava flows. Native vegetation comprising of mostly remains only on the slopes, as much of the environment has been cleared.
Inland Slopes (NSS)	Foothills and ranges including the western fall of the Great Dividing Range. Lachlan Fold Belt consisting of Cambrian to Early Carboniferous sedimentary and volcanic rock including granite and quartzite. Large proportion of minerals and coal found in this region. Open woodlands formed of White Box are dominant with many other Eucalypt derived tree species.
Kerrabee (SYB)	Sandstone plateau with cliffs into wide valleys with sandy alluvial fill. Triassic Narrabeen Group quartz, sandstone and shales. Volcanic derived basalt and sandy sediments also present. Ironbark forests with dry heath on the plateau. Red Gum, and Box, trees with spear grass in the valleys. River Oak along the main streams.

4.2.2 Soil landscapes

Soil landscapes and their boundaries provide pre-defined areas that are classified by several geographic features, and which are informative for archaeological investigations. They provide localised information including landform patterns, soils, geology, rock outcrop percentage, land use and vegetation, which provides another layer to categorise the landscape for the predictive model, additional to what a topographic description can provide. Soil landscape information builds on underlying geology and describes the depths of residual soils and colluvial soils and identifies areas that are characterised by erosion or skeletal soils and exposed bedrock versus those that may contain a deeper profile where cultural material may be buried.

Soil landscapes which contribute a cumulative coverage of the project study area greater than 1,000 ha (totalling ~66%) are summarised in Table 4.2 and shown on Figure 4.1 (Murphy & Lawrie 1998). Some 5,464 ha (~21%) is

not included in established soil landscape data. Common across all soil landscapes within the project study area is that they are topographically characterised by undulating low hills. However, within the Rouse, Ulan, Red Hill, Lees Pinch and Barigan Creek landscapes, which cumulatively account for around 43% of the project study area, a prevalence of sandstone, limestone and granite geologies results in escarpment and plateau landforms with frequent outcropping. The archaeological implications for this is an increased likelihood of rock shelter (including both habitation and art) sites, as well as grinding groove and quarry sites within areas that these soil landscapes are present. An analysis of slope data within these soil landscapes throughout the project study area failed to identify any areas with a slope gradient of 80 degrees or higher, which is typically used to target areas of high potential for rockshelters.

Within the Turill, Wuuluman, Laheys Creek, Ballimore, and Barigan landscapes, which cumulatively account for around 46% of the project study area, there is a prevalence of low gradient slopes and rises, and small flats adjacent to waterways. The archaeological implications for this is an increased likelihood of open occupation areas reflected by artefact scatters, hearths and areas of potential archaeological deposits (PAD), as well as the potential to retain significant cultural features which have been documented throughout the region including stone arrangements and bora grounds. These landscapes typically have a greater depth of deposit, with topsoils generally ranging from 10–60 cm and subsoils greater than 100 cm, increasing the potential for landforms to retain subsurface archaeological material. Deeper alluvial and colluvial soil profiles present along the major river systems and at the base of elevations have the potential to retain PAD of significant antiquity. A prevalence of acid soils common across many of the soil landscapes within the project study area would likely result in a lack of preservation for organic artefact materials such as shell, bone and wood. As such cultural assemblages would likely be dominated by varying densities of stone artefacts.

Disturbances associated with agricultural land uses across the region including grazing and cultivation are prevalent across all soil landscapes and has frequently resulted in extensive vegetation clearance. The archaeological implications of these historic and ongoing landform disturbances is the deleterious effect they can have on more intrusive Aboriginal sites such as culturally modified trees and stone arrangements. Destabilisation of land surfaces as a result of vegetation clearance as well as ongoing cultivation or livestock impacts, is well documented throughout the region to have increased landform susceptibility to erosion. Erosional impacts can contribute to the degradation of surface and subsurface archaeological material, and the movement of cultural objects into secondary contexts.

Table 4.2 Major soil landscapes within the project study area (in order of prevalence)

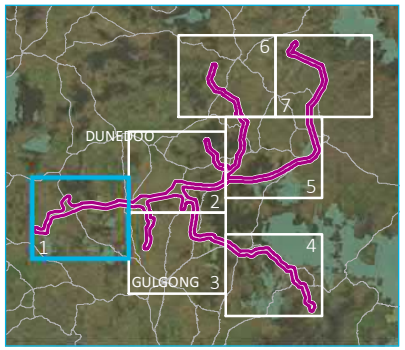
Soil landscape (Murphy & Lawrie 1998)	Cumulative coverage within project study area (ha)	(%)	Summary
Rouse (rs)	3951	14	• Landforms: Undulating hills and low hills with granite outcropping as tors and sloping pavements. Landform elements affected include drainage lines, depressions, footslopes, lower slopes and more rarely, mid and upper slopes. Relief 50 – 90 m. Slopes 5 – 15%. Drainage lines 300 – 1000 m apart. • Geology: Gulgong Granite, biotite granite, adamellite, granodiorite. • Soils: Loamy sand to clayey sand topsoil extending to 10 – 20 cm. Loamy sand to light sandy clay loam subsoil extending to 50 cm. • Vegetation: Blakely's red gum-narrow-leaved red ironbark woodland community. • Disturbance: Grazing and cultivation. Minor sheet and gully erosion, some areas of severe gully erosion.
Turill (ti)	3194	12	• Landforms: Undulating low hills with small flats adjacent to creeks. Elevations vary from 440 – 560 m above sea level. Slopes range between 5 – 20%. • Geology: Narrabeen Sandstone, mudstone, and Jurassic shale and sandstone. • Soils: Loose clayey sand or sandy loam topsoil to 30 cm. Sandy loam or sandy clay subsoil. • Vegetation: Dry sclerophyll woodland dominated by broad-leaved ironbark, red ironbark and narrow-leaved ironbark. Groups or individuals of spotted iron gum and kurrajong grow on more fertile soils. • Disturbance: Grazing and cultivation. Minor to moderate sheet erosion on the slopes, with minor gully erosion in drainage lines.
Home Rule (hr)	2364	9	• Landform: Undulating low rises ranging from 420 – 500 m elevation. Slopes are gently inclined 4 – 8%, with slopes from 2000 – 6000 m long. Local relief varies from 30 – 60 m. Drainage lines are 300 – 1000 m apart. • Geology: Sediment derived from the Gulgong and Rouse Granites. • Soils: Loose loamy sand topsoil 10 – 35 cm, and loose clayey sand subsoil on upper slopes. Hard-setting sandy loams to 40 cm and sandy clay or sandy loam subsoils on mid to lower slopes. • Vegetation: A grey gum, narrow-leaved red ironbark woodland community. A riverine community of river she-oak and rough-barked apple is common along perennial streams and main drainage lines. • Disturbance: Grazing and cultivation. Minor sheet and gully erosion, some areas of severe gully erosion.

Table 4.2 Major soil landscapes within the project study area (in order of prevalence)

Soil landscape (Murphy & Lawrie 1998)	Cumulative coverage within project study area (ha)	(%)	Summary
Goonoo	2034	7	• Landform: Undulating low rises ranging from 280 – 560 m elevation. Slopes are gently inclined 2 – 10%, with slopes from 800 – 1000 m long. Local relief varies from 10 – 15 m. Drainage lines are 1000 m apart. • Geology: Sediment derived from the Pilliga Sandstones. • Soils: earthy sands, yellow solodic, red earth and yellow earth soils. Typically, a loamy sands topsoil of ~20 cm overlying sandy clay loam ~30-40cm, over hard clay and/or geological substrate. • Vegetation: A grey gum, narrow-leaved red ironbark woodland community. A riverine community of river she-oak and rough-barked apple is common along perennial streams and main drainage lines. • Disturbance: Grazing and cultivation. Minor sheet and gully erosion, some areas of severe gully erosion.
Ulan (ul)	1786	7	• Landforms: Lower colluvial slopes of sandstone plateaux escarpments; low undulating rises and creek flats. Elevations vary from 360 – 570 m. Slopes range between 2 -10%. Local relief varies between 10 – 40 m. Tributary stream channels. • Geology: Shale, sandstone, conglomerate, chert, coal and torbanite seams. • Soils: Hard-setting sandy loam topsoil to 8 – 20 cm. Sandy clay to 60 cm. • Vegetation: Broad-leaved, red and narrow-leaved ironbark to the west; blak and white cypress pine and Dwyer's red mallee on stony rises; minor clearing for grazing • Disturbance: Grazing and cultivation. Coal mining. Minor sheet and gully erosion, some areas of severe gully erosion.
Ballimore (bm)	1361	5	• Landform: Undulating low hills with elevations from 280 – 400 m. Slopes are gently inclined (3 – 6%) with slopes 2000 – 3000 m long. Local relief varies between 20 – 40 m. Drainage lines are spaced at 500 – 1500 m intervals. • Geology: Ballimore Sandstone. • Soils: Sandy loam to 15 – 40 cm and light to medium clay subsoil to 80 cm. • Vegetation: Only rocky ridges or hills retain native forest vegetation. • Disturbance: Extensive clearance. Grazing and cultivation. Moderate to severe sheet and gully erosion.

Table 4.2 Major soil landscapes within the project study area (in order of prevalence)

Soil landscape (Murphy & Lawrie 1998)	Cumulative coverage within project study area (ha)	(%)	Summary
Lees Pinch (lp)	1280	5	• Landform: Sandstone plateaux and hillslopes with boulder debris, from 400 – 680 m above sea level. Slopes are moderately inclined to steep 15 – 40%, or cliffs, with slopes from 300 – 1000 m long. Local relief varies from 60 – 240 m. Drainage lines are 400 – 1200 m apart. • Geology: Narrabeen sandstone, conglomerate sandstone, shale, conglomerate, mudstone, chert, coal and torbanite seams. • Soils: Loamy sand or gravelly sandy clay loam topsoil 10 – 15cm and clayey sand subsoil with a clear change to weathered sandstone at 15 – 50 cm on plateaus and slopes. Hard-setting loam topsoil to 30 – 60 cm followed by sandy clay loam to 80 – 115 cm on lower slopes and depressions. • Vegetation: Scribbly gum – narrow leaved stringybark community is common. • Disturbance: Grazing. Minor sheet erosion.
Barigan Creek (bc)	1089	4	• Landform: Lower slopes of sandstone plateaux escarpments, low undulating rises and creek flats. Horizontal beds of sandstone outcrop as benches. Elevations vary from 360 m – 470 m above sea level. Slopes between 2 – 10%. Local relief varies between 10 – 30 m. Stream channels are tributaries to larger streams. • Geology: Shale, sandstone, siltstone, conglomerate, chert. • Soils: Sandy loam topsoil overlying light to medium clay subsoil. • Vegetation: Dry sclerophyll woodland community dominated by narrow-leaved stringybark, broad-leaved ironbark and narrow-leaved red ironbark. Rough-barked apple grows along major drainage lines. • Disturbance: Grazing and cultivation. Minor to moderate gully erosion; areas of severe sheet erosion. Some areas of severe localised salinity.
Laheys Creek (lc)	1036	4	• Landform: Undulating low hills with elevations between 400 – 520 m. Slopes are gently inclined (3 – 10%) with slopes 500 – 1500 m long. Local relief varies between 40 – 50 m. Drainage lines are spaced 400 – 1200 m apart. • Geology: Sandstone, shales. • Soils: Hard-setting sandy loam or loamy sand to 10 – 30 cm with clay loam to 60 – 120 cm on lower slopes and valley floors. • Sandy loam with sharp change to light clay or sandy clay loam overlying weathered shale or sandstone at 50 – 70cm on upper slopes and crests. • Vegetation: Blakely's red gum and white cypress pine with grey box on lower slopes. Sifton bush and hopbush infestations are common. • Disturbance: Extensive clearance. Grazing and cultivation. Moderate sheet erosion and moderate gully erosion common; some areas of severe gully erosion. Surface soils moderately acidic.



KEY

- Project study area
- Major road
- Minor road
- Named watercourse

Soil landscape

- Bald Hill | Ebh
- Ballimore | RBEbm
- Burrendong | SLbd
- Dapper Hill | SHdh
- Laheys Creek | YSlc
- Mebul | CSme
- Mitchell Creek | Ami
- Mookerawa | SHmk
- Mullion Creek | SHmu
- Spring Ridge | SLsr
- Surface Hill | NKBsu
- Talbragar | Atb
- Tucklan | Etk

INSET KEY

- Major road
- NPWS reserve

Environmental context:
Soil landscapes
Map 1 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 4.1

EMM creating opportunities

Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

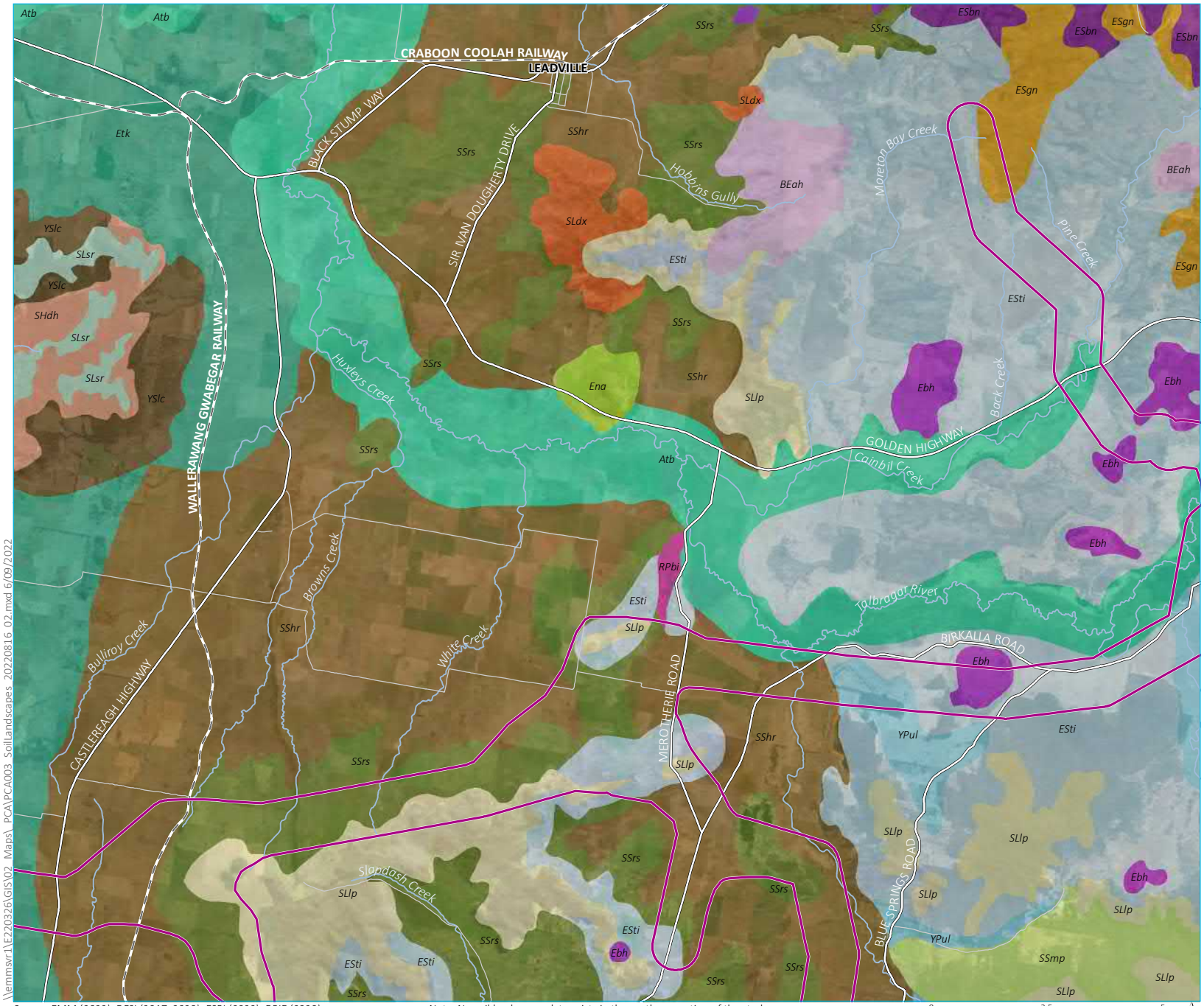
Note: No soil landscapes data exists in the northern section of the study area

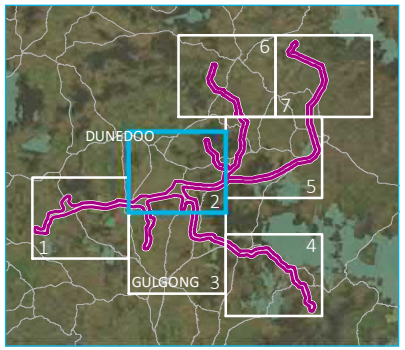
0 2.5 5 km

GDA2020 MGA Zone 55

N

\\emmsvr1\E220326\GIS\02 Maps\ PCA\PCA003 SoilLandscapes 20220816 02.mxd 6/09/2022





KEY

- Project study area
- Rail line
- Major road
- Minor road
- Named watercourse

Soil landscape

- Ant Hill | BEah
- Bald Hill | Ebh
- Balladoran | ESbn
- Belowrie | RPbi
- Dapper Hill | SHdh
- Dexter | SLdx
- Goonoo | ESgn
- Home Rule | SShr
- Laheys Creek | YSlc
- Lees Pinch | SLlp
- Munghorn Plateau | SSmp
- Nanima | Ena
- Rouse | SSrs
- Spring Ridge | SLsr
- Talbragar | Atb
- Tucklan | Etk
- Turill | ESti
- Ulan | YPul

INSET KEY

- Major road
- NPWS reserve

Environmental context: Soil landscapes Map 2 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 4.1

Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

Note: No soil landscapes data exists in the northern section of the study area

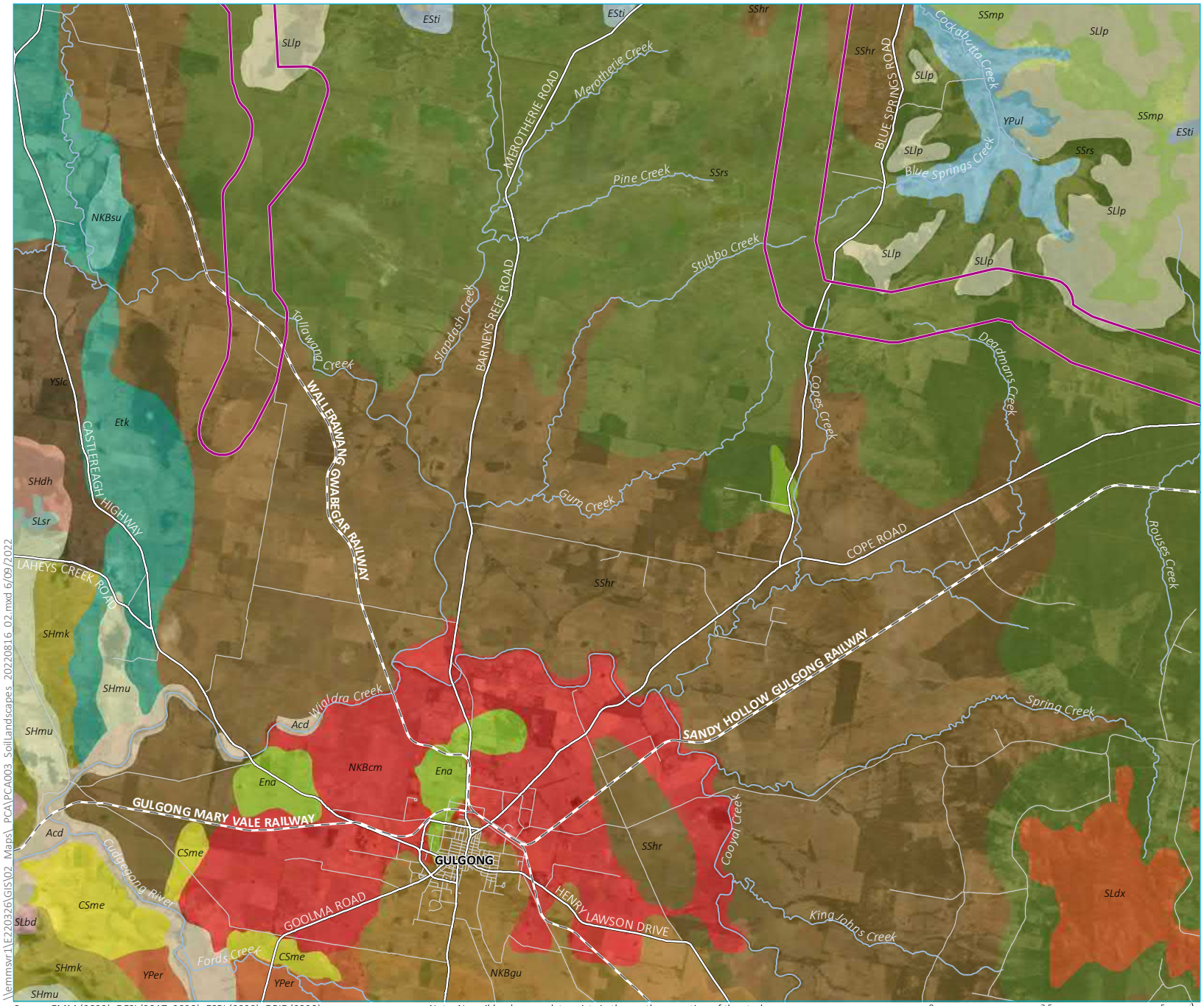
0 2.5 5 km

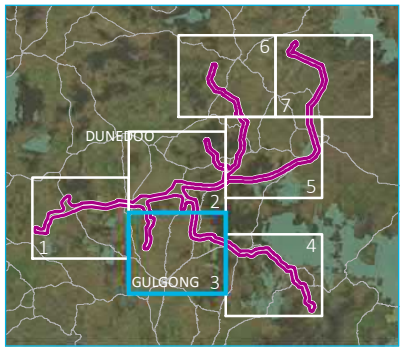
GDA2020 MGA Zone 55

N

\\emmsvr1\E220326\GIS\02_Maps_PCA\PCA003_SoilLandscapes_20220816_02.mxd 6/09/2022

creating opportunities





KEY

- Project study area
- Rail line
- Major road
- Minor road
- Named watercourse

Soil landscape

- Burrendong | SLbd
- Craigmore | NKBcm
- Cudgegong | Acd
- Dapper Hill | SHdh
- Dexter | SLdx
- Erudgerie | YPer
- Gulgong | NKBgu
- Home Rule | SShr
- Laheys Creek | YSlc
- Lees Pinch | SLlp
- Mebul | CSme
- Mookerawa | SHmk
- Mullion Creek | SHmu
- Munghorn Plateau | SSmp
- Nanima | Ena
- Rouse | SSrs
- Spring Ridge | SLsr
- Surface Hill | NKBsu
- Tucklan | Etk
- Turill | ESti
- Ulan | YPul

INSET KEY

- Major road
- NPWS reserve

Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

Note: No soil landscapes data exists in the northern section of the study area

0 2.5 5 km

GDA2020 MGA Zone 55

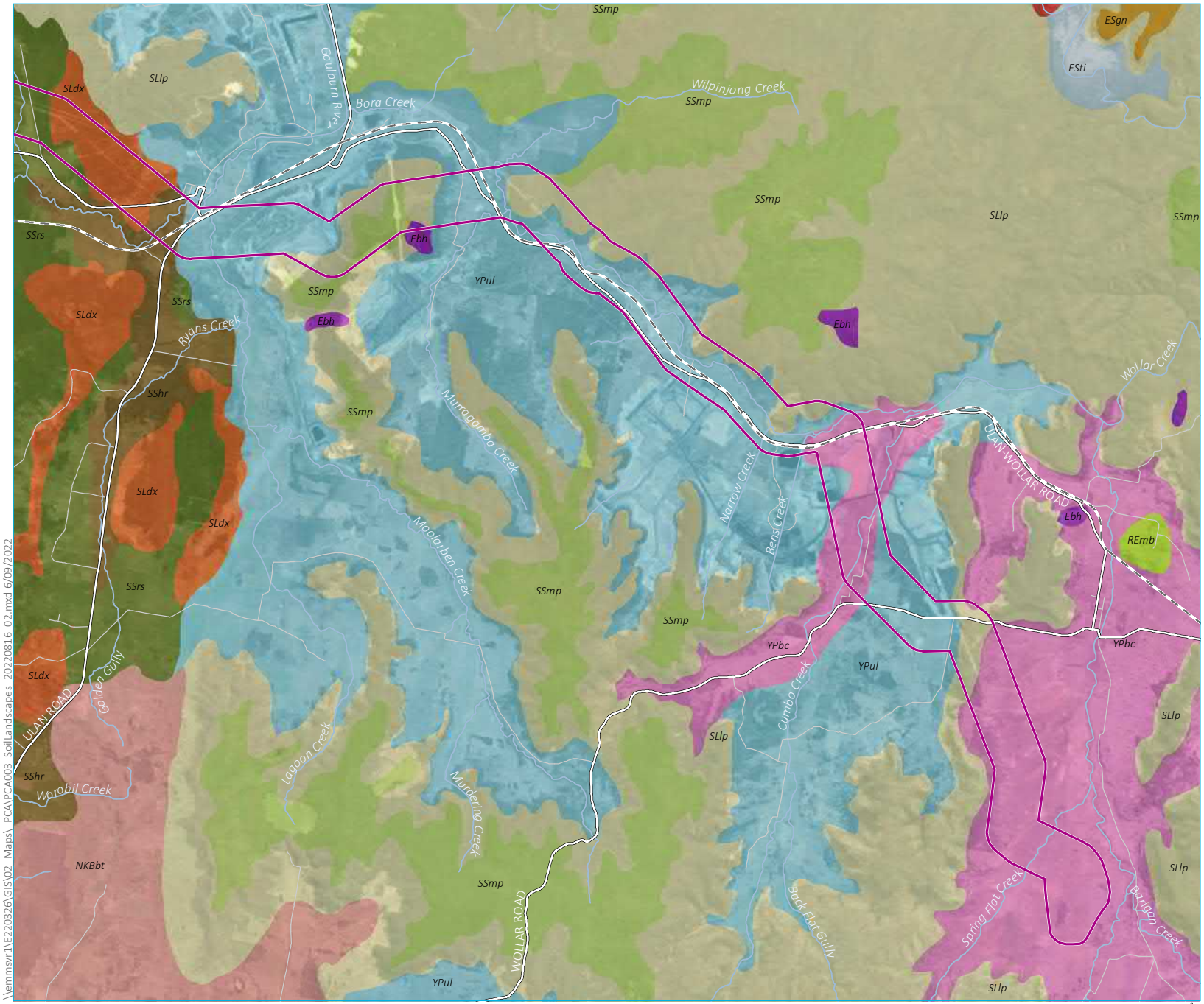
N

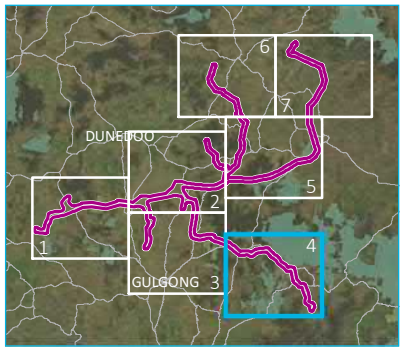
\\emmsvr1\E220326\GIS\02 Maps\ PCA\PCA003 SoilLandscapes 20220816 02.mxd 6/09/2022

Environmental context: Soil landscapes Map 3 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 4.1

EMM creating opportunities





KEY

- Project study area
- Rail line
- Major road
- Minor road
- Named watercourse

Soil landscape

- Bald Hill | Ebh
- Barigan Creek | YPbc
- Botobolar | NKBbt
- Crowee | YEcr
- Dexter | SLdx
- Goonoo | ESgn
- Home Rule | SShr
- Lees Pinch | SLlp
- Munghorn Plateau | SSmp
- Murrumbo | REmb
- Rouse | SSrs
- Turill | ESti
- Ulan | YPul

INSET KEY

- Major road
- NPWS reserve

Environmental context:
Soil landscapes
Map 4 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 4.1

EMM creating opportunities

\\emmsvr1\E220326\GIS\02_Maps_PCA\PCA003_SoilLandscapes_20220816_02.mxd 6/09/2022

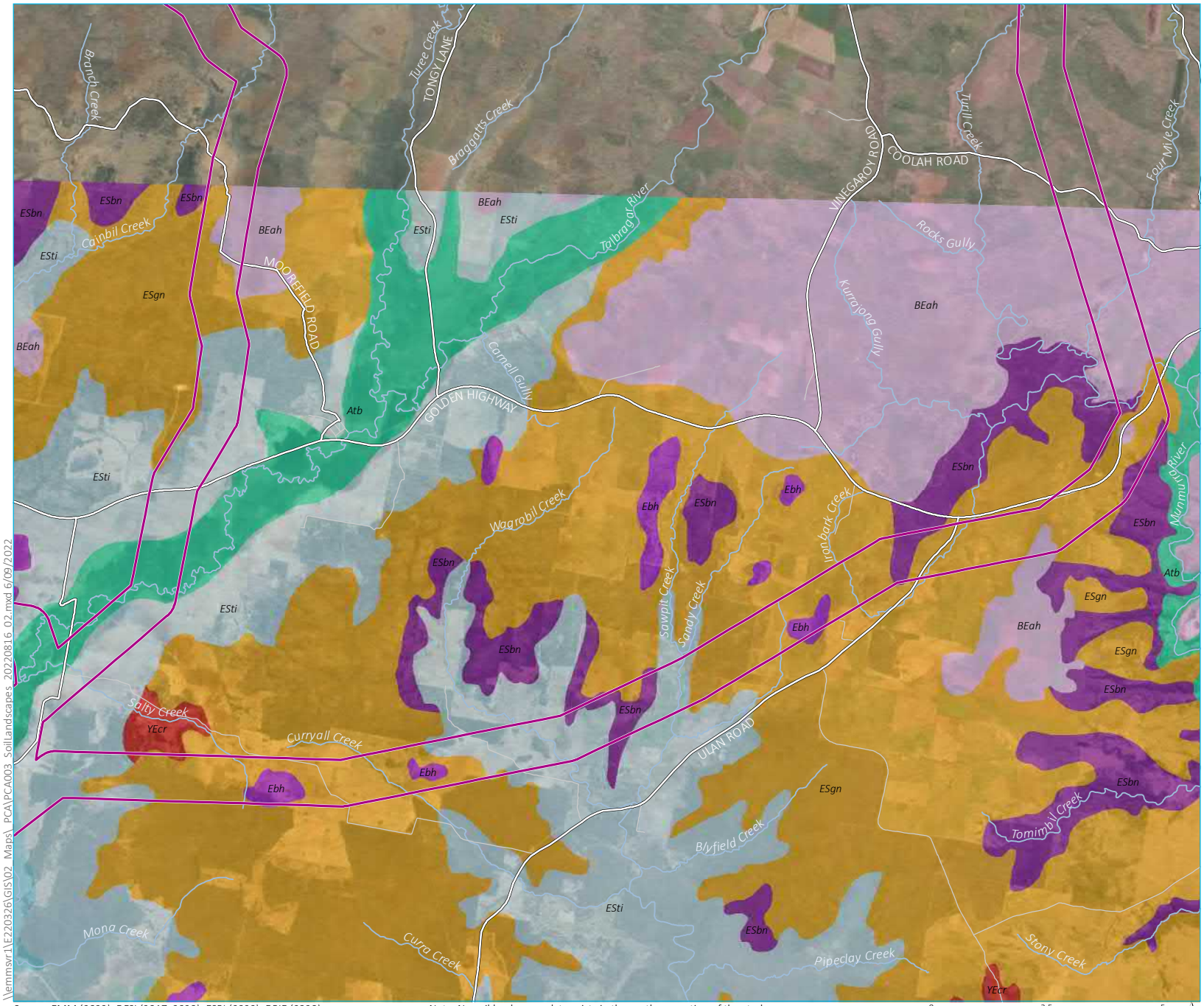
Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

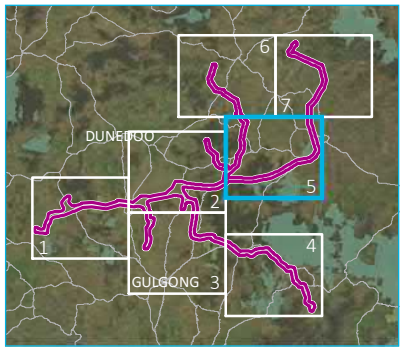
Note: No soil landscapes data exists in the northern section of the study area

0 2.5 5 km

GDA2020 MGA Zone 55

N





KEY

- Project study area
- Major road
- Minor road
- Named watercourse

Soil landscape

- Ant Hill | BEah
- Bald Hill | Ebh
- Balladoran | ESbn
- Crowee | YEcr
- Goonoo | ESgn
- Talbragar | Atb
- Turill | ESti
- Ulan | YPul

INSET KEY

- Major road
- NPWS reserve

Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

Note: No soil landscapes data exists in the northern section of the study area

0 2.5 5 km

GDA2020 MGA Zone 55

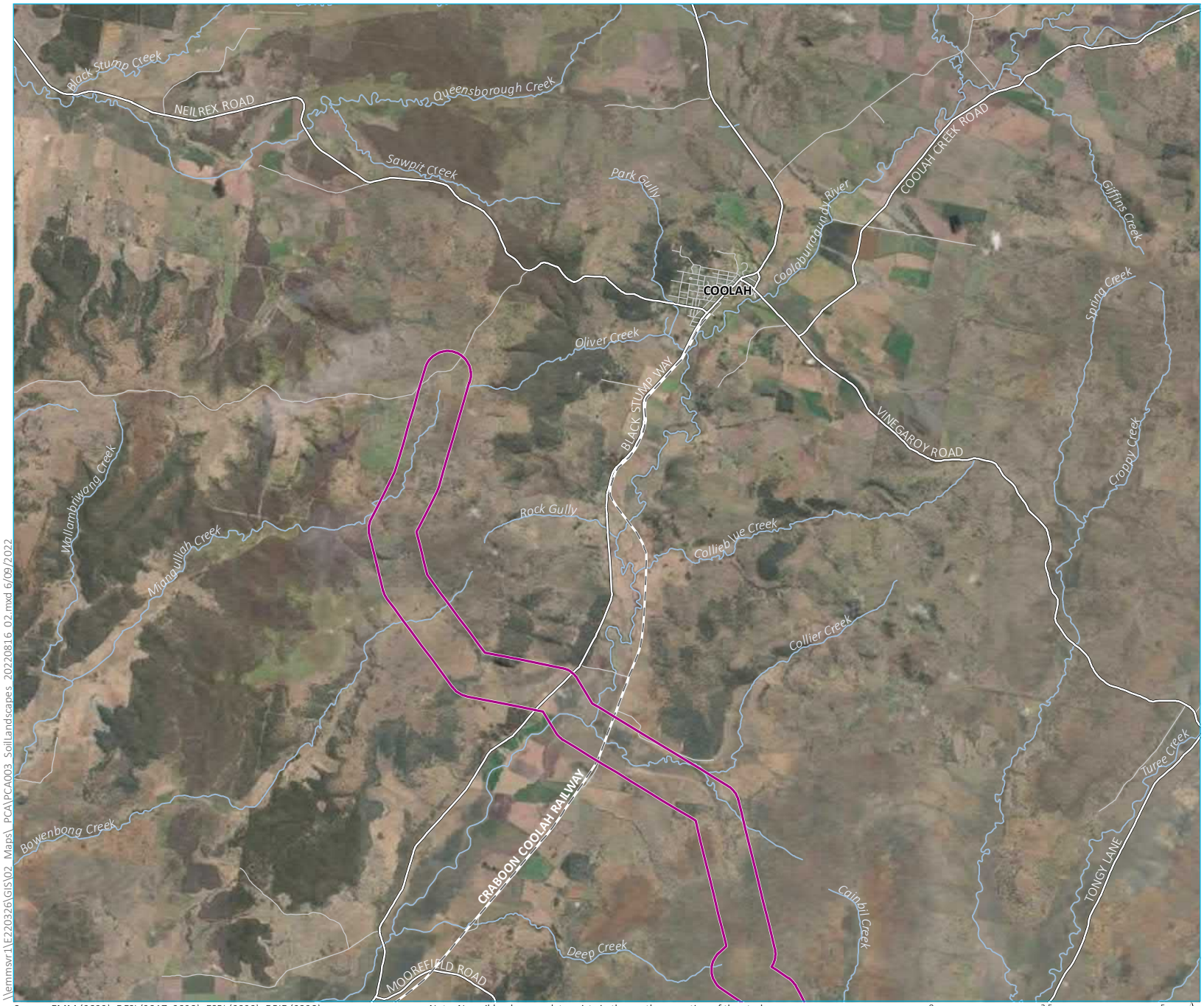
N

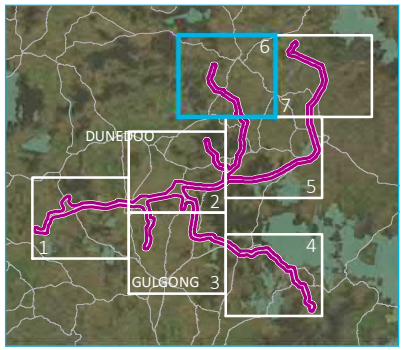
\\emmsvr1\E220326\GIS\02_Maps_PCA\PCA003_SoilLandscapes_20220816_02.mxd 6/09/2022

Environmental context: Soil landscapes Map 5 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 4.1

EMM creating opportunities





KEY

- Project study area
- Rail line
- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve

\\emmsvr1\E220326\GIS\02_Maps_PCA\PCA003_SoilLandscapes_20220816_02.mxd 6/09/2022

Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

Note: No soil landscapes data exists in the northern section of the study area

0 2.5 5 km

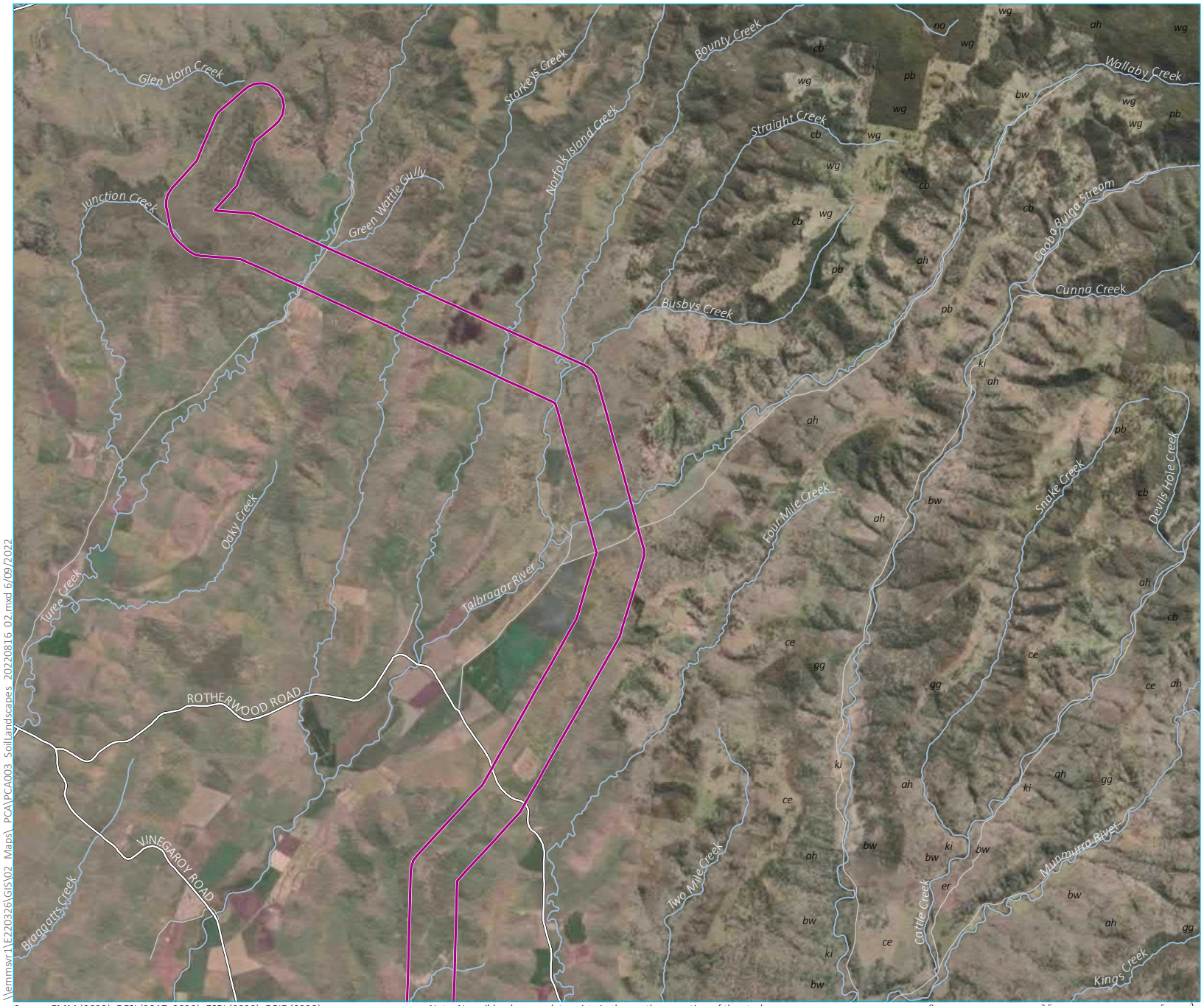
GDA2020 MGA Zone 55

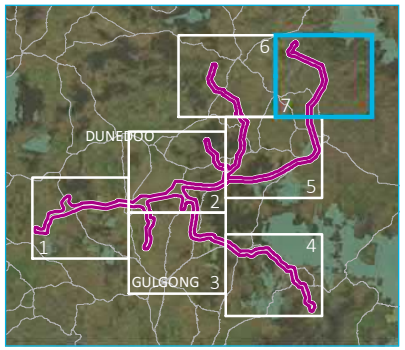
N

Environmental context:
Soil landscapes
Map 6 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 4.1

EMM
creating opportunities





KEY

- Project study area
- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve

Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

Note: No soil landscapes data exists in the northern section of the study area

0 2.5 5 km

GDA2020 MGA Zone 55

N

\\emmsvr1\E220326\GIS\02_Maps_PCA\PCA003_SoilLandscapes_20220816_02.mxd 6/09/2022

Environmental context: Soil landscapes Map 7 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 4.1

EMM creating opportunities

4.2.3 Hydrology

Hydrological features are the most likely to indicate areas of archaeological potential within the project study area. Access to water and the natural resources associated with it will have dominated the distribution of habitation throughout the area, with landforms in close proximity to major and/or perennial waterways often resulting in prolonged habitation and hence more substantial archaeological material. This is corroborated by previous archaeological works in the area and ethnographic accounts of the area.

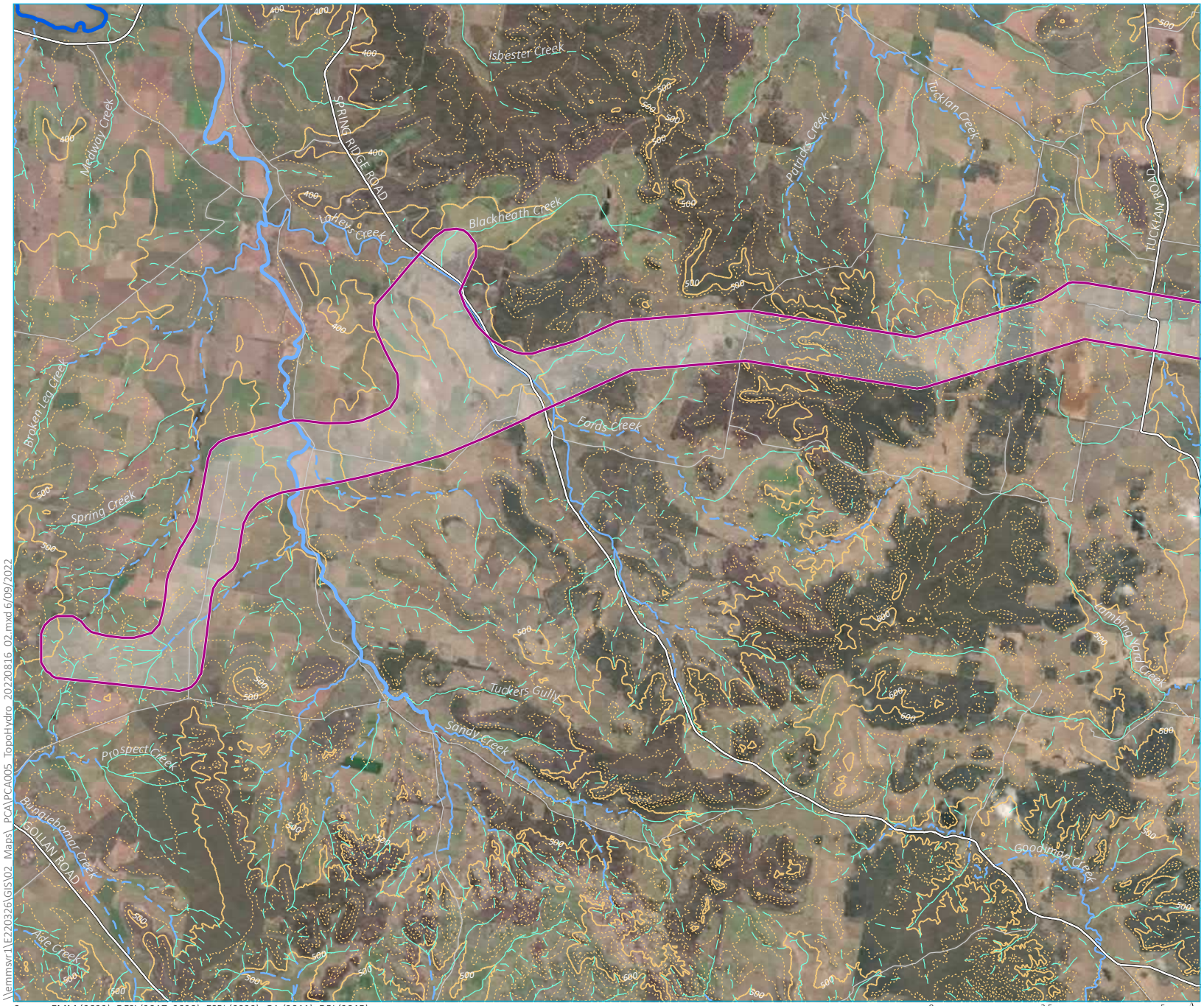
Watercourses, aggregated by Strahler stream order, and the number of occurrences within the project study area are listed in Table 4.3 and shown on Figure 4.2. The known archaeological record for the region supports a predictive model for location of Aboriginal sites within 200 m of a water source. Throughout the majority of central western NSW where watercourses are regularly dispersed, significant archaeological material is most frequently identified in association with perennial or semi-permanent waterways (typically 3rd order Strahler and above). There are 42 occurrences of named watercourses 3rd order and above within the project study area. The project study area interacts and/or is in close proximity with the three major waterways for the region, the Macquarie, Talbragar and Goulbourn Rivers, as well as significant local waterways, such as Four Mile Creek, Sandy Creek, Laheys Creek, Wollar Creek, Coolaburragundy River, Tallawong Creek, and Turee Creek. Terraces and flats associated with these major waterways may feature deep alluvial soil profiles and hence have the potential to retain subsurface deposits of significant quantity and antiquity.

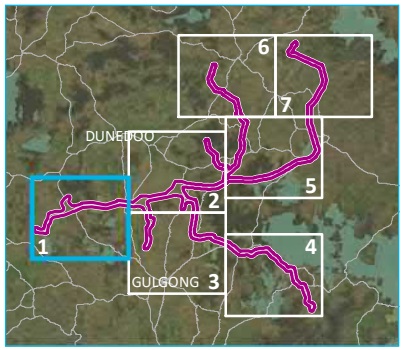
Previous archaeological investigations within and in proximity to the project study area have demonstrated a significant concentration of archaeological material associated with Wollar Creek, Barigan Creek, Laheys Creek and Sandy Creek, among others, with the cultural resource declining significantly with distances exceeding 200 m from the waterway. Archaeological material representative of short-term or opportunistic activities is more often associated with ephemeral waterways, drainage lines or other features such as Gilgai or rock outcropping which can retain water following rainfall events. There are also 28 occurrences of named 1st and 2nd order watercourses within the project study area (Table 4.3).

Table 4.3 Named watercourses intersecting the project study area

Strahler Order	Occurrences within project study area	Watercourse Names
6	4	Talbragar River, Four Mile Creek, Moolarben Creek, Coolaburragundy River.
5	10	Bounty Creek, Busbys Creek, Cainbil Creek, Cockabutta Creek, Cumbo Creek, Sandy Creek, Sportmans Holllow Creek, Tallwang Creek, Turee Creek, Wilpinjong Creek.
4	16	Bounty Creek, Cainbil Creek, Collier Creek, Four Mile Creek, Green Wattle Gully, Ironbark Creek, Laheys Creek, Miangulliah Creek, Mona Creek, Murragamba Creek, Sportmans Hollow Creek, Spring Flat Creek, Starkeys Creek, Talbragar River, Wagrobil Creek, Wilpinjong Creek.
3	12	Bens Creek, Bowenbong Creek, Curryall Creek, Ironbark Creek, Miangulliah Creek, Murrumbline Creek, Norfolk Island Creek, Pine Creek, Salty Creek, Sportsmans Hollow Creek, Spring Creek, Turrill Creek.
2	15	Back Creek, Blackheath Creek, Copes Creek, Curryall Creek, Deep Creek, Huxleys Creek, Junction Creek, Miangulliah Creek, Moreton Bay Creek, Narrow Creek, Planters Creek, Tallawang Creek, Tucklan Creek, Turill Creek, White Creek.
1	13	Back Creek, Browns Creek, Deadmans Creek, Junction Creek, Miangulliah Creek, Oliver Creek, Patricks Creek, Salty Creek, Spring Creek, Stubbo Creek, Tallawang Creek, White Creek, Yellow Waterholes Gully

Notes: Several creeklines appear in more than one category. This reflects the multiple intersection of the creekline with the project study area, and where in some locations the creek may be of a different size (or Strahler order).





KEY

- Project study area
- Major road
- Minor road
- Topographic contour (20 m interval)
- Topographic contour (100 m interval)

Strahler stream order

- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 7th order

INSET KEY

- Major road
- NPWS reserve
- State forest

Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); GA (2011); DPI (2015)

0 2.5 5 km

GDA2020 MGA Zone 55

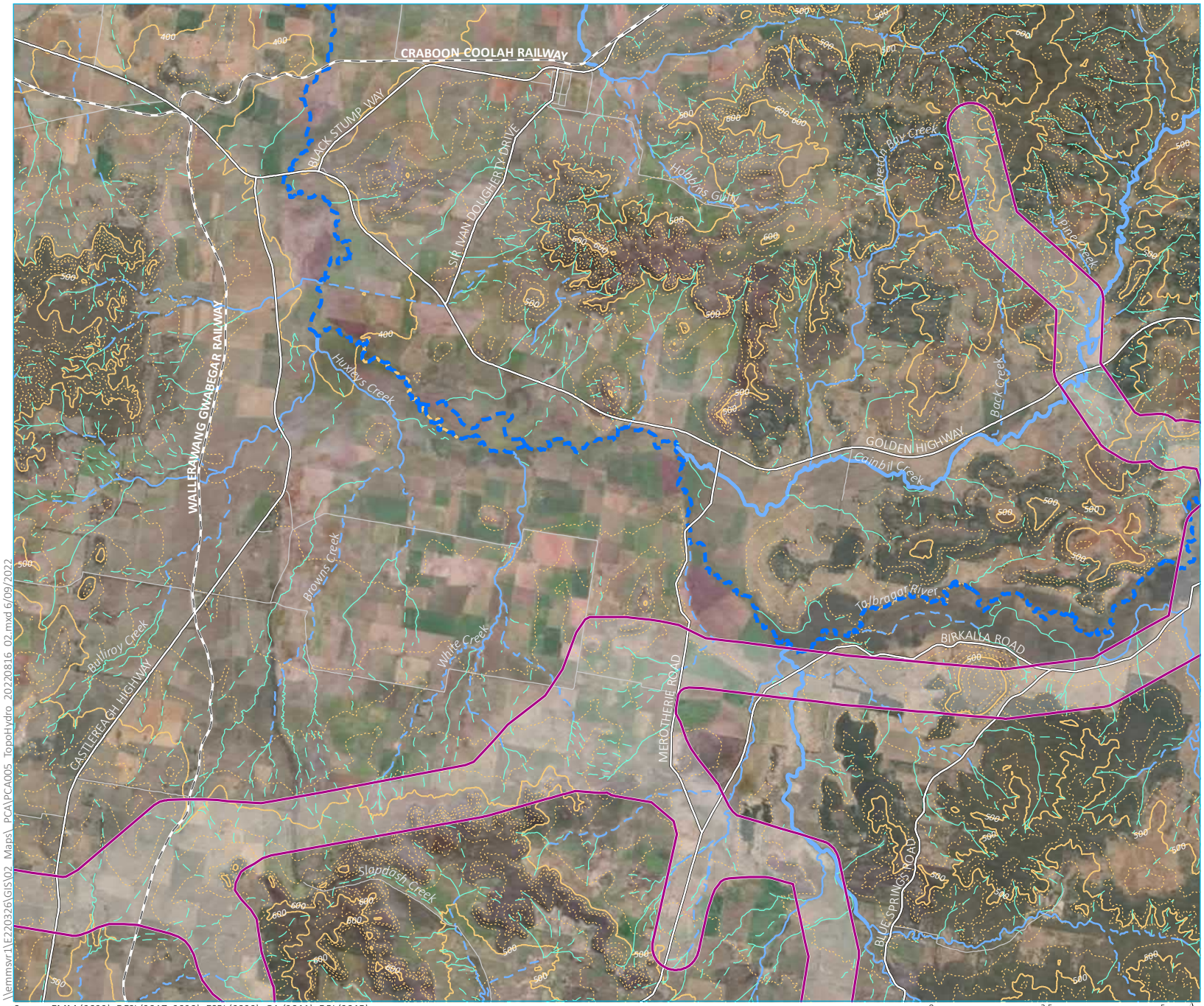
N

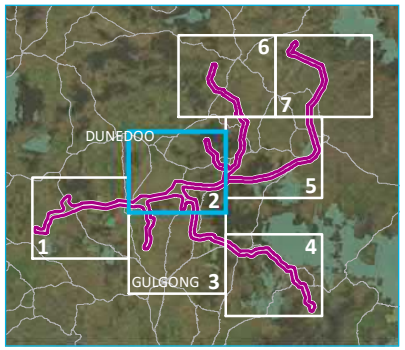
\\emmsvr1\E220326\GIS\02 Maps\ PCA\PCA005 TopoHydro 20220816 02.mxd 6/09/2022

Environmental context: Topography and hydrology Map 1 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 4.2

EMM creating opportunities





KEY

- Project study area
- Rail line
- Major road
- Minor road
- Topographic contour (20 m interval)
- Topographic contour (100 m interval)

Strahler stream order

- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order

INSET KEY

- Major road
- NPWS reserve
- State forest

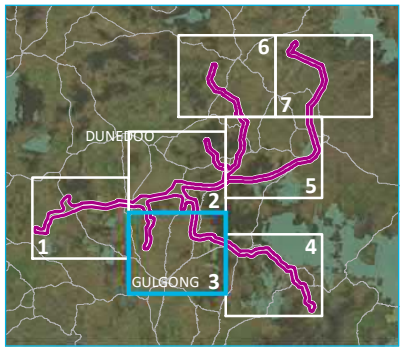
Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); GA (2011); DPI (2015)

\\emmsvr1\E220326\GIS\02 Maps\ PCA\PCA005 TopoHydro 20220816 02.mxd 6/09/2022

Environmental context:
Topography and hydrology
Map 2 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 4.2

EMM
creating opportunities



KEY

- Project study area
- Rail line
- Major road
- Minor road
- Topographic contour (20 m interval)
- Topographic contour (100 m interval)

Strahler stream order

- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order
- 7th order
- 8th order

INSET KEY

- Major road
- NPWS reserve
- State forest

Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); GA (2011); DPI (2015)

0 2.5 5 km

GDA2020 MGA Zone 55

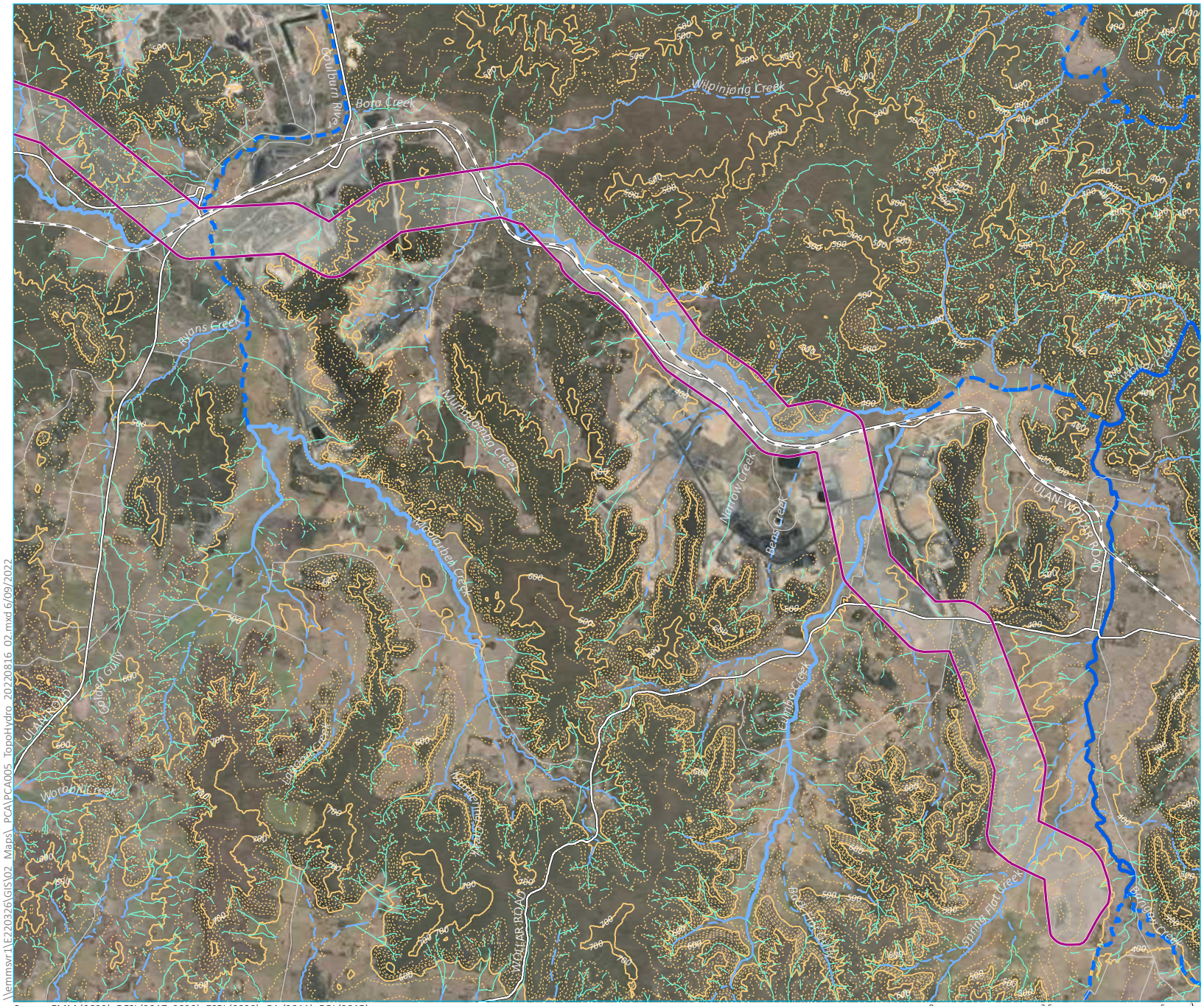
N

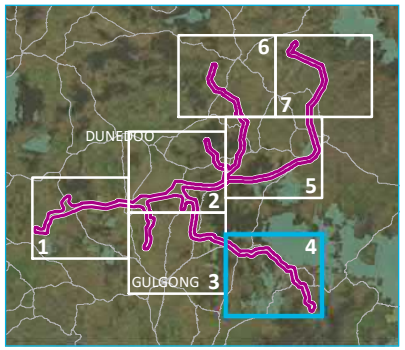
\\emmsvr1\E220326\GIS\02 Maps\ PCA\PCA005 TopoHydro 20220816 02.mxd 6/09/2022

Environmental context:
Topography and hydrology
Map 3 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 4.2

EMM
creating opportunities





KEY

- Project study area
- Rail line
- Major road
- Minor road
- Topographic contour (20 m interval)
- Topographic contour (100 m interval)

Strahler stream order

- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order
- 7th order

INSET KEY

- Major road
- NPWS reserve
- State forest

Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); GA (2011); DPI (2015)

0 2.5 5 km

GDA2020 MGA Zone 55

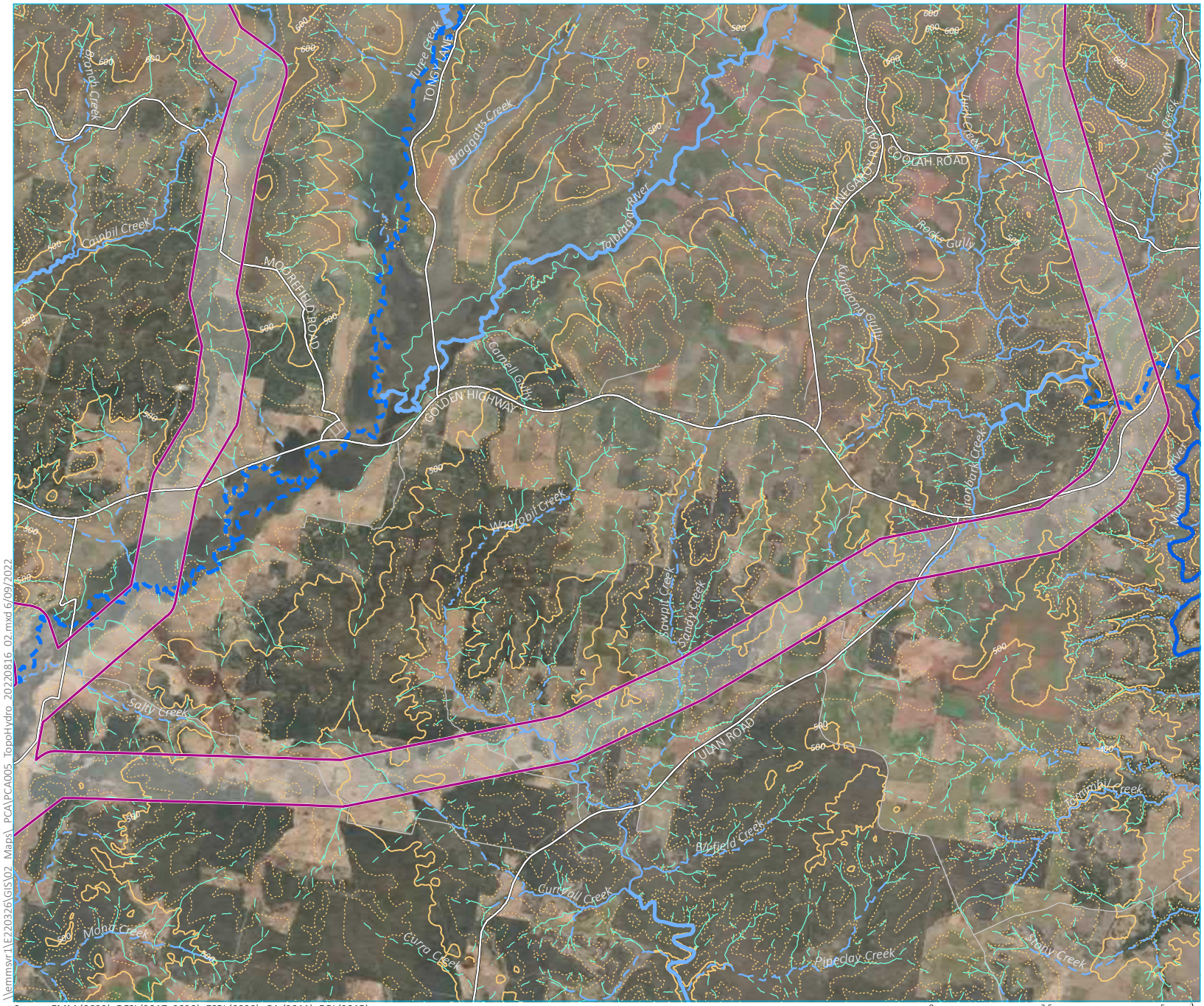
N

\\emmsvr1\E220326\GIS\02 Maps\ PCA\PCA005 TopoHydro 20220816 02.mxd 6/09/2022

Environmental context: Topography and hydrology Map 4 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 4.2

EMM creating opportunities



KEY

- Project study area
- Major road
- Minor road
- Topographic contour (20 m interval)
- Topographic contour (100 m interval)

Strahler stream order

- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order
- 7th order

INSET KEY

- Major road
- NPWS reserve
- State forest

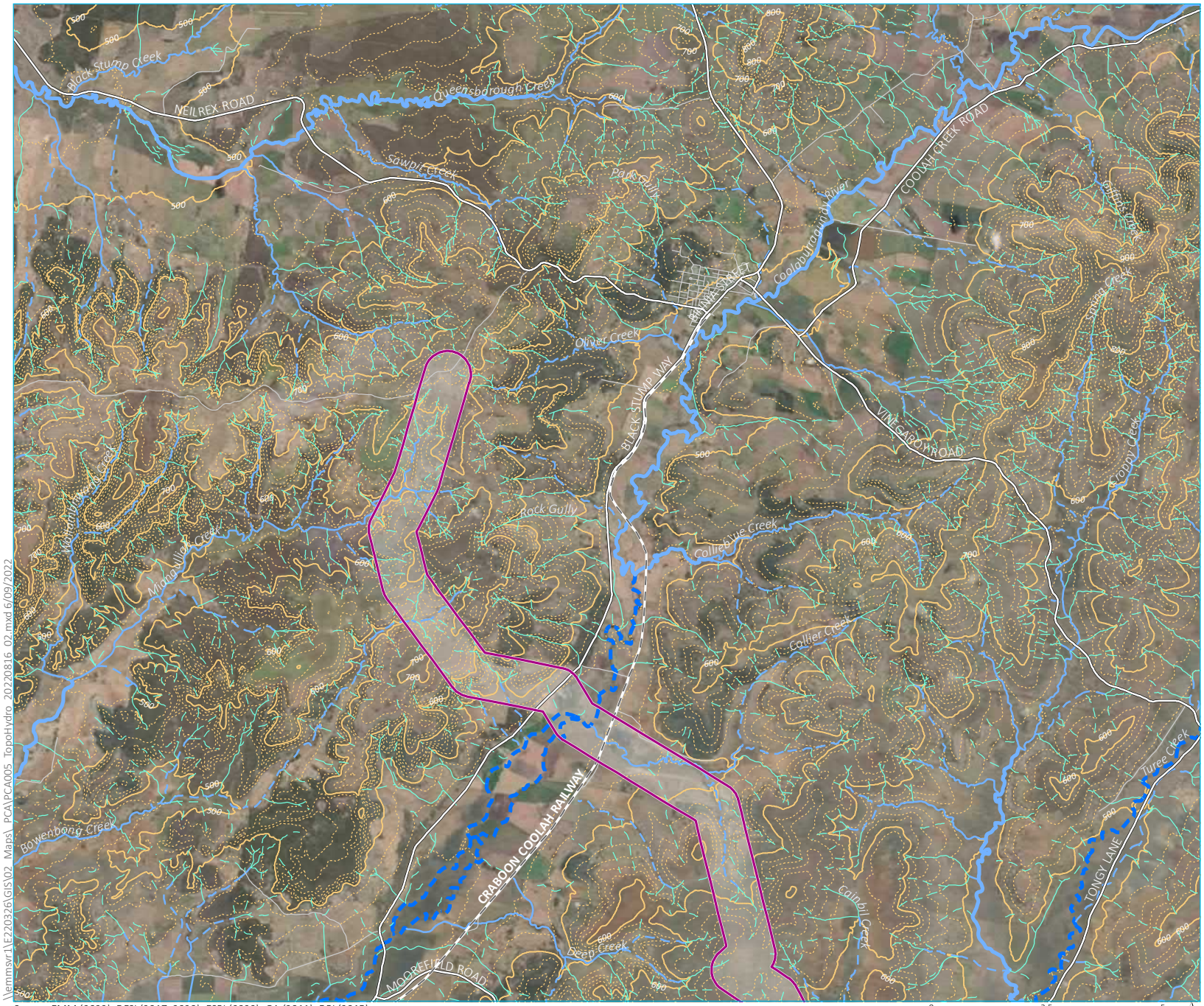
Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); GA (2011); DPI (2015)

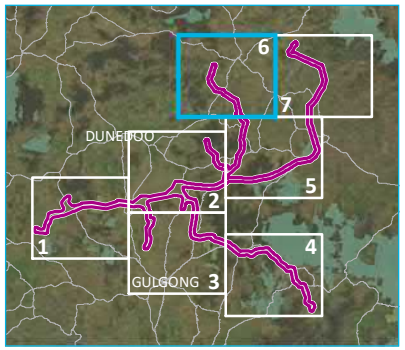
\\emmsvr1\E220326\GIS\02 Maps\ PCA\PCA005 TopoHydro 20220816 02.mxd 6/09/2022

Environmental context: Topography and hydrology Map 5 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 4.2

EMM creating opportunities





KEY

- Project study area
- Rail line
- Major road
- Minor road
- Topographic contour (20 m interval)
- Topographic contour (100 m interval)

Strahler stream order

- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order

INSET KEY

- Major road
- NPWS reserve
- State forest

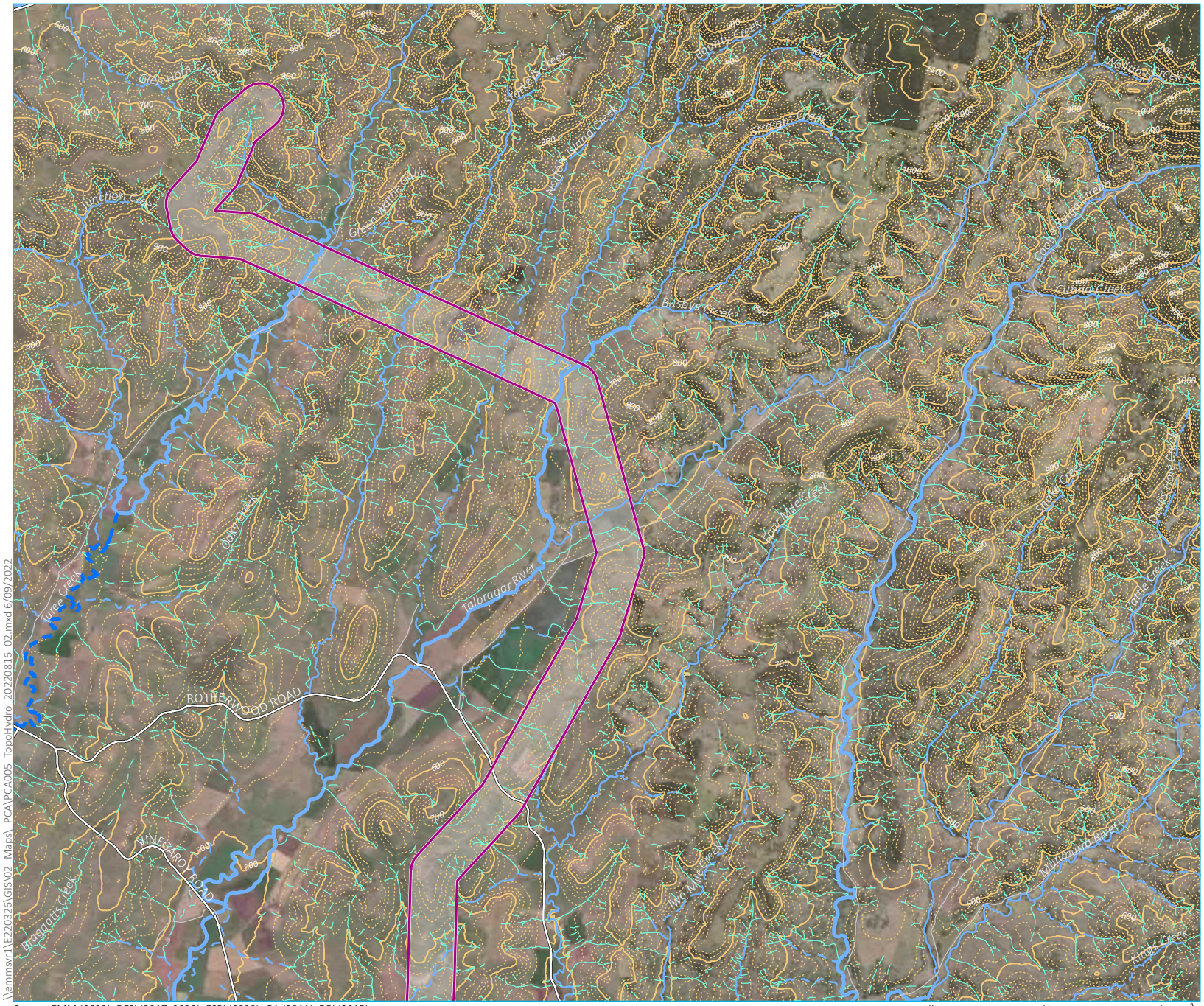
Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); GA (2011); DPI (2015)

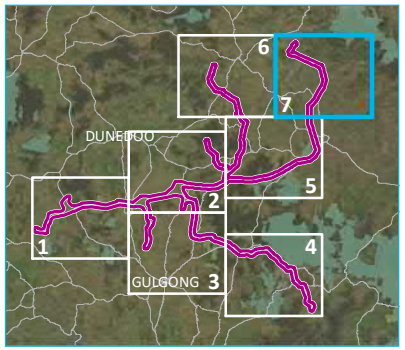
\\emmsvr1\E220326\GIS\02 Maps\ PCA\PCA005 TopoHydro 20220816 02.mxd 6/09/2022

Environmental context: Topography and hydrology Map 6 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 4.2

EMM creating opportunities





KEY

- Project study area
- Major road
- Minor road
- Topographic contour (20 m interval)
- Topographic contour (100 m interval)

Strahler stream order

- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order

INSET KEY

- Major road
- NPWS reserve
- State forest

Environmental context:
Topography and hydrology
Map 7 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 4.2

EMM
creating opportunities

\\emmsvr1\E220326\GIS\02 Maps\ PCA\PCA005 TopoHydro 20220816 02.mxd 6/09/2022

Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); GA (2011); DPI (2015)

0 2.5 5 km

GDA2020 MGA Zone 55

N

4.2.4 Previous disturbance and land use

Previous land disturbance has a significant impact on survivability of cultural materials if present. While there are natural processes that can disturb and/or destroy cultural material, more frequently it is increasing human activity over the last 250 years that has resulted in the most significant impacts.

The project study area has been subject to various activities that would have affected the landscape since the early nineteenth century (Section 3). The wider region was extensively cleared of all old growth vegetation to transform the land into a landscape more suitable for agriculture and/or pastoral grazing. Original vegetation would have included eucalypt, spotted gum and ironbark species of tree typical of the Tableland Region. During the 1930s, larger mining expeditions for coal and shale began and significantly transformed areas within the project study area.

Land clearing and cultivation is a part of the development of the historical landscape in the project study area.

4.3 Archaeological context

4.3.1 Previous investigations

Previous archaeological investigations of the region have included a range of road, telecommunication and electrical infrastructure, coal mining, and more recently solar and wind farms.

By far the most extensive studies in the region have occurred at Wilpinjong Coal Mine in the eastern portion of the project study area. Investigations by Southeast Archaeology (2015), in consultation with numerous Wiradjuri and Wonnarua traditional owners, identified 239 Aboriginal sites and places within a 1,275 hectare (ha) study area. When incorporating works from other substantive studies of proposed coal project immediately east of Wilpinjong – the Mt Penny Coal Project (ARAS 2012) and Bylong Coal Project (RPS Australia East 2015) – some 747 sites are documented, correlating to ~1 site/8 ha. Based on the size of the CWO REZ transmission project, this may suggest some ~550 sites being within the project study area. Of these 747 sites, the vast majority of them are stone artefact scatters, usually of low numbers (<20) (n=364/49%) or isolated finds (n=180/24%). With few exceptions – usually where artefacts are found in association with other rarer types (eg grinding grooves, rockshelters) – they were considered of low significance.

However, these studies identified a number of sites and features that were less common in the region, and in some cases highlighted as of higher value to the local and/or regional community. At Winpinjong, there was an extensive number of rockshelters identified as a result in part of the steep relief dominating the study area. Some 136 rockshelter sites were identified with varying degrees of certainty, along with culturally modified trees, several water-holes and a place of cultural value, Rocky Hill (see below). Of the 239 sites documented, only six were considered of moderate or high significance. To the west, there have been several assessments of Moorlarben coal mine – also intersecting with the project study area - with the most recent by Niche (2021) as part of a modification. These investigations identified a number of rockshelters (n=19) associated with high ridgelines extending through the site, in combination with a large number of low density artefact scatters and/or isolated Aboriginal objects (n=23) distributed more disparately across the locale. An earlier modification also assessed by Niche (2017) indicates that the mine's internal database has records of 871 previously documented sites and places are within the site's curtilage, and some 326 of these have been previously destroyed. A breakdown of these indicated that 414 of these sites were artefact scatters or isolated Aboriginal objects. Rockshelters and grinding grooves were also listed in lesser numbers (Niche 2017).

In the vicinity of Elong Elong, the proposed Cobbora Coal Project was assessed in 2012 (EMM, 2012). These investigations identified a more diverse archaeological landscape, with some 229 sites recorded across the 276 km^2 application area. Many of these were associated with Sandy Creek and Laheys Creek that ran through the study area, and included rockshelters, (n=7), grinding grooves (n=18), culturally modified trees (n=25) and hearths (n=15). The remaining 164 sites consisted of stone artefact sites of varying densities.

There are a significant number of recently assessed solar and wind farms for the region, including Beryl solar farm (NGH Environmental 2017), Bodangora wind farm (NSW Archaeology 2011), Dunedoo solar farm (NGH Environmental 2020), Liverpool Range wind farm (NSW Archaeology 2017), Maryvale solar farm (Kelleher Nightingale Consulting 2018), Stubbo solar farm (OzArk Environment and Heritage 2020), Valley of Winds wind farm (OzArk Environment and Heritage 2022), Spicers Creek wind farm (Umwelt 2022), Uungula wind farm (Austral Archaeology 2020), and Wollar solar farm (NGH Environmental 2018). These are generally the undulating hills and flat landscapes to the west of the Great Dividing Range, and that correlate more closely with much of the project study area. A detailed synthesis of these assessments will form part of subsequent reporting, but in general with few exceptions, they are dominated by isolated and low density stone artefacts often associated with areas of exposure and/or creek lines. There are also lesser examples of grinding grooves found in creeklines at Valley of Winds and Wollar, and culturally modified trees across several of these projects. Of note was a 'birthing tree', identified as a cultural site, within the Wollar solar farm footprint. To date few of these have been subject to any form of sub-surface investigations, with the Uungula study perhaps being the most extensive. These demonstrated a typically shallow soil profile, with the deepest deposits being <70 cm deep. Few cultural materials were recovered.

4.3.2 Database searches

The AHIMS database is managed by Heritage NSW and includes a location and description of Aboriginal objects and sites recorded through academic research and cultural resource management. The database identifies any Aboriginal sites or places registered within the project study area; and aids predictions for the project study area showing the frequency and distribution of Aboriginal site types in the broader landscape.

On 22 April 2022 and 16 August 2022, AHIMS searches were undertaken that encompassed the entire project study area. Due to the size of the project study area and limitations on searches of the AHIMS database (including limits on search extents and the quantity of results within any one search area), this ultimately resulted in the completion of 34 discrete searches being conducted totalling around 4,978,538 km^2 in area. Copies of the AHIMS searches are not included in this report but can be provided on request.

A total of 2,847 Aboriginal heritage sites were identified via the AHIMS searches (Table 4.4, Figure 4.3). The most common site types registered in AHIMS for the region are artefactual sites (n=2,295, 80.6%)[1]; followed by areas of PAD (n=313[1], 11.0%), culturally modified trees (n=148[1], 5.2%), and grinding grooves (n=65[1], 2.3%). The representation of art sites (n=44[1], 1.5%) increases dramatically towards the eastern portion of the project study area correlating with availability of suitable geological outcropping. AHIMS search results also included 37 registrations for which details, including location and site type, are restricted. EMM are currently liaising with Heritage NSW regarding the details of these sites.

With respect to site distribution, the registered sites in the region appear to reflect a combination of compliance-based assessments and research-based investigations. In particular, the sites registered in the vicinity of mining operations near Ulan, Moolarben and Wilpinjong certainly add an element of recording bias to the registered sites in the region (see also Section 4.3.1). This high-density clustering of sites around mining operations is more likely indicative of the level of investigation in this region, rather than any discernible archaeological patterning.

Of the 2,847 total, there are 295 Aboriginal sites located within the project study area (Figure 4.3). The most common site types are artefact sites (n=262, 88.8%); followed by comparable representation of PADs (n=27,9.15%) and culturally modified trees (n=11, 3.73%). Of note is a site identified as the 'Ulan Wilpinjong Creek bora ground' (#36-3-0044), which presumably reflects an important location of past ceremonial activity and would form a focus of subsequent investigations. It's location is situated on the very edge of the current corridor within the Wilpinjong mine lease. This pattering is more reflective of the extensive archaeological investigations

[1] Note, numerous sites contain multiple attributes, these values therefore may capture the same site multiple times for different features.

associated with mining operations (Section 4.3.1) than necessarily a robust indication of the entire range of cultural materials in the region.

It is also important to note that areas where few or no Aboriginal sites were identified on the AHIMS database does not necessarily correlate with a low frequency of sites being present, rather the spatial disparity with which sites are identified across the region is more often a reflection of the amount of archaeological survey that has been done in the area. This means that Aboriginal objects may be present in any of the proposed transmission line locations despite an apparent lack of AHIMS sites.

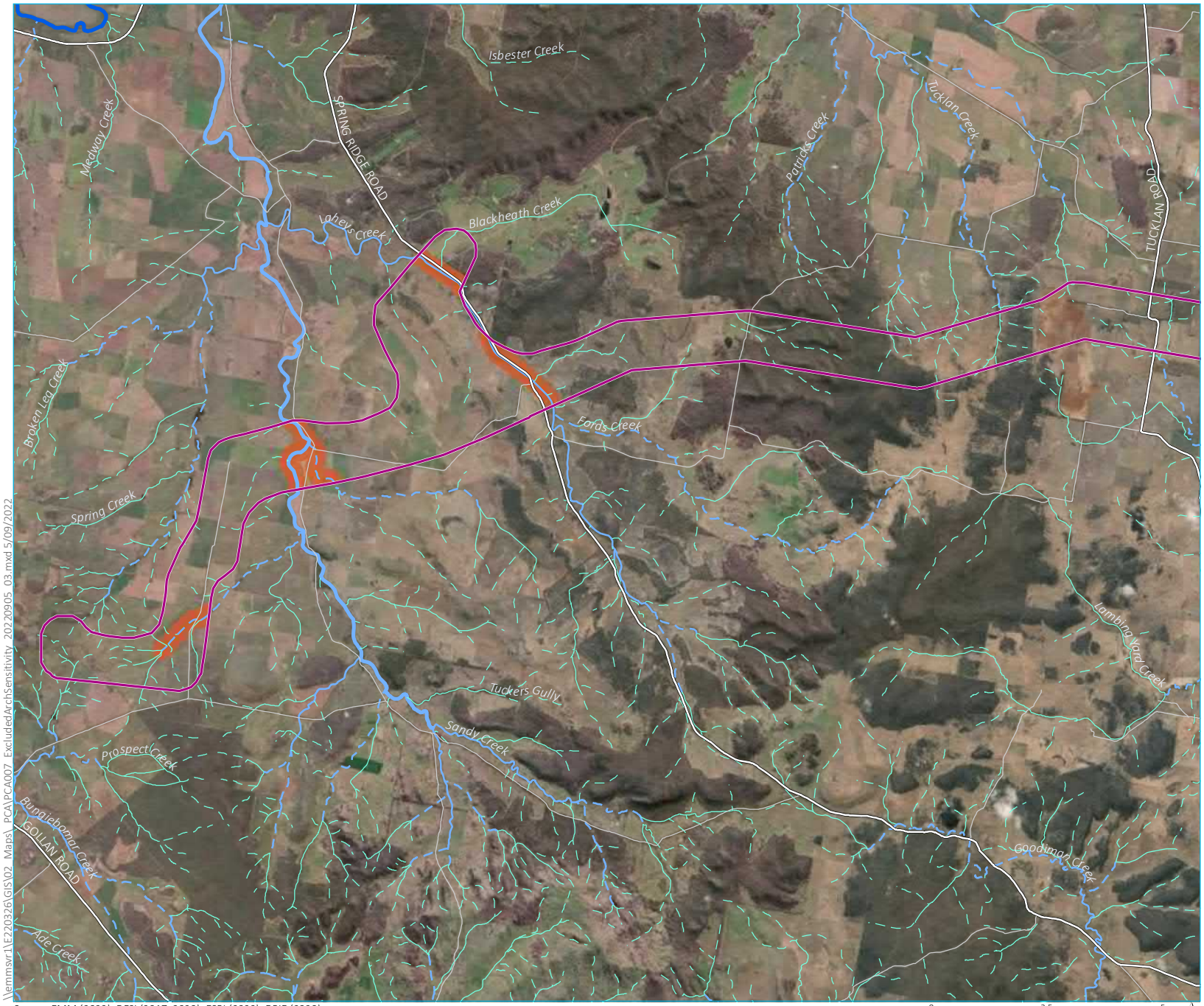
Table 4.4 Previously recorded Aboriginal objects, sites and places within the AHIMS database.

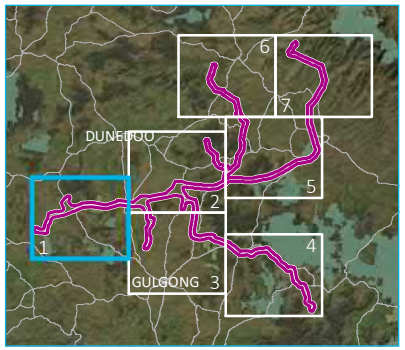
Site Feature/s	Total AHIMS assemblage		AHIMS Sites within the project study area	
	(n)	% of total	(n)	% of total
Artefact	2,179	76.54	245	83.05%
Potential Archaeological Deposit (PAD)	187	6.57	10	3.39
Modified Tree (Carved or Scarred)	143	5.02	11	3.73
Potential Archaeological Deposit (PAD), Artefact	110	3.86	17	5.76
Grinding Groove	43	1.51	5	1.69
Restricted	37	1.30	- [2]	-
Art (Pigment or Engraved)	34	1.19	4	1.36
Hearth	15	0.53	-	-
Water Hole	14	0.49	-	-
Habitation Structure	12	0.42	-	-
Stone Quarry	12	0.42	-	-
Grinding Groove, Artefact	11	0.39	-	-
Stone Arrangement	7	0.25	1	0.34
Aboriginal Ceremony and Dreaming	6	0.21	1	0.34
Art (Pigment or Engraved), Potential Archaeological Deposit (PAD)	5	0.18	-	-
Habitation Structure, Artefact, Potential Archaeological Deposit (PAD)	4	0.14	-	-
Ochre Quarry	4	0.14	-	-
Burial	3	0.11	-	-
Hearth, Potential Archaeological Deposit (PAD)	6	0.21	-	-
Modified Tree (Carved or Scarred), Grinding Groove	3	0.11	-	-
Art (Pigment or Engraved), Artefact	2	0.07	-	-
Art (Pigment or Engraved), Grinding Groove	2	0.07	-	-

[2] EMM are currently liaising with Heritage NSW regarding the details of these 37 restricted sites, including location and site type, and as such cannot yet confirm if any occur within the project study area.

Table 4.4 Previously recorded Aboriginal objects, sites and places within the AHIMS database.

Site Feature/s	Total AHIMS assemblage		AHIMS Sites within the project study area	
	(n)	% of total	(n)	% of total
Art (Pigment or Engraved), Grinding Groove, Artefact	1	0.04	-	-
Grinding Groove, Artefact, Potential Archaeological Deposit (PAD)	1	0.04	-	-
Grinding Groove, Stone Arrangement, Water Hole	1	0.04	1	0.34
Grinding Groove, Water Hole	1	0.04	-	-
Habitation Structure, Artefact	1	0.04	-	-
Midden	1	0.04	-	-
Modified Tree (Carved or Scarred), Burial	1	0.04	-	-
Modified Tree (Carved or Scarred), Ceremonial Ring (Stone or Earth)	1	0.04	-	-
Total	**2,847**	**100.00**	**295**	**100.00**





KEY

- Project study area
- Major road
- Minor road
- Archaeologically sensitive area

Strahler stream order

- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 7th order

INSET KEY

- Major road
- NPWS reserve

Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

0 2.5 5 km

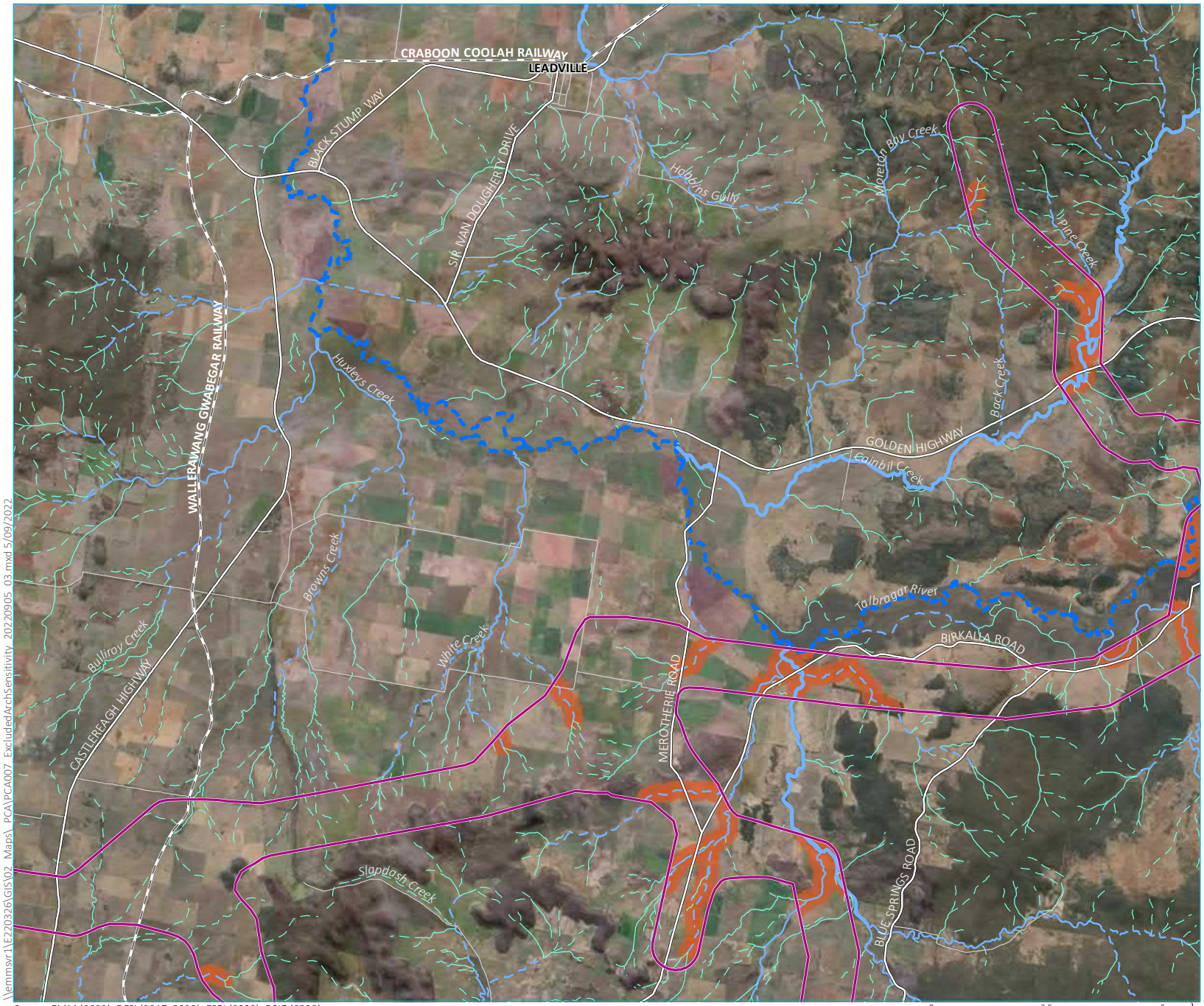
GDA2020 MGA Zone 55

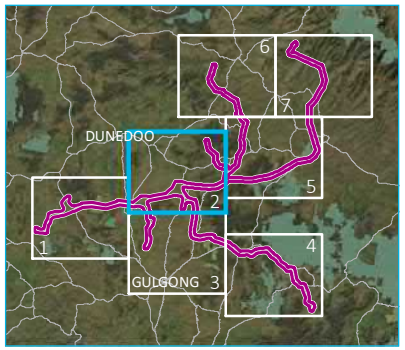
N

Archaeological context: Archaeologically sensitive areas Map 1 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 4.3

EMM creating opportunities





KEY

- Project study area
- Rail line
- Major road
- Minor road
- Archaeologically sensitive area

Strahler stream order

- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order

INSET KEY

- Major road
- NPWS reserve

Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

0 2.5 5 km

GDA2020 MGA Zone 55

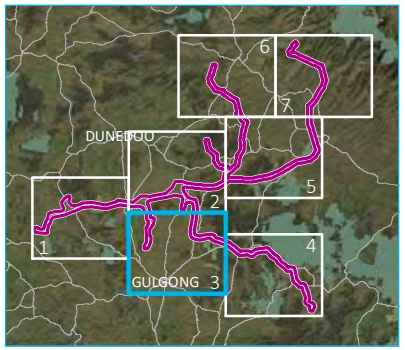
N

\\emmsvr1\E220326\GIS\02 Maps\ PCA\PCA007 ExcludedArchSensitivity 20220905 03.mxd 5/09/2022

Archaeological context: Archaeologically sensitive areas Map 2 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 4.3

EMM creating opportunities



KEY

- Project study area
- Rail line
- Major road
- Minor road
- Archaeologically sensitive area

Strahler stream order

- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order
- 7th order
- 8th order

INSET KEY

- Major road
- NPWS reserve

Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

0 2.5 5 km

GDA2020 MGA Zone 55

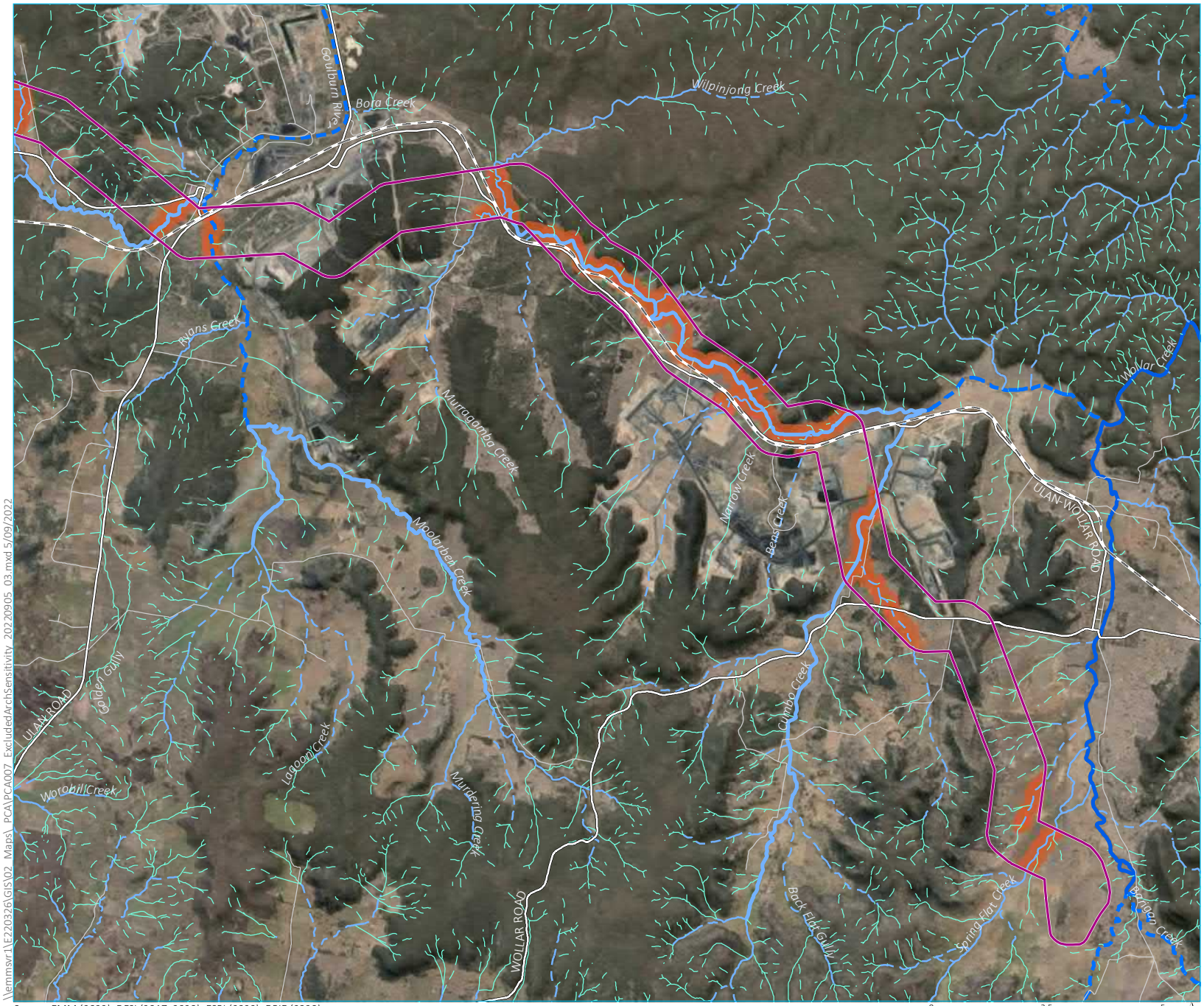
N

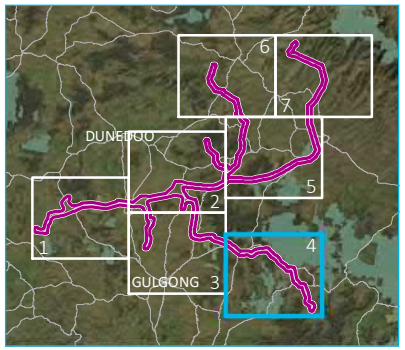
\\emmsvr1\E220326\GIS\02_Maps_PCA\PCA007_ExcludedArchSensitivity_20220905_03.mxd 5/09/2022

Archaeological context: Archaeologically sensitive areas Map 3 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 4.3

EMM creating opportunities





KEY

- Project study area
- Rail line
- Major road
- Minor road
- Archaeologically sensitive area

Strahler stream order

- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order
- 7th order

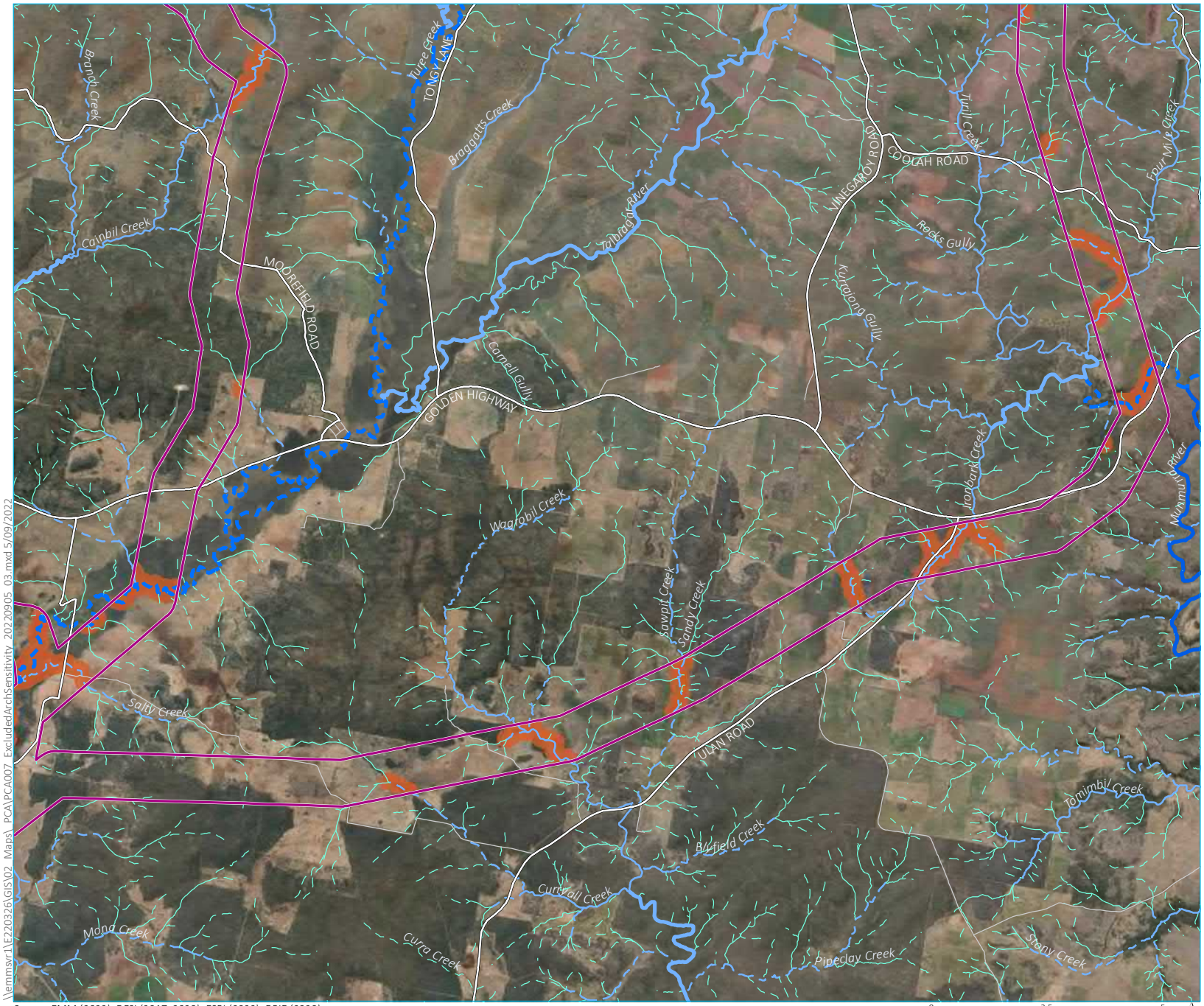
INSET KEY

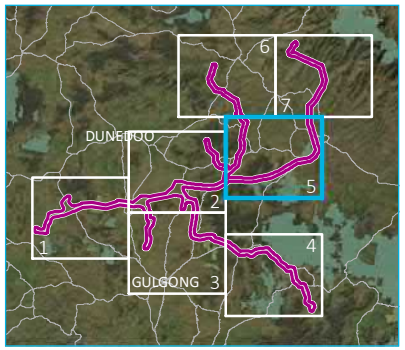
- Major road
- NPWS reserve

Archaeological context: Archaeologically sensitive areas Map 4 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 4.3

EMM creating opportunities





KEY

- Project study area
- Major road
- Minor road
- Archaeologically sensitive area

Strahler stream order

- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order
- 7th order

INSET KEY

- Major road
- NPWS reserve

\\emmsvr1\E220326\GIS\02 Maps\ PCA\PCA007 ExcludedArchSensitivity 20220905 03.mxd 5/09/2022

Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

0 2.5 5 km

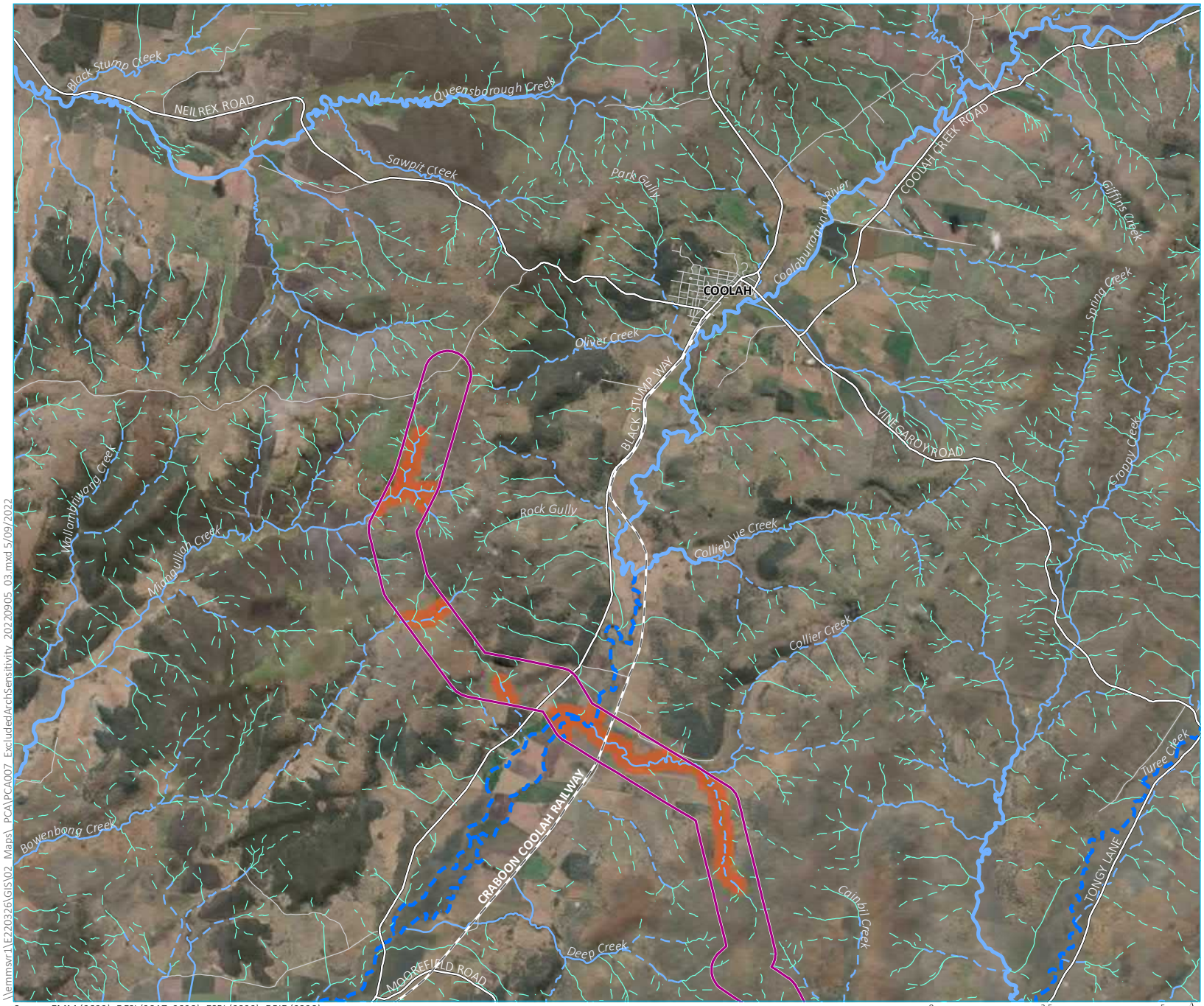
GDA2020 MGA Zone 55

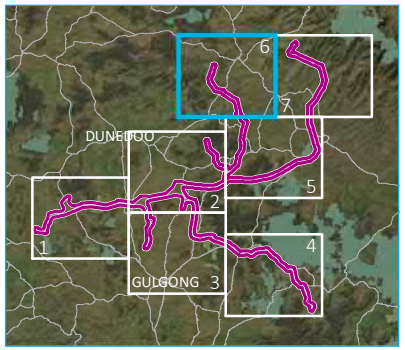
N

Archaeological context: Archaeologically sensitive areas Map 5 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 4.3

EMM creating opportunities





KEY

- Project study area
- Rail line
- Major road
- Minor road
- Archaeologically sensitive area

Strahler stream order

- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order

INSET KEY

- Major road
- NPWS reserve

Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

0 2.5 5 km

GDA2020 MGA Zone 55

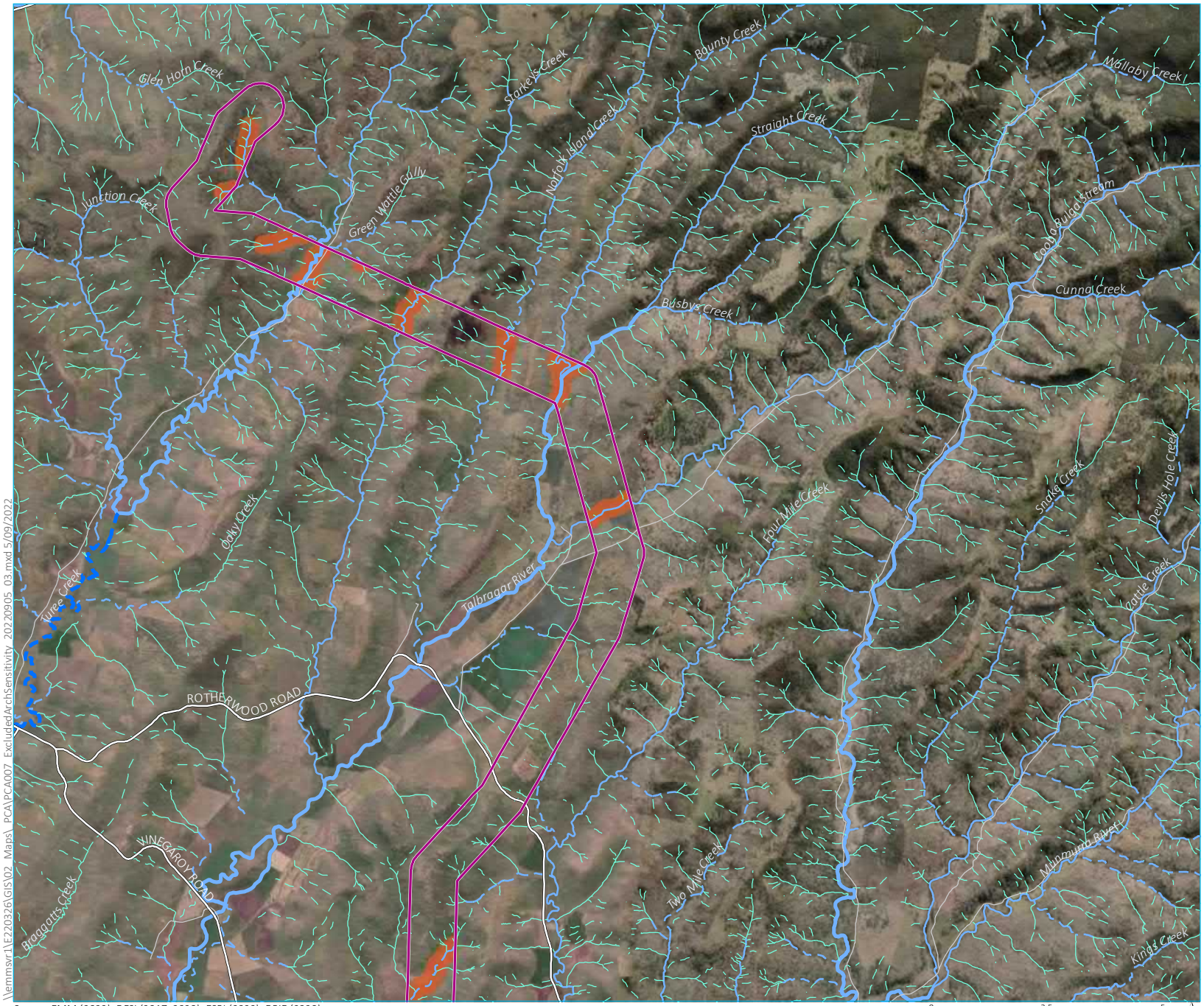
N

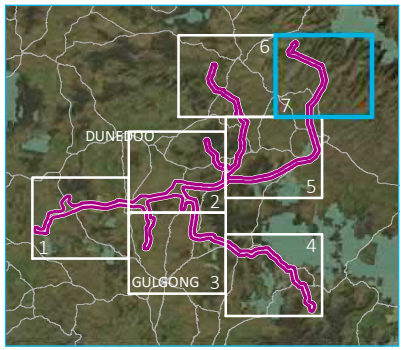
\\emmsvr1\E220326\GIS\02_Maps_PCA\PCA007_ExcludedArchSensitivity_20220905_03.mxd 5/09/2022

Archaeological context: Archaeologically sensitive areas Map 6 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 4.3

EMM creating opportunities





KEY

- Project study area
- Major road
- Minor road
- Archaeologically sensitive area

Strahler stream order

- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order

INSET KEY

- Major road
- NPWS reserve

Archaeological context: Archaeologically sensitive areas Map 7 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 4.3

EMM creating opportunities

\\emmsvr1\E220326\GIS\02_Maps_PCA\PCA007_ExcludedArchSensitivity_20220905_03.mxd 5/09/2022

4.4 Culturally significant sites

Predominant Aboriginal site types identified within the project study area include artefact sites, culturally modified trees and PADs. A wider range of site types were identified in the broader AHIMS search which demonstrate a broad range of cultural landscape uses across this region. These include rarer site types such as Aboriginal ceremony and dreaming sites and stone arrangements. These sites generally have a heightened cultural significance with Aboriginal people in the area.

The preliminary heritage assessment has limited information on intangible/cultural places or values within the project study area as no Aboriginal consultation has been undertaken to date. Existing documentary information has identified one specific place, a site known as Rocky Hill or Bird Rock located ~2.7 km outside the project study area (Wilpinjong Extension) which should be noted for its significance. The site is associated with rockshelters containing art (#36-3-2952, #36-3-2954), an ochre quarry (#36-3-2953), scarred tree (#36-3-3740), water hole (#36-3-2804) and numerous artefact sites. The presence of Rocky Hill or Bird Rock in the immediate surrounds of the project study area provides a good indication of the potential for such culturally significant sites within the project study area. More recently a 'birthing tree' – another type of cultural site - is also documented in the vicinity of Wollar Creek (Section 4.3.1).

Furthermore, due to the presence of restricted sites in the AHIMS data, often associated with dreaming and/or other ceremonial activities, for which details including site type or location are not yet available, the potential exists for further culturally significant sites or places within the project study area.

4.5 Predictive model

Based on the distribution of sites and finds by previous investigations and the AHIMS data, a number of predictions in relation to cultural material within the project study area can be developed. Spatially, at a generic level, the criteria as outlined in Heritage NSW's *Due Diligence Code of Practice* (DECCW 2010) can be utilised, which includes: i) within 200 m of waters; ii) located within a sand dune system; iii) located on a ridge top, ridgeline, or headland; iv) located within 200 m below or above a cliff face; or v) within 20 m of or in a cave rock shelter or cave mouth; and vi)is on land that is not disturbed land.

These criteria can be further refined with the addition of fieldwork ground-truthing and consultation with Aboriginal stakeholders. Of note is that while significant cultural material is often found in the vicinity of water, it is more commonly associated with third order and above waterways, and less so on smaller tributaries or ephemeral drainage lines. Areas of anticipated archaeological sensitivity are shown on Figure 4.3 as a buffer of 200m from waterways 3rd order Strahler and above. Further, significant cultural material along waterways is most frequently associated with elevated areas, including terraces, crests, and low hills, with much less evidence on floodplains or slopes.

Cultural material is likely to be dominated by various densities of surface and/or sub-surface stone artefacts. These will generally be found in numbers of <20 and often as isolated objects. Only 33 of the 2,314 artefactual sites (where information is available) were documented with more than 50 artefacts. In most cases, the artefact typologies, and occasional chronological dating, suggests these materials are primarily dating to the last few thousand years.

Land clearing and development have had a significant impact on the potential for archaeological deposits to occur within the project study area as well as the retention of obtrusive site types such as modified trees or stone arrangements.

Based on this, the following site types can be expected within the project study area:

- **Artefact sites:** Open camp sites represent past Aboriginal subsistence and stone knapping activities and include archaeological remains such as stone artefacts and hearths. This site type usually appears as surface scatters of stone artefacts in areas where vegetation is limited, and ground surface visibility increases. Isolated finds may represent a single item discard event or be the result of limited stone

knapping activity. The presence of such isolated artefacts may indicate the presence of a more extensive, in situ buried archaeological deposit, or a larger deposit obscured by low ground visibility.

- **Potential Archaeological Deposit (PAD)**: Areas of PAD are landform features where there is a strong likelihood that the area will contain subsurface cultural deposits. PADs can have associated surface material or be limited to subsurface material. The presence of PAD associated with waterways or landform features (ie terraces or crests) within the project study area has been established by previous assessments. It is likely for areas of PAD to occur within the project study area.

- **Culturally modified (scarred or carved) trees:** Tree bark was utilised by Aboriginal people for various purposes, including the construction of shelters (huts), canoes, paddles, shields, baskets and bowls, fishing lines, cloaks, torches, and bedding, as well as being beaten into fibre for string bags or ornaments (eg Attenbrow 2002). Trees may also have been scarred in order to gain access to food resources (eg cutting toeholds so as to climb the tree and catch possums or birds), or to mark locations such as tribal territories. Such scars, when they occur, are typically described as scarred trees. The historic clearance of old growth trees across the project study area reduces the likelihood for this site type to occur, however potential remains within remnant mature trees located within travel or waterway corridors where vegetation is more commonly retained.

- **Grinding grooves:** Grinding grooves are the physical evidence of tool making or food processing activities undertaken by Aboriginal people. The manual rubbing of stones against other stones creates grooves in the rock; these are usually found on flat areas of abrasive rock such as sandstone. Grinding grooves have been previously identified within the project study area and as such there is potential for this site type to occur, specifically within landscapes where the dominant geology is sandstone or granite derived.

- **Freshwater middens:** Freshwater middens are defined as a concentration of artefactual debris that includes a significant percentage of freshwater shell. They are usually the result of interim or base camp activity and are normally situated within riparian zones characterised by relatively permanent water. Within the project study area middens may be associated with creeks, rivers, billabongs and prior stream channels.

- **Burial sites**: Mortuary practices often took place in proximity to camp sites, as most people tended to die in or close to camp and it is difficult to move a body over a long distance. Soft, sandy soils on or close to rivers and creeks allowed for easier removal of earth for burial. Similarly, rock shelters or middens also provided accessible burial places. Burial sites may be marked by stone cairns, modified trees, or a natural landmark. They may also be identified through historic records or oral histories.

With specific reference to the project study area, the above information can be summarised as follows:

- In the vicinity of Wollar, Wilpinjong and Moorlarben, there is high potential for rockshelter site types in areas where sandstone outcropping and steep relief occur. This may also be the case for other parts of the project east of Uarbry.

- To the west encompassing areas around Merotherie, Elong Elong and Uarbry, the archaeological record is dominated by stone artefacts of typically low densities. These are found in a wide range of environments and landforms, although more extensive deposits are found in proximity to major tributaries. Examples of this include Laheys Creek and Maryvale Creek based on previous assessments. Artefacts are typically found on the surface and may also be shallowly buried. Also within these environments, sites such as grinding grooves and culturally modified trees have also been documented, where environmental conditions are met - specifically, the presence of exposed sandstone in the vicinity of creek-lines and remnant vegetation, respectively.

- Cultural sites are also documented in the region. Currently, these are poorly understood and typically reflect visually dominant features in the landscape, such as hills and ranges. However, other site types, such as the birthing tree at Wollar may also be encountered elsewhere in the region.

5 Historical heritage

5.1 Key findings

- A review of heritage registers was undertaken to ascertain the number of items that occur in, within 5 km and within 20 km of the project study area to provide a broader context of the cultural landscape within which the project is situated.

- Some 264 listed heritage items occur within 20 km of the project study area. Of these, three are within the project study area and 22 are within 5 km (Annexure A). These can be characterised as residential and rural activities extending over the last 250 years and focussing on urban conurbations, such as Wollar, Coolah, Gulgong and Cassilis. The three items within the project study area are of local heritage significance (two rural homestead complexes and Goulbourn River National Park) (Table 5.1). There are no previously identified items within the project study area listed on the SHR, SHI, s170 register, NHL, CHL, RNE and HHIMS.

- A preliminary field survey identified a previously recorded, but unlisted, family cemetery and a former Cobb & Co structure, within the project study area in the vicinity of the Elong Elong Energy Hub.

5.2 Previous investigations

There are at least ten other solar and wind farms throughout the region that have undergone recent heritage assessments and surveys (refer to 4.3.1 for a full list). From these, historical heritage was identified within or close to the project study area, both previously documented and newly identified. Assessment of the Liverpool Range Wind Farm by Umwelt Pty Limited (not publicly available, but presented in Tilt Renewables Fact Sheet Oct 2021), identified two locally listed heritage items (Upper Hunter Shire LEP 2013) that partially intersect with their project. These included the Yarrawonga (I140) and Dalkeith (I141) estates, located within (Yarrawonga) and approximately 2.5 km east (Dalkeith) of the current project study area. In addition, four potential (unlisted) heritage items were identified including a meat store/shed (PHI 1), shearer's shed, and quarters associated with the Yarrawonga property (PHI 2); and a modified tree (PHI 3) and former shearers' kitchen on the Dalkeith property (PHI 4). Only PHI 2 was assessed as potentially possessing local heritage significance. Overall, the future construction of the wind farm would have no impacts to listed or potential historic heritage items. Indirect impacts associated with the wind farm were considered negligible, but only in the case of listed or potentially listed items (n=3). An earlier assessment of the wind farm by NSW Archaeology Pty Limited (2017) as part of the original EIS identified seven historical sites, which consisted of primarily fencing and former electrical infrastructure.

Similarly, a recent study at the Valley of the Winds Wind Farm (OzArk Environment and Heritage 2022) recorded four potential (unlisted) historic heritage sites – Mt Hope trigonometrical station (HS01), The Rock trigonometrical station (HS01), an unknown rural structure (HS02) and Collier Creek rail bridge (HS01). None of these sites have significant historic heritage values and were recorded as not being directly impacted by the Valley of the Winds Wind Farm project. Of these, Collier Creek rail bridge is inside the project study area, while the three other sites are at least 800 m outside the project study area.

A further proposed five solar and wind farms are partially located within the project study area, which are currently undergoing environmental and heritage investigations. These include Birriwa Solar Farm, Tallawang Solar Farm, Barney's Reef Wind Farm, Sandy Creek Solar Farm and Cobbora Solar Farm. These studies, along with heritage listed items located in the database search show that historic heritage is present throughout the region and within the project study area.

5.3 Database searches

Items that have been assessed as possessing heritage significance and have been gazetted are identified through searching through various registers (Section 2). A search of the heritage registers relevant to the project study area and surrounds was undertaken to assess the known items situated in the boundary and in the vicinity.

Some 264 listed heritage items occur within 20 km of the project study area. Of these, three are within the project study area and 22 are within 5 km (see below) (Figure 5.1; Annexure A). These are dominated by residential and rural properties established in the region over the last 250 years, and with a focus on small urban conurbations such as at Cassilis, Coolah, Wollar and Gulgong. There is frequent reference to government administration (eg police stations, court houses) and ecclesiastical activities (eg cemeteries and churches), as well as residential and commercial buildings found in these locales. A number of nature reserves, conservation areas, and national parks are also documented.

The three listed heritage items located within the project study area are listed Table 5.1. These include Goulbourn River National Park, which the project study area skirts the southern boundary of the item, and two historical homesteads at Wollar and Cassilis.

There are no items within the project study area previously listed on the State Heritage Register, State Heritage Inventory, Section 170 Registers, National Heritage List, Commonwealth Heritage List and Register of National Estate.

Parts of the Goulburn River National Park are being considered for inclusion on the National Heritage List (NHL: 105696 – Nominated Place) as part of an extension to the Greater Blue Mountains Area (NHL: 105999 and World Heritage List – WHL:105127).

Table 5.1 Historic heritage in the project study area

Jurisdiction	Site Name	Item Number	Suburb	Comment
Mid-Western Regional LEP	Goulburn River National Park	I994	Ulan	The project would be refined so that the proposed transmission line easement avoids direct impacts to the national park.
Mid-Western Regional LEP	Wandoona Homestead	I996	Wollar	The spatial data provided by the Department of Planning and Environment erroneously includes two heritage items in the one location. The second item “Homestead” (I367) is actually located outside of the project study area to the east of the Wollar Substation.
Upper Hunter LGA	Yarrawonga	I140	Cassilis	A homestead complex that is located in the northern portion of the project study area.

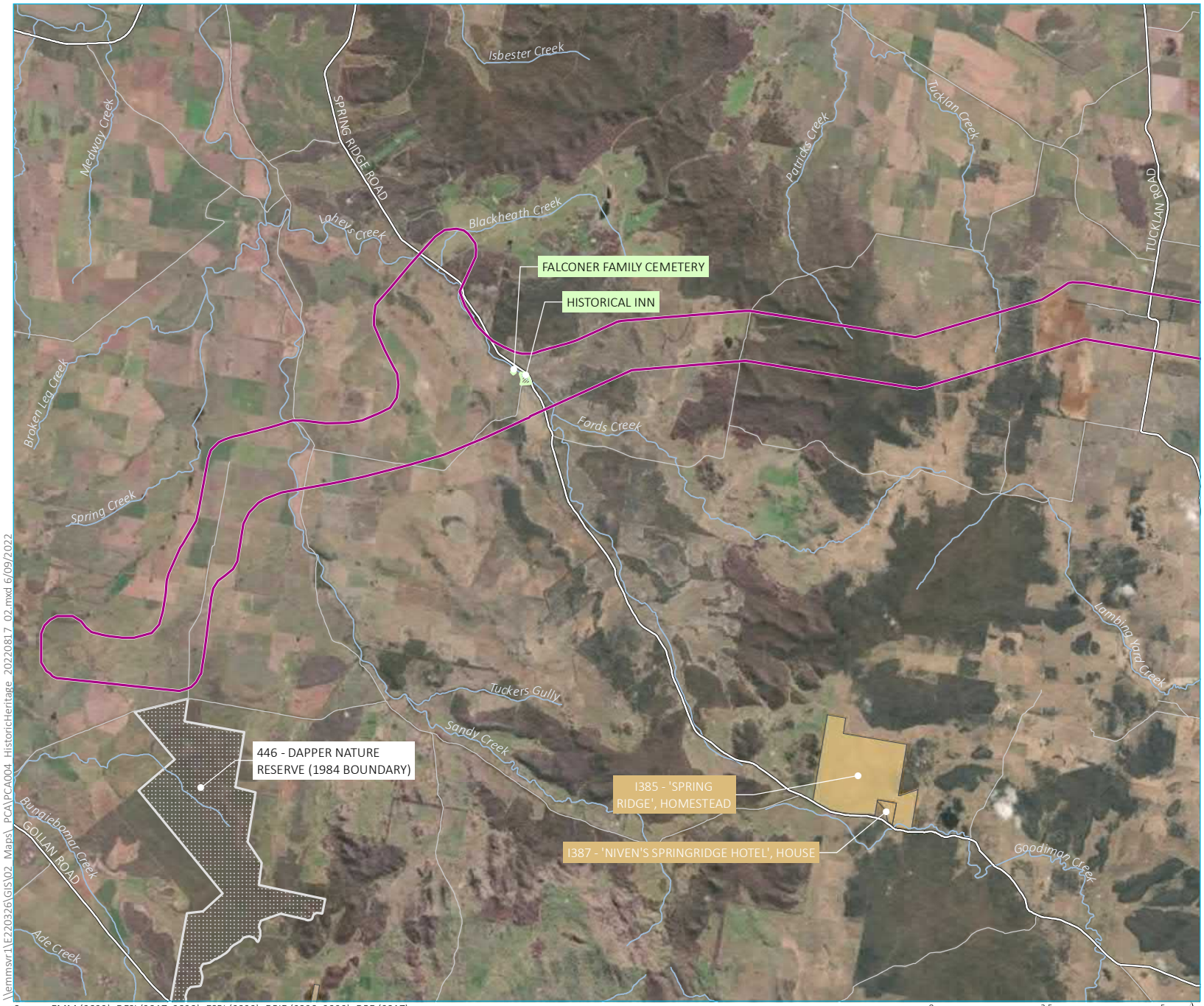
5.4 Preliminary field investigations

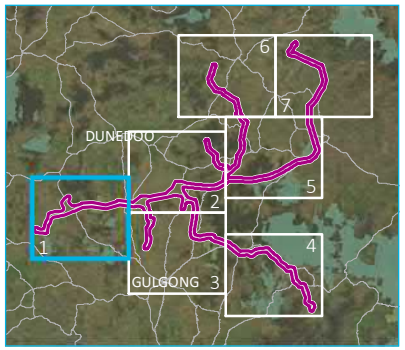
An initial investigation of the project study area was conducted by archaeologists in July 2021. These identified two potential historical heritage items that have been previously documented (EMM 2012), but not listed on any databases. Both of these sites are situated within the project study area (Figure 5.1) in the vicinity of the Elong Elong Energy Hub:

- A cemetery adjacent to Laheys Creek (and known as Laheys Creek Cemetery) - a private family burial ground initially owned by the Falconer family. The earliest burial dates from 1862 with the most recent dating to 1965. Local history records suggest that the cemetery may contain up to 40 burials. A previous assessment of significance prepared for the cemetery found it to be of local significance (EMM 2012).

- Some 240 metres to the south-east of the cemetery, it is believed was a former Cobb & Co site. EMM (2012) recorded a site that was labelled 'Cobb & Co stopping place' but could not find documentary evidence to support the claim. However, artefacts were recorded in the vicinity during the field survey. While it is not clear that it was a Cobb & Co, there is evidence to suggest there was an inn on the land, with the 1885 Parish of Dapper map marks an 'Inn', a 'Bridge' and an indistinguishable structure at this location.

It must be highlighted that initial field investigations focussed on only a small percentage of the project study area, and there is potential for further heritage items to be present as additional on-site activities are undertaken to inform the heritage assessment for the EIS.





KEY

- Project study area
- Major road
- Minor road
- Named watercourse
- Potential heritage sites

Mid-Western Regional Local Environmental Plan 2012

- Item - General

NON-STATUTORY LISTING

- Register of the national estate

INSET KEY

- Major road
- NPWS reserve

\\emmsvr1\E220326\GIS\02_Maps_PCA\PCA004_HistoricHeritage_20220817_02.mxd 6/09/2022

Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); DPIE (2020, 2022); DPE (2017)

0 2.5 5 km

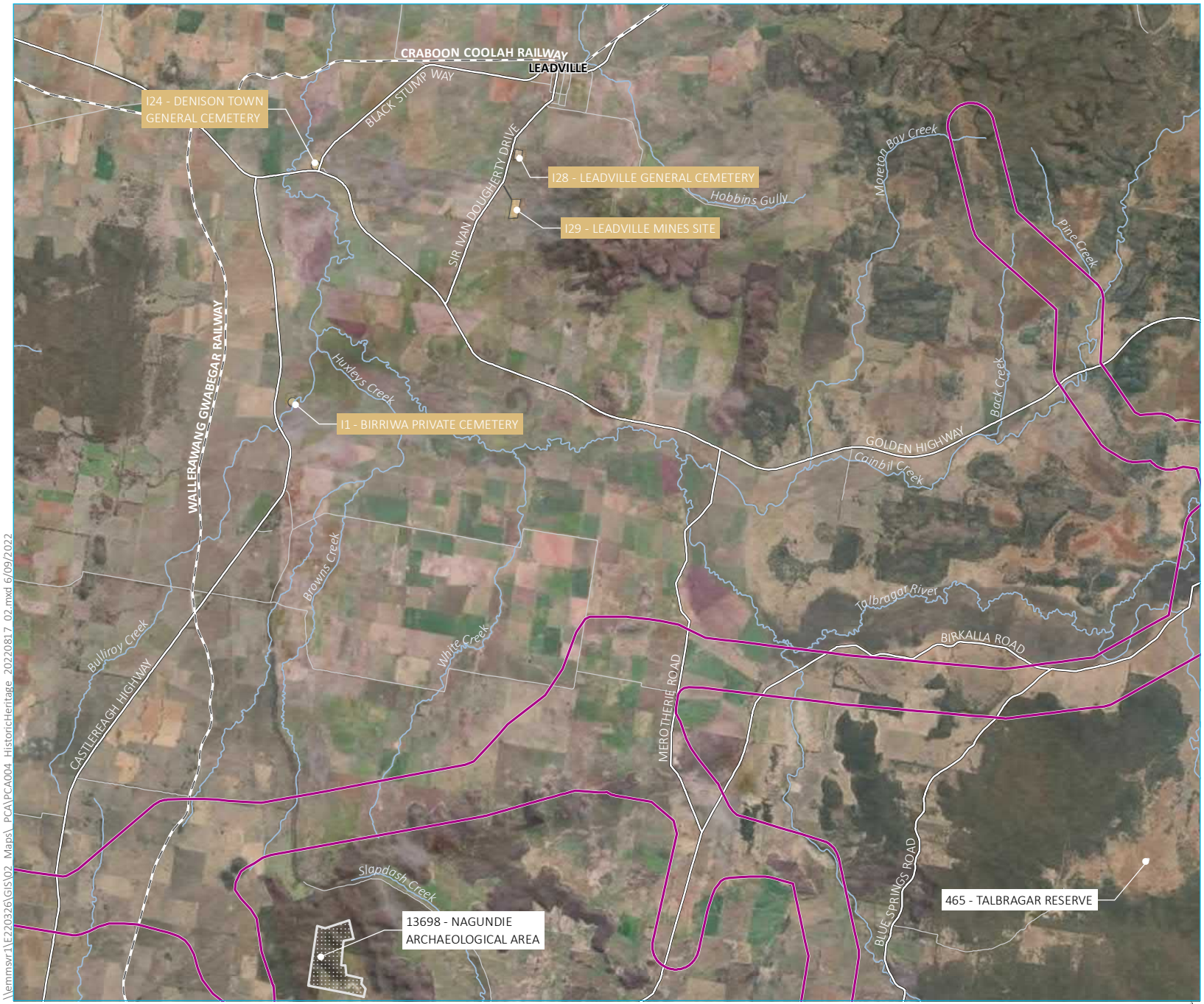
GDA2020 MGA Zone 55

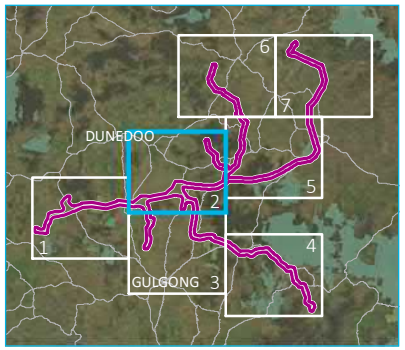
N

Historic heritage and the study area
Map 1 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 5.1

EMM creating opportunities





KEY

- Project study area
- Rail line
- Major road
- Minor road
- Named watercourse

Warrumbungle Local Environmental Plan 2013

- Item - General

NON-STATUTORY LISTING

- Register of the national estate

INSET KEY

- Major road
- NPWS reserve

Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); DPIE (2020, 2022); DPE (2017)

0 2.5 5 km

GDA2020 MGA Zone 55

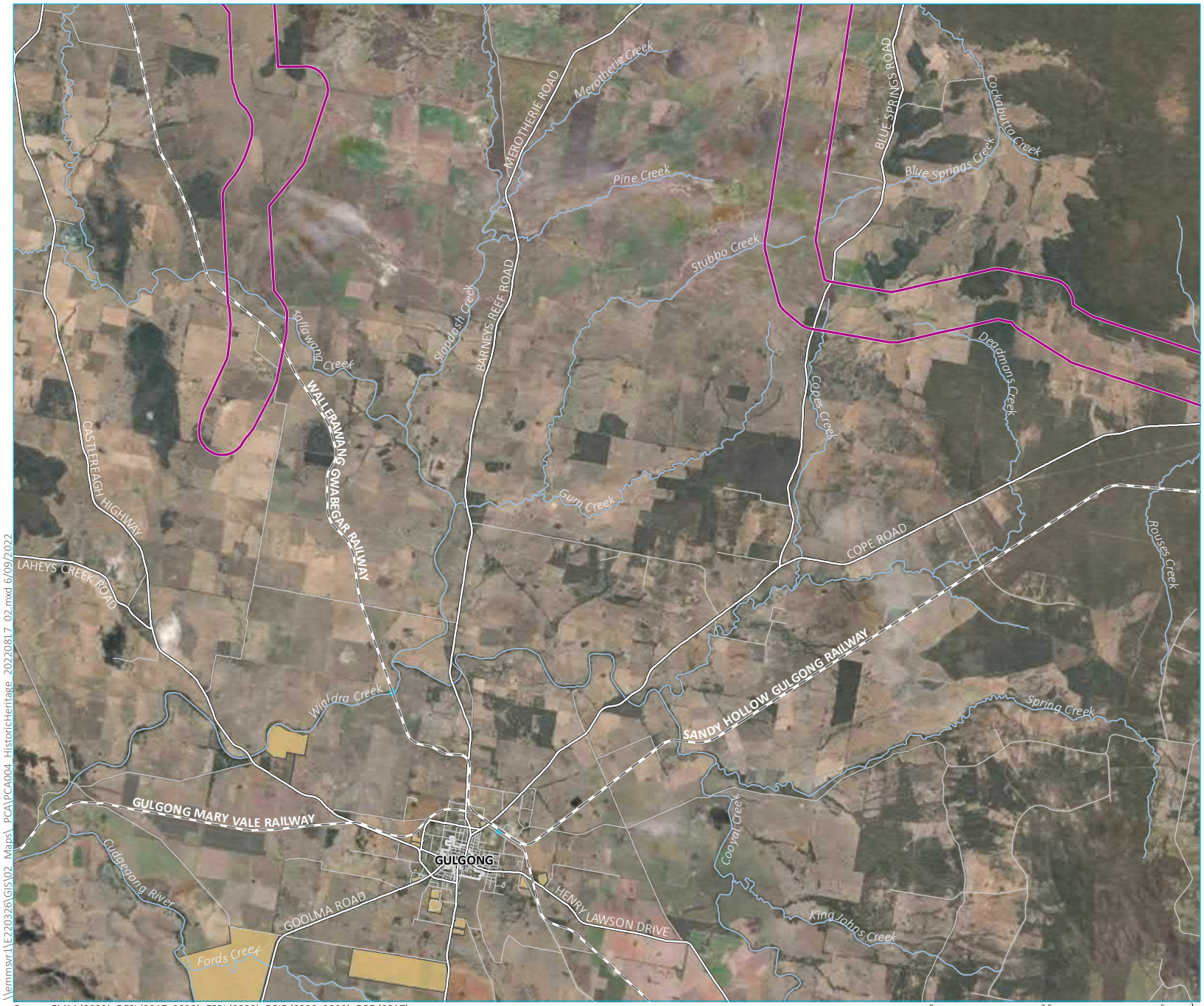
N

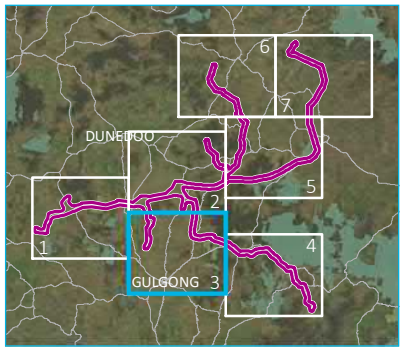
\\emmsvr1\E220326\GIS\02 Maps\ PCA\PCA004 HistoricHeritage 20220817 02.mxd 6/09/2022

Historic heritage and the study area
Map 2 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 5.1

EMM creating opportunities





KEY

- Project study area
- Rail line
- Major road
- Minor road
- Named watercourse

Mid-Western Regional Local Environmental Plan 2012

- Item - General

HERITAGE ACT

- State heritage register

NON-STATUTORY LISTING

- Register of the national estate

INSET KEY

- Major road
- NPWS reserve

Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); DPIE (2020, 2022); DPE (2017)

0 2.5 5 km

GDA2020 MGA Zone 55

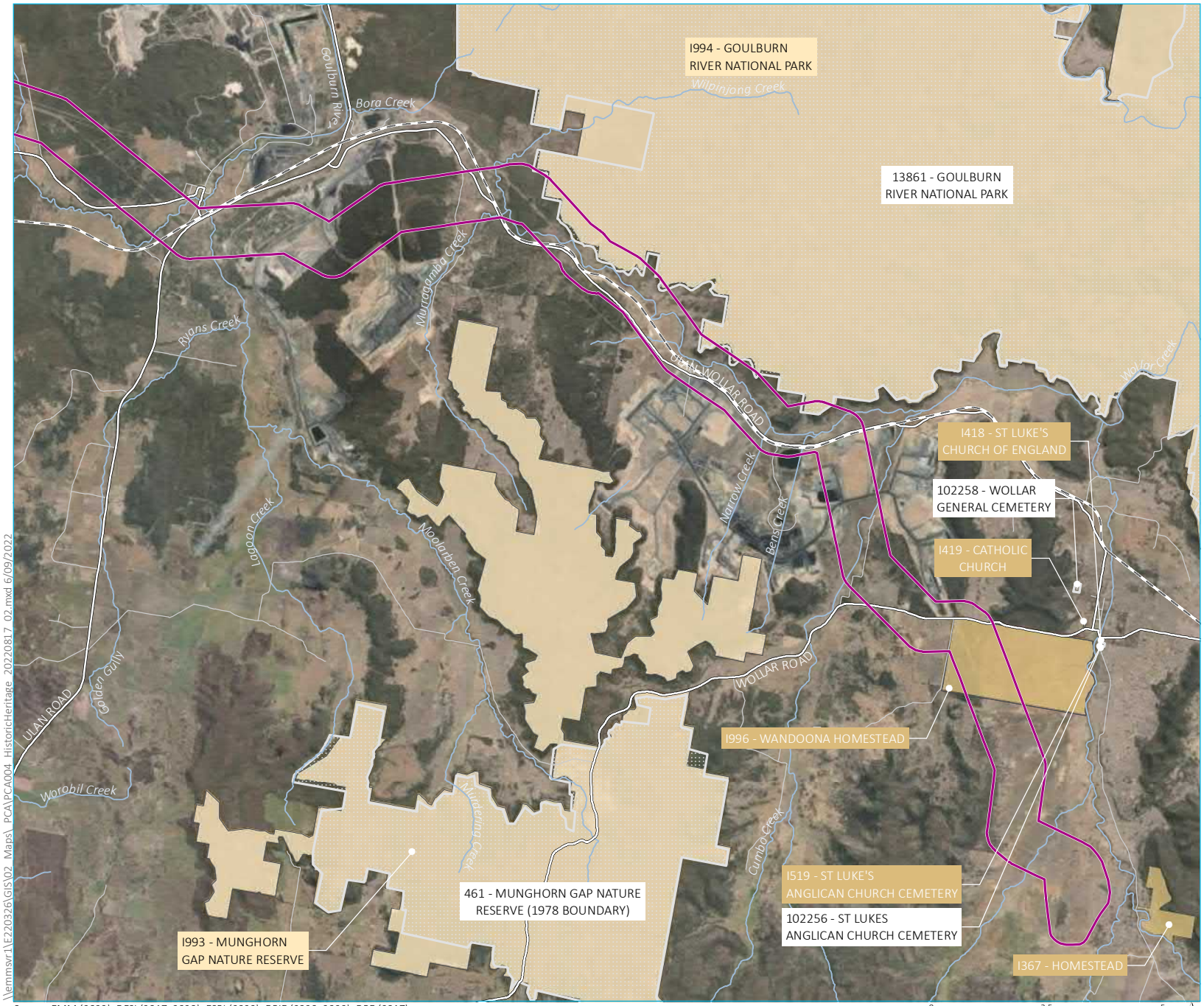
N

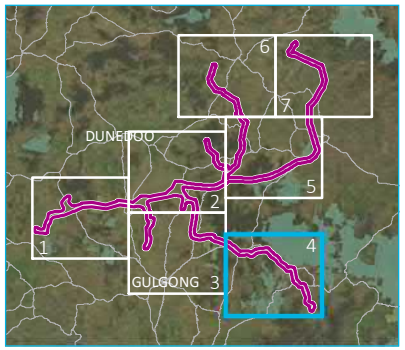
\\emmsvr1\E220326\GIS\02 Maps\ PCA\PCA004 HistoricHeritage 20220817 02.mxd 6/09/2022

Historic heritage and the study area
Map 3 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 5.1

EMM
creating opportunities





KEY

- Project study area
- Rail line
- Major road
- Minor road
- Named watercourse

Mid-Western Regional Local Environmental Plan 2012

- Item - General
- Item - Landscape

NON-STATUTORY LISTING

- Register of the national estate

INSET KEY

- Major road
- NPWS reserve

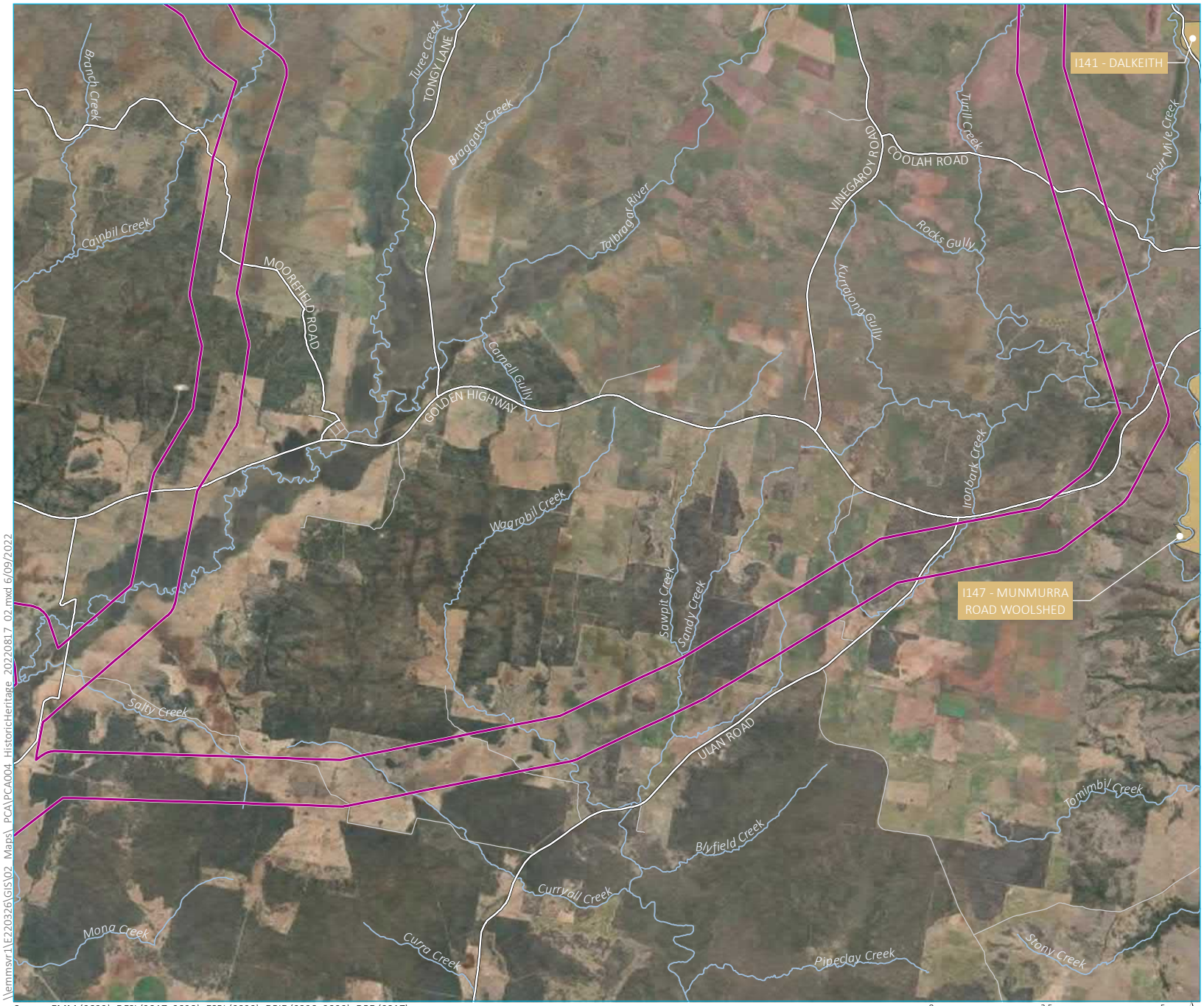
Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); DPIE (2020, 2022); DPE (2017)

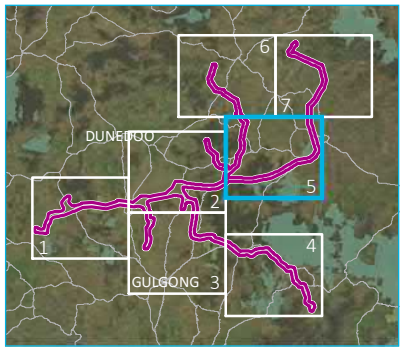
\\emmsvr1\E220326\GIS\02 Maps\ PCA\PCA004 HistoricHeritage 20220817 02.mxd 6/09/2022

Historic heritage and the study area
Map 4 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 5.1

EMM creating opportunities





KEY

- Project study area
- Major road
- Minor road
- Named watercourse

Upper Hunter Local Environmental Plan 2013

- Item - General

INSET KEY

- Major road
- NPWS reserve

Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); DPIE (2020, 2022); DPE (2017)

0 2.5 5 km

GDA2020 MGA Zone 55

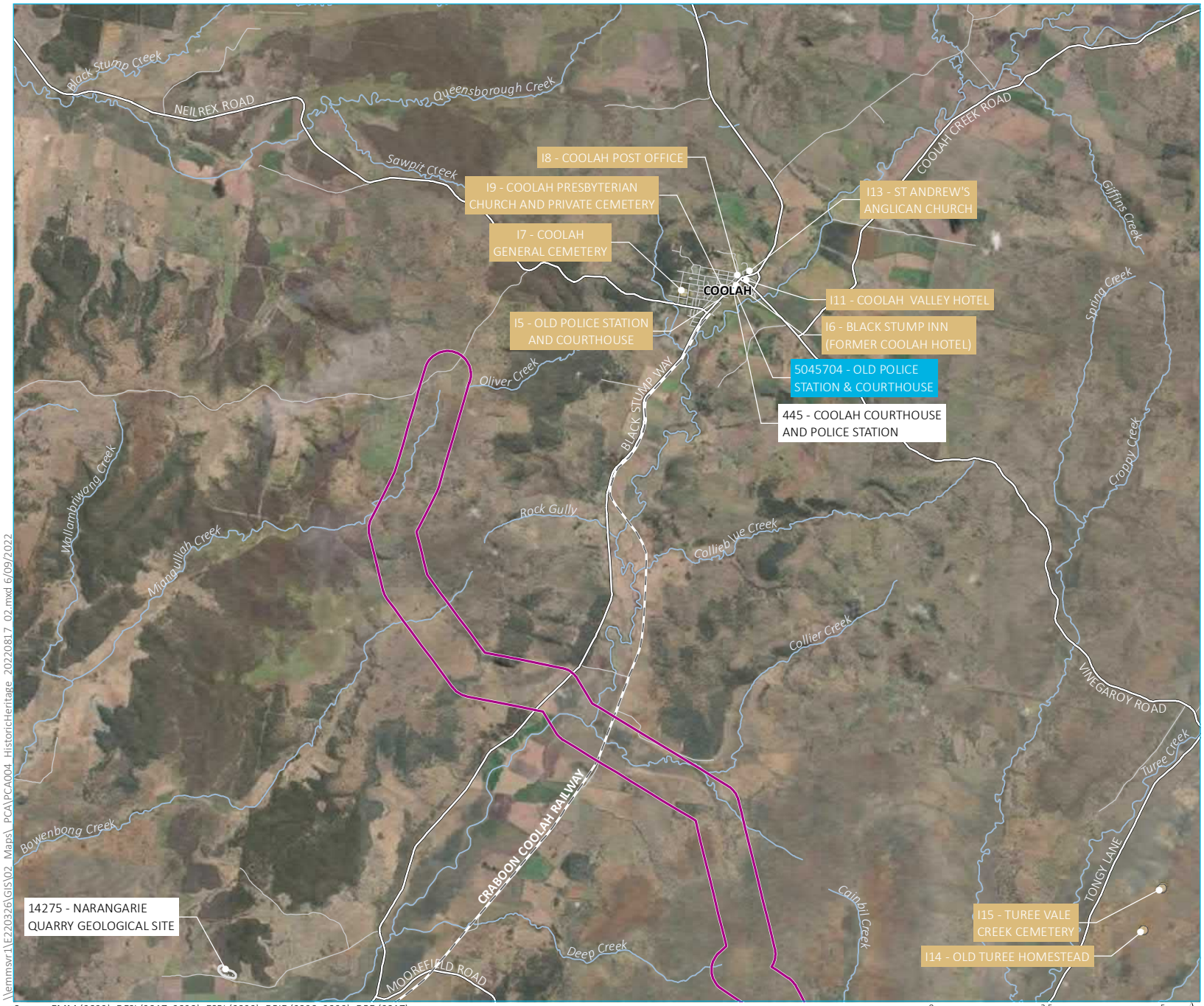
N

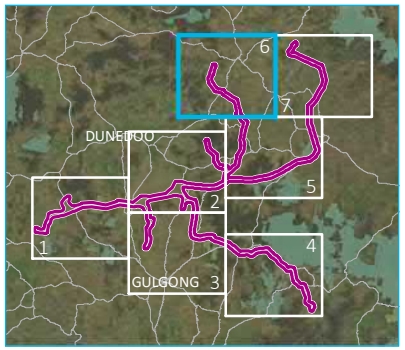
\\emmsvr1\E220326\GIS\02 Maps\ PCA\PCA004 HistoricHeritage_20220817 02.mxd 6/09/2022

Historic heritage and the study area
Map 5 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 5.1

EMM creating opportunities





KEY

- Project study area
- Rail line
- Major road
- Minor road
- Named watercourse

Warrumbungle Local Environmental Plan 2013

- Item - General

HERITAGE ACT

- State heritage register

NON-STATUTORY LISTING

- Register of the national estate

INSET KEY

- Major road
- NPWS reserve

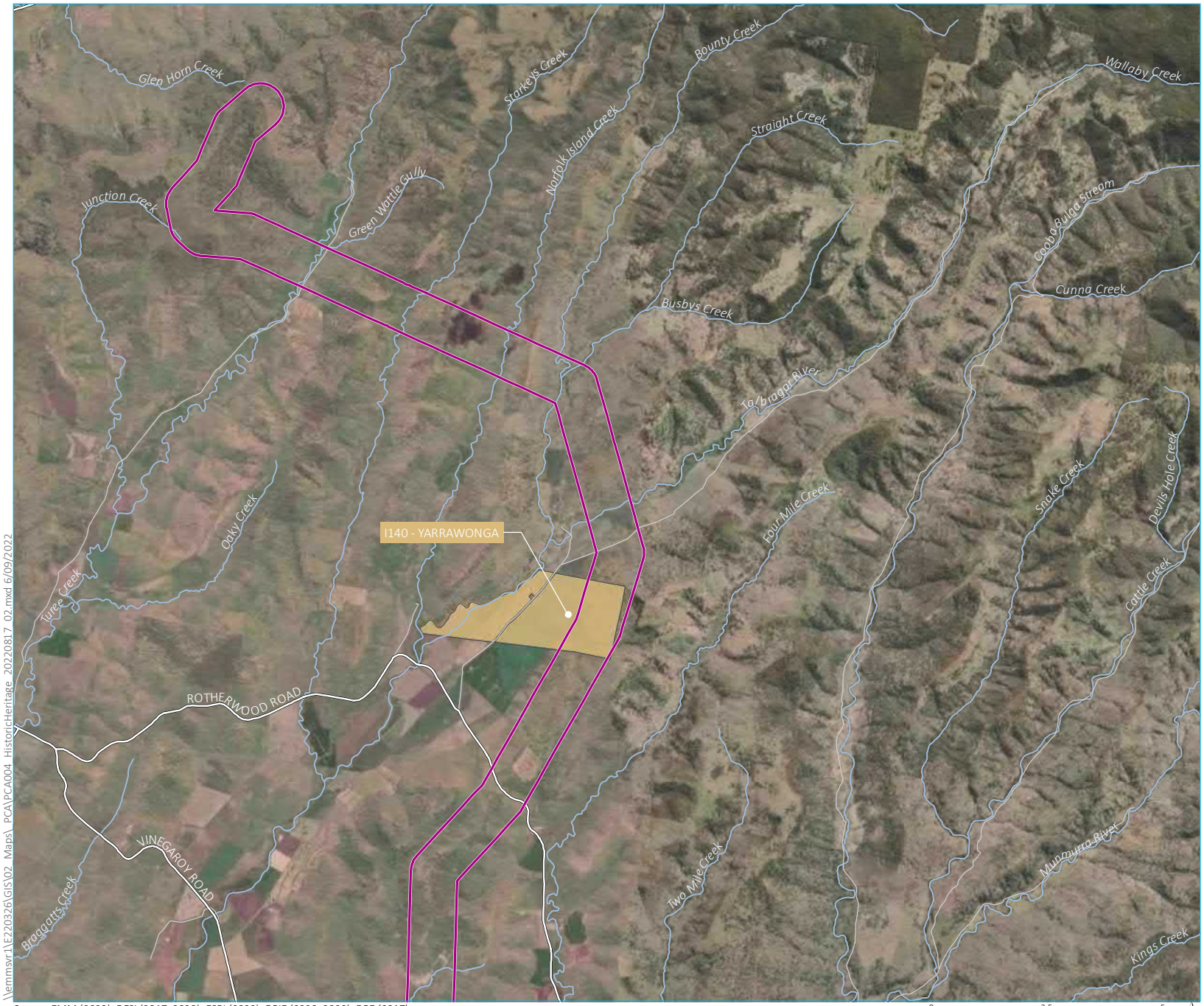
Historic heritage and the study area
Map 6 of 7

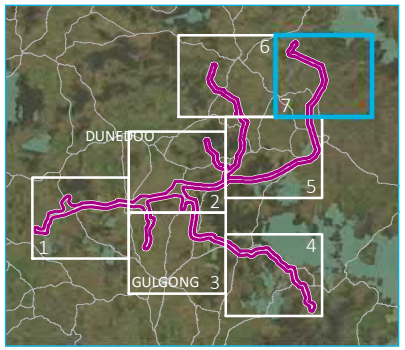
Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 5.1

EMM creating opportunities

Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); DPIE (2020, 2022); DPE (2017)

\\emmsvr1\E220326\GIS\02_Maps_PCA\PCA004_HistoricHeritage_20220817_02.mxd 6/09/2022





KEY

- Project study area
- Major road
- Minor road
- Named watercourse

Upper Hunter Local Environmental Plan 2013

- Item - General

INSET KEY

- Major road
- NPWS reserve

Historic heritage and the study area
Map 7 of 7

Central-West Orana Renewable Energy Zone Transmission
Preliminary heritage assessment
Figure 5.1

Source: EMM (2022); DFSI (2017, 2020); ESRI (2022); DPIE (2020, 2022); DPE (2017)

\\emmsvr1\E220326\GIS\02 Maps\ PCA\PCA004 HistoricHeritage 20220817 02.mxd 6/09/2022

creating opportunities

5.5 Predictive model

The principle that applies to the existence and preservation of Aboriginal sites, also applies to historical sites. In most cases, people would have chosen land that had the potential to provide - landscape features such as soils, proximity to potable water and resources for food and utilitarian uses, played a role in the selection of spaces for new migrants, and their descendants, to the colony. As life for the colonial population was, in general, more sedentary than for the original inhabitants, if the selected area of land required modifications, a greater level of intervention was introduced to the landscape. Soils were enriched and new species introduced, dams and causeways were built into drainage lines, and relatively permanent structures were built. These, and other modifications made to the landscape by the colonists, destroyed discrete areas of the Aboriginal cultural landscape, but added layers to the cultural landscape in other locations.

The environmental context of the project study area indicates that farming has been a continuous activity since the 1830s (Section 3). The implications of farming for over 250 years are, that while the integrity of some Aboriginal archaeological sites may be disturbed, important evidence of Aboriginal life will survive, as will remnants of the historical uses of a place. Further, contact between the two cultures may have resulted in a combination of the Aboriginal and historical past being preserved in the landscape. Reference should be made to Section 4 for a more detailed discussion on the preservation of Aboriginal heritage sites.

The cultural landscape that the project sits in is comprised of listed rural properties with homesteads dating from the early nineteenth to mid-twentieth century (Annexure A). Properties such as those listed on environmental schedules would have been historically larger than they are today, with outbuildings such as stables, sheds, and stores, as well as fence lines, wells, privies and other structures and landscape adjustments made to suit life in a remote location. Not as common but possible, is the presence of historical graves. As a result, unrecorded sites may exist outside their modern listed curtilage, which typically follows the legal lot boundary. These sites may include:

- old historic non-Aboriginal graves;
- old fence lines, such as post and rail fencing; these may occur along road easement boundaries and farmlands;
- indications of field systems, such as drainage channels and ridge and furrow ploughlands; these are likely to survive in low lying agricultural ground, especially in areas that are now used for grazing, rather than cropping;
- traces of agricultural and industrial processing or extractive sites, such as factories, and quarries; these may be found throughout agricultural lands on valley floors and adjacent low ranges;
- archaeological sites, such as the occupation remains of former dwellings including homesteads, houses and huts; these would be distributed in close association with land settlement patterns, and correlated with favourable agricultural lands, trading nodes and transport corridors;
- nineteenth-century structures, such as farm dwellings, outbuildings, selectors' and timber-getters' huts; these may survive as standing buildings, ruins or archaeological deposits and are most likely to survive on less developed rural properties, on early portion numbers, and in or near established farm building complexes;
- standing buildings and structures; these will be focused along the early centres and corridors of occupation, industry, travel and transport;
- sites associated with early roads; these will be closely associated with early cadastral road reserves, watershed ridgelines, and related to early river and creek crossing points;

- transport and access routes, such as bridle paths, stock routes, and roads of varying forms and ages; these may survive as abandoned remnants adjacent to modern transport routes, or as alignments now followed by more modern or upgraded road and track infrastructure;
- railway sites, features and infrastructure; these will be focused along rail corridors; and
- former timber mills and associated infrastructure, such as timber pole structures, remains of machinery, tracks and tramways; these may survive within State forests, and in valley clearings adjacent to forest areas.

6 Conclusions

6.1 Gap analysis

This review has identified the following information gaps in the available baseline data:

6.1.1 Aboriginal heritage

- Only small proportions of the project study area have been the subject of systematic assessment. Most of this survey has been associated with linear infrastructure, mining developments in the eastern portion of the project study area, as well as a small number of development-driven assessments. More recently, a number of solar and wind farm projects are also undertaking assessments across the REZ. As a consequence, the location and distribution of known Aboriginal sites provides an unreliable baseline.

- Aboriginal sites in and around the project study area have been recorded from the mid-1970s through to 2020. The condition and status of Aboriginal sites can change very quickly or remain stable for long periods. The stability of Aboriginal archaeological sites is dependent on a number of factors including, but not limited to; position in the landscape, vegetation cover, and natural sedimentation processes, including degrading (erosion) and aggrading (accumulation) landscapes. Impacts within the project study area resulting from agricultural land use, such as disturbances caused by vehicle and stock movements, cultivation, and dam construction, can drastically accelerate the degradation of sites. Relocating and updating the status of previously recorded Aboriginal sites within the project study area will be a key component to assessing the overall impacts of the project, as well as developing impact mitigation strategies.

- There is limited information on the Aboriginal cultural values of the project study area, which can only reliably be determined through consultation with relevant local Aboriginal community representatives.

6.1.2 Historical heritage

- Only small proportions of the project study area have been the subject of systematic historical heritage assessment. Most of this survey has been associated with linear infrastructure, mining developments in the eastern portion of the project study area, as well as a small number of development-driven assessments. More recently, a small number of solar and wind farm projects are also undertaking assessments across the REZ. As a result, the relatively low frequency of historic heritage recordings within the project study area does not provide a reliable indication of the likely surviving archaeological resource or other historic heritage values.

- There is a small number of sites and places within the project study area which have been placed on heritage schedules. The range and type of listed sites does not reflect the range of historical sites potentially occurring within the project study area. Archaeological sites are notably absent.

- The focus of previously conducted heritage studies has been on the identification and review of the surviving built heritage. There have not been equivalent or systematic reviews of potential archaeological sites, or systematic evaluation of historically identifiable former residential or industrial locales.

- Little assessment and identification of 'significant cultural landscape' values has been conducted within the project study area. A systematic assessment of landscape values based on cultural landscape criteria has not been conducted. Such an assessment would include features such as remnant native vegetation, old fence lines, tree plantings, aesthetic values, and the pattern of land tenure.

6.2 Recommended further investigations to support the EIS

It is recommended that the following investigations will be required to ensure that cultural heritage values are properly identified, assessed and avoided where possible through design refinement.

6.2.1 Aboriginal heritage

Based on the results of the preliminary heritage assessment, it is recommended that during the project design refinement process areas of known or anticipated archaeological sensitivity, ie interactions with registered AHIMS sites or within 200 m of 3rd order and above Strahler waterways, are avoided. The project design should also seek to utilise areas of existing disturbance where feasible.

An Aboriginal Cultural Heritage Assessment (ACHA) must be prepared for the project which includes:

1. consultation with Aboriginal stakeholders in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010.* The aims of the consultation process are to identify relevant stakeholders, provide a means of communication and information exchange, and identify areas and sites of known cultural significance to the Aboriginal community;

2. a desktop review of existing Aboriginal heritage datasets, relevant reports, topographic maps, aerial photographs and geological and soil landscape mapping within the project study area;

3. development of a landscape-based predictive model of the archaeological resource using relevant and comparable local and regional data, and map areas of relative predicted archaeological sensitivity across the project study area. This will inform areas to target in subsequent survey and test excavation stages;

4. completion of archaeological field assessment of the project study area with the participation of Aboriginal stakeholder representatives. Archaeological field assessment will include survey of the proposed route alignment(s) (~220 m wide), in addition to test excavation of proposed impact areas (ie tower locations) where/if they are found to interact with areas of PAD, or previously recorded and newly recorded Aboriginal sites;

5. provide input into the project design refinement process and develop an assessment of potential impacts on Aboriginal heritage cultural values and site by the project; and

6. develop appropriate management and mitigation strategies which seek to avoid or minimise impacts to Aboriginal heritage.

The assessment (and supporting field surveys) would be undertaken in broad accordance with the following government plans, policies, and guidelines:

- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH 2011);
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010); and
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (the Code of Practice) (DECCW 2010).

6.2.2 Historical heritage

On the basis of the results of the preliminary heritage assessment, a historical heritage assessment (archaeological, built and landscape values) and a statement of heritage impact (SoHI) will be prepared. The historical heritage assessment and SoHI will involve:

1. targeted documentary research to understand the historical development of the project study area;

2. development of a predictive model of the archaeological resource using relevant and comparable local and regional data, and map areas of relative predicted historic heritage sensitivity to both assist in the identification of potential archaeological sites and surviving built structures or other previously unidentified features;

3. field survey within the proposed project study area to validate the predictive model;

4. significance assessment of the historical values in the project area to guide future project decisions;

5. assessment the potential risk of impact (direct or indirect) by the project to identified historic heritage values; and

6. development of appropriate management and mitigation strategies which seek to avoid or minimise impacts to historic heritage.

The assessment (and supporting field surveys) would be undertaken in broad accordance by the following government plans, policies and guidelines:

- The *Burra Charter*: The Australia ICOMOS Charter for Places of Cultural Significance, 2013.
- The NSW Heritage Manual, which includes:
  - *Statements of Heritage Impact Guidelines* (Heritage Office 2006);
  - *Investigating Heritage Significance* (Heritage Office 2004);
  - *Assessing Heritage Significance* (Heritage Office 2001); and
  - *Assessing Significance for Historical Archaeological Sites and 'Relics'* (Heritage Branch Department of Planning 2009).
  - *Archaeological Assessments: Archaeological Assessment Guidelines*, (Heritage Office, Department of Urban Affairs and Planning, 1996).

References

ARAS, 2012. Aboriginal cultural heritage assessment for Mt Penny Coal Project, EL7406. Unpublished report to Mt Penny Coal Pty Ltd.

Attenbrow, V., 2002, Pre-Colonial Aboriginal Land and Resource Use in Centennial, Moore and Queens Parks – Assessment of Historical and Archaeological Evidence for Centennial Parklands Conservation Management Plan.

EMM Consulting Pty Limited, 2012. Aboriginal Cultural Heritage Assessment: Corrobora Coal Project. Unpublished Report for Cobbora Holding Company Pty Limited.

Gapps, S., 2022, Gudyarra. The First Wiradjuri War of Resistance – The Bathurst War, 1922-1824. Australia, New South Publishing.

Empire, 1869, *Dubbo*. August 3, 1869. http://nla.gov.au/nla.news-article60893146.

Extent Heritage Advisors, 2017, Bathurst Regional Local Government Area Aboriginal Heritage Study: Public Release Version.

Former Mudgee Shire Heritage Committee 2004, *Former Mudgee Shire Community-Based Heritage Study*. Unpublished report prepared for Mid-Western Regional Council.

Foster, M., 2019, The Forgotten War of 1900: Jimmy Governor and the Aboriginal People of Wollar. *Australian Historical Studies* 50 (3): 305–20.

Go Green Services, 2002, Wiradjuri Heritage Study For the Wagga Wagga Local Government Area of New South Wales.

Greenwood, P., 2013, Land of the Wiradjuri: Traditional Wiradjuri Culture. Wagga Wagga, NSW: Riverina Environmental Education Centre.

IBRA7, 2012, Interim Biogeographic Regionalisation for Australia, 1–10. http://www.environment.gov.au/land/nrs/science/ibra.

Kass, T.,

- 2001, *Wellington Thematic History*. Unpublished report prepared for NSW Heritage Office.
- 2003, *A Thematic History of the Central West: Comprising the NSW Historical Regions of Lachlan and Central Tablelands*. Unpublished report prepared for NSW Heritage Office.

Moore, S., Williams, L., 2001. *The True Story of Jimmy Governor.* Allen and Unwin, Sydney.

Monitor Heritage Consultants, 2019, Warrumbungle Shire Thematic History.

Mudgee Guardian and North-Western Representative, 1904, Liverpool Plains. *Mudgee Guardian and North-Western Representative*, September 22, 1904. http://nla.gov.au/nla.news-article157629983.

Murphy, B.W., Lawrie, J.W., 1998, *Soil Landscapes of the Dubbo 1:250 000 Sheet*, Department of Land & Water Conservation.

O'Connell, J.F., Allen, J., Williams, M.A.J., Cooper, A., Williams, A.N., Turney, C.S.M., Spooner, N.A., Kamminga, J., Brown, G. (2018) When did Homo Sapiens firs reach Southeast Asia and Sahul? *Proceedings of the National Academy of Sciences of the United States (Perspectives)*, www.pnas.org/cgi/doi/10.1073/pnas.1808385115.

Ozark Environment and Heritage Pty Limited,

- 2007, Aboriginal Heritage Study: Dubbo Local Government Area Stage 2: Field Survey.

- 2020, Stubbo Solar Farm – Aboriginal cultural heritage and historical heritage assessment report. Unpublished report for UPC/AC Renewables Australia.

- 2022, Valley of the Winds Wind Farm – Aboriginal cultural heritage assessment report. Unpublished report for UPC/AC Renewables Australia.

NGH Environmental Pty Limited,

- 2017, Beryl Solar Farm – Aboriginal cultural heritage assessment. Unpublished report for First Solar Pty Ltd.

- 2020, Dunedoo Solar Farm - – Aboriginal cultural heritage assessment. Unpublished report for Sun Spot 4 Pty Ltd.

Niche Environment and Heritage Pty Limited

- 2017, Moorlarben Coal Complex Open Cut Optimisation Modification: Aboriginal Cultural Heritage Assessment. Unpublished report for Moorlarben Coal Pty Ltd.

- 2015, "Wilpinjong Extension Project: Historical Heritage Assessment,."Unpublished report for Peabody Energy.

- 2021, Moorlarben Coal Complex UG2 Modification: Aboriginal Cultural Heritage Assessment. Unpublished report for Yancoal Pty Ltd.

NSW Archaeology Pty Limited,

- 2011, Bodangora Wind Farm. European and Aboriginal cultural heritage assessment report. Unpublished report for Bodangora Wind Farm Pty Ltd.

- 2017, Liverpool Range Wind Farm Stage 1 – Aboriginal cultural heritage assessment report. Unpublished report for Epuron Pty Ltd.

NSW National Parks and Wildlife Service, 2003, *The Bioregions of New South Wales - Their Biodiversity, Conservation and History.* Hurstville NSW: NSW National Parks and Wildlife Service. https://www.environment.nsw.gov.au/resources/nature/bioregionscontentsintro.pdf.

Pearson, M, 2004, Appendix G Wilpinjong Coal Project: Non-Aboriginal Heritage Impact Assessment.

Pearson, N., 1981, Seen through different eyes: Changing land use and settlement patterns in the upper Macquarie River region of NSW from prehistoric times to 1860. Unpublished PhD Thesis, Australian National University, Canberra.

Southeast Archaeology, 2015, WIlpinjong coal mine, Central Tabelands of New South Wales – extension project: Aboriginal cultural heritage assessment. Unpublished report to Wilpinjong Coal Limited.

RPS Australia East Pty Ltd, 2015, Bylong Coal Project – Aboriginal archaeology and cultural heritage impact assessment. Unpublished report for Hansen Bailey.

Ryan, L., Debenham, J., Pascoe, B., Smith, R., Owen, C., Richards, J., Gilbert, S et al, 2022, Colonial Frontier Massacres in Australia 1788-1930. Newcastle, NSW: University of Newcastle. 2022. https://c21ch.newcastle.edu.au/colonialmassacres/detail.php?r=566.

Tindale, N.B., 1974, *Aboriginal Tribes of Australia: Their Terrain, Environmental Controls, Distribution, Limits and Proper Names*.

Tilt Renewables, 2021 (October), 'Fact Sheet 16', *Historic Heritage Fact Sheet.*

Umwelt Pty Limited, 2022, Spicers Creek wind farm – scoping report. Unpublished report for CWP Renewables.

Watkins, J.J., Cameron, R.G., Yoo, E.K., Colquhoun, G.P., 1999. *Gulgong 1:100 000 Geological Sheet 8833, 1st Edition*. Geological Survey of New South Wales, Orange, Sydney/Australia Geological Survey Organisation, Canberra.

Annexure A

Historical heritage register data

EMM
creating opportunities

A.1 Historical register results

Tables A.2 and A.3 lists heritage items within ~5 and ~20 km of the project study area. Where one item or components of one item is/are identified in separate listings, they have been grouped and identified by grey shading. Not all listings are gazetted, that is, protected under legislation, but where they have been identified, they have significance that requires assessment prior to development. For instance, the National Parks and Wildlife Service maintains a list of historical heritage items that have been recognised as potentially possessing significance – those items are listed on the HHIMS register. Some HHIMS items may be listed on a statutory register, such as the environment schedule of an LEP as well. Further item that have archaeological potential require assessment to ascertain their status as 'relics' before decisions that may result in physical impacts are made as relics are protected under the Heritage Act.

Abbreviations used in Tables A.2 and A.3 are:

Table A.1 Abbreviations used in historical heritage registered data

Abbreviation	Long-form	Relevant Act
CHL	Commonwealth Heritage List	*Environmental Protection Biodiversity Conservation Act 1999*
DLEP	Dubbo Local Environmental Plan	*Environmental Planning and Assessment Act 1974*
HHIMS	Historic Heritage Management System	Not statutory
MLEP	Mid-Western Local Environmental Plan	*Environmental Planning and Assessment Act 1974*
NHL	National Heritage List	*Environmental Protection Biodiversity Conservation Act 1999*
RNE	Register of the National Estate	Not statutory
SHR	State Heritage Register	*Heritage Act 1977*
S170	Section 170 Register	*Heritage Act 1977*
ULEP	Upper Hunter Local Environmental Plan;	*Environmental Planning and Assessment Act 1974*
WHL	World Heritage List	Not statutory
WLEP	Warrumbungle Local Environmental Plan	*Environmental Planning and Assessment Act 1974*
	Additional comments	Describes additional considerations not captured in the site type.

Table A.2 Historical heritage register search results within the project study area and within 5 km of the project study area.

ITEM NAME	LISTING ID	SIGNIFICANCE	RESITER	SITE TYPE	ADDITIONAL COMMENTS
DUBBO REGIONAL LOCAL GOVERNMENT AREA					
No listed items					
MID-WESTERN REGIONAL LOCAL GOVERNMENT AREA					
Catholic Church	I419	Local	MLEP	General	Built
Goulburn River National Park	I994	Local	MLEP	Landscape	Landscape/archaeological
Homestead	I367	Local	MLEP	General	Built/archaeological
Munghorn Gap Nature Reserve	I993	Local	MLEP	Landscape	Landscape/archaeological
Wandoona Homestead	I996	Local	MLEP	General	Built/archaeological
St Luke's Anglican Church Cemetery	I519	Local	MLEP	General	Built/archaeological
St Luke's Church of England	I418	Local	MLEP	General	Built/archaeological
UPPER HUNTER LOCAL GOVERNMENT AREA					
Anglican church, St Columba of Iona	I144	Local	ULEP	General	Built/archaeological
Cassilis Conservation Area	C1	Local	ULEP	Conservation Area	Landscape
Cassilis Station homestead and grave site	I145	Local	ULEP	General	Built/archaeological
Cemetery including headstones and graves	I143	Local	ULEP	General	Built/archaeological
Courthouse	I134	Local	ULEP	General	Built
Dalkeith	I141	Local	ULEP	General	Built
Dwelling (former Chinese emporium)	I139	Local	ULEP	General	Built
Farmhouse/stone cottage (former Anglican parsonage)	I142	Local	ULEP	General	Built/archaeological

Table A.2 Historical heritage register search results within the project study area and within 5 km of the project study area.

ITEM NAME	LISTING ID	SIGNIFICANCE	RESITER	SITE TYPE	ADDITIONAL COMMENTS
Former store	I137	Local	ULEP	General	Built/archaeological
Llangollen	I138	Local	ULEP	General	Built
Munmurra Road woolshed	I147	Local	ULEP	General	Built/archaeological
Police residence	I136	Local	ULEP	General	Built/archaeological
Police station	I135	Local	ULEP	General	Built/archaeological
Royal Hotel Cassilis	I133	Local	ULEP	General	Built/archaeological
St Joseph's Roman Catholic Church	I154	Local	ULEP	General	Built/archaeological
Quindalup School House group, Cassilis Primary School	I151	Local	ULEP	General	Built/archaeological
Yarrawonga	I140	Local	ULEP	General	Built/archaeological
WARRUMBUNGLE LOCAL GOVERNMENT AREA					
No listed items					

Table A.3 Historical heritage register search results within the project study area and within 20 km of project study area

ITEM NAME	LISTING ID	SIGNIFICANCE	REGISTER	SITE TYPE	ADDITIONAL COMMENTS
DUBBO REGIONAL LOCAL GOVERNMENT AREA					
Elong Elong General Cemetery	I240	Local	DLEP	General	Built/archaeological
Gollan Hall and War Memorial	I272	Local	DLEP	General	Built
Sandy Hollow to Maryvale railway line	I275	Local	DLEP	General	Built
Spicers Creek Cemetery	I308	Local	DLEP	General	Built/archaeological
Spicers Creek School residence	I309	Local	DLEP	General	Built/archaeological
MID-WESTERN REGIONAL GOVERNMENT AREA					
The Greater Blue Mountains Area – Additional Values	105696	World	WHL (pending)	Natural	Nomination
Albury House, House	I326	Local	MLEP	General	Built
American Tobacco Warehouse	I289	Local	MLEP	General	Built
Australian Joint Stock Bank	I253	Local	MLEP	General	Built
Biraganbil homestead	1368	Local	MLEP	General	Built/archaeological
Catholic Church	I419	Local	MLEP	General	Built
Catholic School	I196	Local	MLEP	General	Built
Catholic Rectory, Church and buildings	I216	Local	MLEP	General	Built
CBC Bank	I284	Local	MLEP	General	Built
Church of St John the Baptist	I199	Local	MLEP	General	Built
Centennial Hotel	I295	Local	MLEP	General	Built

Table A.3 Historical heritage register search results within the project study area and within 20 km of project study area

ITEM NAME	LISTING ID	SIGNIFICANCE	REGISTER	SITE TYPE	ADDITIONAL COMMENTS
Commercial building (Loneragans Garage)	I336	Local	MLEP	General	Built
Commercial building	I337	Local	MLEP	General	Built
Commercial building	I241	Local	MLEP	General	Built
Commercial building	I244	Local	MLEP	General	Built
Commercial building	I245	Local	MLEP	General	Built
Commercial building	I247	Local	MLEP	General	Built
Commercial building	I290	Local	MLEP	General	Built
Commercial building	I285	Local	MLEP	General	Built
Commercial building	I286	Local	MLEP	General	Built
Commercial building	I291	Local	MLEP	General	Built
Commercial building	I294	Local	MLEP	General	Built
Commercial building	I292	Local	MLEP	General	Built
Commercial building	I287	Local	MLEP	General	Built
Court House	I251	Local	MLEP	General	Built
Cullengoral	I301	Local	MLEP	General	Built/archaeological
Davies Butchery	I248	Local	MLEP	General	Built
Farmers and Graziers Co-op	I246	Local	MLEP	General	Built
Fire Station	I254	Local	MLEP	General	Built
Goulburn River National Park	I994	Local	MLEP	Landscape	Natural/landscape

Table A.3 Historical heritage register search results within the project study area and within 20 km of project study area

ITEM NAME	LISTING ID	SIGNIFICANCE	REGISTER	SITE TYPE	ADDITIONAL COMMENTS
Gulgong	C2	Local	MLEP	Conservation area	Landscape
Gulgong Cemetery	I388	Local	MLEP	General	Built/archaeological
Gulgong Dry Cleaners	I243	Local	MLEP	General	Built
Gulgong District Hospital	I312	Local	MLEP	General	Built
Gulgong Grandstand	I359	Local	MLEP	General	Built/landscape
Gulgong Pioneer Museum	I236	Local	MLEP	General	Built
Gulgong railway bridge over Wialdra Creek	01038	State	SHR	Built	Built
Gulgong Railway Station and yard group	01158	State	SHR	Built	Built
Railway station and stationmaster's house group	I349	State	MLEP	General	Built
Guntawang homestead	I390	Local	MLEP	General	Built/archaeological
Goolma Primary School	I999	Local	MLEP	General	Built
'Haleys Cottage', House	I259	Local	MLEP	General	
Hobsons Shops Golden West Trading Post	0402	State	SHR	Built	
'Hobsons Shops Golden West Trading Post' and house	I242	State	MLEP	General	
Greatest Wonder of the World and the American Tobacco Warehouse	01983	State	SHR	Built	Potential relics
'Greatest Wonder of the World'	I288	Local	MLEP	General	Built
Historic ruin	12951	Not assessed	HHIMS	Potential	Element
Homestead (shown as the same shapefile as I996)	I367	Local	MLEP	General	Built/archaeological
House	I321	Local	MLEP	General	Built

Table A.3 Historical heritage register search results within the project study area and within 20 km of project study area

ITEM NAME	LISTING ID	SIGNIFICANCE	REGISTER	SITE TYPE	ADDITIONAL COMMENTS
House	I276	Local	MLEP	General	Built
House	I334	Local	MLEP	General	Built
House	I213	Local	MLEP	General	Built
House	I299	Local	MLEP	General	Built
House	I351	Local	MLEP	General	Built
House	I189	Local	MLEP	General	Built
House	I311	Local	MLEP	General	Built
House	I354	Local	MLEP	General	Built
House	I255	Local	MLEP	General	Built
House	I193	Local	MLEP	General	Built
House	I355	Local	MLEP	General	Built
House	I228	Local	MLEP	General	Built
House	I220	Local	MLEP	General	Built
House	I307	Local	MLEP	General	Built
House	I212	Local	MLEP	General	Built
House	I214	Local	MLEP	General	Built
House	I316	Local	MLEP	General	Built
House	I317	Local	MLEP	General	Built
House	I264	Local	MLEP	General	Built

Table A.3 Historical heritage register search results within the project study area and within 20 km of project study area

ITEM NAME	LISTING ID	SIGNIFICANCE	REGISTER	SITE TYPE	ADDITIONAL COMMENTS
House	I332	Local	MLEP	General	Built
House	I235	Local	MLEP	General	Built
House	I211	Local	MLEP	General	Built
House	I240	Local	MLEP	General	Built
House	I190	Local	MLEP	General	Built
House	I270	Local	MLEP	General	Built
House	I239	Local	MLEP	General	Built
House	I356	Local	MLEP	General	Built
House	I331	Local	MLEP	General	Built
House	I202	Local	MLEP	General	Built
House	I300	Local	MLEP	General	Built
House	I262	Local	MLEP	General	Built
House	I344	Local	MLEP	General	Built
House	I348	Local	MLEP	General	Built
House	I233	Local	MLEP	General	Built
House	I309	Local	MLEP	General	Built
House	I272	Local	MLEP	General	Built
House	I267	Local	MLEP	General	Built
House	I338	Local	MLEP	General	Built

Table A.3 Historical heritage register search results within the project study area and within 20 km of project study area

ITEM NAME	LISTING ID	SIGNIFICANCE	REGISTER	SITE TYPE	ADDITIONAL COMMENTS
House	I275	Local	MLEP	General	Built
House	I306	Local	MLEP	General	Built
House	I319	Local	MLEP	General	Built
House	I333	Local	MLEP	General	Built
House	I340	Local	MLEP	General	Built
House	I341	Local	MLEP	General	Built
House	I345	Local	MLEP	General	Built
House	I234	Local	MLEP	General	Built
House	I203	Local	MLEP	General	Built
House	I194	Local	MLEP	General	Built
House	I208	Local	MLEP	General	Built
House	I263	Local	MLEP	General	Built
House	I310	Local	MLEP	General	Built
House	I302	Local	MLEP	General	Built
House	I217	Local	MLEP	General	Built
House	I194	Local	MLEP	General	Built
House	I320	Local	MLEP	General	Built
House	I335	Local	MLEP	General	Built
House	I315	Local	MLEP	General	Built

Table A.3 Historical heritage register search results within the project study area and within 20 km of project study area

ITEM NAME	LISTING ID	SIGNIFICANCE	REGISTER	SITE TYPE	ADDITIONAL COMMENTS
House	I329	Local	MLEP	General	Built
House	I304	Local	MLEP	General	Built
House	I353	Local	MLEP	General	Built
House	I222	Local	MLEP	General	Built
House	I343	Local	MLEP	General	Built
House	I271	Local	MLEP	General	Built
House	I297	Local	MLEP	General	Built
House	I314	Local	MLEP	General	Built
House	I322	Local	MLEP	General	Built
House	I278	Local	MLEP	General	Built
House	I237	Local	MLEP	General	Built
House	I200	Local	MLEP	General	Built
House	I225	Local	MLEP	General	Built
House	I205	Local	MLEP	General	Built
House	I358	Local	MLEP	General	Built
House	I268	Local	MLEP	General	Built
House	I221	Local	MLEP	General	Built
House	I201	Local	MLEP	General	Built
House	I339	Local	MLEP	General	Built

Table A.3 Historical heritage register search results within the project study area and within 20 km of project study area

ITEM NAME	LISTING ID	SIGNIFICANCE	REGISTER	SITE TYPE	ADDITIONAL COMMENTS
House	I273	Local	MLEP	General	Built
House	I313	Local	MLEP	General	Built
House	I257	Local	MLEP	General	Built
House	I265	Local	MLEP	General	Built
House	I229	Local	MLEP	General	Built
House	I191	Local	MLEP	General	Built
House	I318	Local	MLEP	General	Built
House	I230	Local	MLEP	General	Built
House	I261	Local	MLEP	General	Built
House	I269	Local	MLEP	General	Built
House	I281	Local	MLEP	General	Built
House	I219	Local	MLEP	General	Built
House	I266	Local	MLEP	General	Built
House	I209	Local	MLEP	General	Built
House	I223	Local	MLEP	General	Built
House	I342	Local	MLEP	General	Built
House	I347	Local	MLEP	General	Built
House	I298	Local	MLEP	General	Built
House	I260	Local	MLEP	General	Built

Table A.3 Historical heritage register search results within the project study area and within 20 km of project study area

ITEM NAME	LISTING ID	SIGNIFICANCE	REGISTER	SITE TYPE	ADDITIONAL COMMENTS
House	I206	Local	MLEP	General	Built
House	I324	Local	MLEP	General	Built
'Jas Loneragan'	I279	Local	MLEP	General	Built/archaeological
'Loneragans Flour Mill'	I350	Local	MLEP	General	Built/archaeological
'Loyola', House	I274	Local	MLEP	General	Built
'Merry', House	I330	Local	MLEP	General	Built
Morrowolga homestead	I369	Local	MLEP	General	Built/archaeological
Munghorn Gap Nature Reserve	I993	Local	MLEP	Landscape	Complex
Munghorn Gap Ranger's Station	1085	Not assessed	HHIMS	Potential	Complex
Munghorn Gap Ranger's Station Cottage	2572	Not assessed	HHIMS	Potential	Element
Munghorn Gap Ranger's Station Chinese Market Garden	2528	Not assessed	HHIMS	Potential	Element
Munghorn Gap Ranger's Station House and Ailanthus	2529	Not assessed	HHIMS	Potential	Element
Munghorn Gap Ranger's Station Sandstone Quarry	2530	Not assessed	HHIMS	Potential	Element
Munghorn Gap Ranger's Station Logging Camp	2531	Not assessed	HHIMS	Potential	Element
Munghorn Gap Ranger's Station Yards	2532	Not assessed	HHIMS	Potential	Element
Munghorn Gap Ranger's Station Burial Site	2533	Not assessed	HHIMS	Potential	Element
Nissen Hut	12952	Not assessed	HHIMS	Potential	Element
Nissen Hut Precinct	13431	Not assessed	HHIMS	Potential	Complex
Niven's Springridge Hotel, House	I387	Local	MLEP	General	Built/archaeological

Table A.3 Historical heritage register search results within the project study area and within 20 km of project study area

ITEM NAME	LISTING ID	SIGNIFICANCE	REGISTER	SITE TYPE	ADDITIONAL COMMENTS
Old Central School	I346	Local	MLEP	General	Built/archaeological
Old Flour Mill	I192	Local	MLEP	General	Built/archaeological
Old gold mine	I392	Local	MLEP	General	Built/archaeological
Old Railway Dam and Pump Shed	I389	Local	MLEP	General	Built/archaeological
Phonograph Museum and residence	I328	Local	MLEP	General	Built
Pineview Homestead and Woolshed	I992	Local	MLEP	General	Built/archaeological
Police Station	I323	Local	MLEP	General	Built
Post Office	I249	Local	MLEP	General	Built
Post Office Hotel	I250	Local	MLEP	General	Built
Prince of Wales Hotel	I282	Local	MLEP	General	Built
Prince of Wales Opera House	I283	Local	MLEP	General	Built
Red Hill House, House	I227	Local	MLEP	General	Built
Row of four houses	I204	Local	MLEP	General	Built
Ruins – Judy's Block	12670	Not assessed	HHIMS	Potential	Element
Ruins – O'Connell's Block	12671	Not assessed	HHIMS	Potential	Element
Seals Hut	12950	Not assessed	HHIMS	Potential	Element
Seals Hut Precinct	13430	Not assessed	HHIMS	Potential	Complex
Showground	I360	Local	MLEP	General	Built/landscape
Shop	I305	Local	MLEP	General	Built

Table A.3 Historical heritage register search results within the project study area and within 20 km of project study area

ITEM NAME	LISTING ID	SIGNIFICANCE	REGISTER	SITE TYPE	ADDITIONAL COMMENTS
Shop	I277	Local	MLEP	General	Built
Shop and residence	I238	Local	MLEP	General	Built/Landscape
Silos and house	I258	Local	MLEP	General	Built
Spring Ridge, Homestead	I385	Local	MLEP	General	Built/archaeological
St Andrews Anglican Church Cemetery	I532	Local	MLEP	General	Built/archaeological
St Andrews Presbyterian Church	I195	Local	MLEP	General	Built
St Mark's Anglican Church	I997	Local	MLEP	General	Built
St Luke's Church of England	I418	Local	MLEP	General	Built
St Luke's Anglican Church Cemetery	I519	Local	MLEP	General	Built/landscape
St Luke's Anglican Church	I198	Local	MLEP	General	Built
St Stephen's Anglican Church, Bylong	I14R	Local	MLEP	General	Built/landscape
St Vincent de Paul shop and residence	I280	Local	MLEP	General	Built
State Forest No 78 logging site	12672	Not assessed	HHIMS	Potential	Element
Stockyard; Seals Hut	12953	Not assessed	HHIMS	Potential	Element
Stockyard; Nissen Hut	12954	Not assessed	HHIMS	Potential	Element
Tarrawonga, House	I224	Local	MLEP	General	Built
Ten Dollar Town Motel	I308	Local	MLEP	General	Built
The Coffee House	I293	Local	MLEP	General	Built
The Henry Lawson Centre	I296	Local	MLEP	General	Built

Table A.3 Historical heritage register search results within the project study area and within 20 km of project study area

ITEM NAME	LISTING ID	SIGNIFICANCE	REGISTER	SITE TYPE	ADDITIONAL COMMENTS
The Lagoon, Homestead	I391	Local	MLEP	General	Built/archaeological
Ulan City Council	I252	Local	MELP	General	Built
Uniting Church	I210	Local	MELP	General	Built
Uniting Church Hall	I325	Local	MELP	General	Built
Wandoona Homestead	I996	Local	MELP	General	Built/archaeological
Wyaldra Shire Hall	I256	Local	MLEP	General	Built
Yamble homestead and outbuildings	I421	Local	MLEP	General	Built
UPPER HUNTER LOCAL GOVERNMENT AREA					
Cemetery including headstones and graves	I143	Local	ULEP	General	Built/landscape
Courthouse	I134	Local	ULEP	General	Built
Dalkeith	I141	Local	ULEP	General	
Dwelling (former Chinese emporium)	I139	Local	ULEP	General	
Cassilis Station homestead and grave site	I145	Local	ULEP	General	
Farmhouse/stone cottage (former Anglican parsonage)	I142	Local	ULEP	General	
Yarrawonga	I140	Local	ULEP	General	
St Joseph's Roman Catholic Church	I154	Local	ULEP	General	
Police station	I135	Local	ULEP	General	
Former store	I137	Local	ULEP	General	
Cassilis Conservation Area	C1	Local	ULEP	Conservation area	Landscape

Table A.3 Historical heritage register search results within the project study area and within 20 km of project study area

ITEM NAME	LISTING ID	SIGNIFICANCE	REGISTER	SITE TYPE	ADDITIONAL COMMENTS
Police residence	I136	Local	ULEP	General	
Llangollen	I138	Local	ULEP	General	
Collaroy Homestead group, including church, lockup, shearing shed and quarters and Soldiers Settlement	I146	Local	ULEP	General	
Royal Hotel Cassilis	I133	Local	ULEP	General	
Munmurra Road woolshed	I147	Local	ULEP	General	
Quindalup School House group, Cassilis Primary School	I151	Local	ULEP	General	
Anglican church, St Columba of Iona	I144	Local	ULEP	General	
WARRUMBUNGLE LOCAL GOVERNMENT AREA					
Black Stump Cemetery	I16	Local	WLEP	General	
Coolah Heritage Conservation Area	C4	Local	WLEP	General	
Coolah Valley Hotel	I11	Local	ULEP	General	Built
Leadville General Cemetery	I28	Local	WLEP	General	
Coolah Valley Hotel	I11	Local	WLEP	General	
Old Police Station and Courthouse	48	State	SHR	Built	
Old Police Station and Courthouse	I5	State	WLEP	General	
Birriwa Private Cemetery	I1	Local	WLEP	General	
Dunedoo Courthouse	I26	Local	WLEP	General	
Dunedoo Railway Station and yard group	01134	State	SHR	Built	
Leadville General Cemetery					

Table A.3 Historical heritage register search results within the project study area and within 20 km of project study area

ITEM NAME	LISTING ID	SIGNIFICANCE	REGISTER	SITE TYPE	ADDITIONAL COMMENTS
Leadville Mines site	I29	Local	WLEP	General	
Cobbora General Cemetery	I3	Local	WLEP	General	
Denison Town General Cemetery	I24	Local	WLEP	General	
Turee Vale Creek Cemetery	I15	Local	WLEP	General	
Black Stump Cemetery	I16				
Black Stump Inn (former Coolah Hotel)	I6	Local	WLEP	General	
Cobbora Police Station, Courthouse and Gaol	I4	Local	WLEP	General	
Dunedoo Heritage Conservation Area	C5	Local	WLEP	Conservation area	Landscape
Old Turee Homestead	I14	Local	WLEP	General	
Coolah Post Office	I8	Local	WLEP	General	
Coolah Presbyterian Church and Private Cemetery	I9	Local	WLEP	General	
Coolah General Cemetery	I7	Local	WLEP	General	
Former Cobbora School and residence	I2	Local	WLEP	General	
St Andrew's Anglican Church	I13	Local	WLEP	General	
Bengadee Sawmill	12151	Not assessed	HHIMS/S170	Building	Element
Coxs Creek Sawmill Ruins	12892	Not assessed	HHIMS	Potential	Element
Brackens Hut	12893	Not assessed	HHIMS	Potential	Element
Stockyard; Bracken's Hut	12894	Not assessed	HHIMS	Potential	Element
Joes Hut	12896	Not assessed	HHIMS	Potential	Element

Table A.3 Historical heritage register search results within the project study area and within 20 km of project study area

ITEM NAME	LISTING ID	SIGNIFICANCE	REGISTER	SITE TYPE	ADDITIONAL COMMENTS
Stockyard; Joes Hut	12897	Not assessed	HHIMS	Potential	Element
Dip Run; Joes Hut	12898	Not assessed	HHIMS	Potential	Element
Brackens Hut	13425	Not assessed	HHIMS	Potential	Complex
Joes Hut	13426	Not assessed	HHIMS	Potential	Complex

Australia

SYDNEY
Ground floor 20 Chandos Street
St Leonards NSW 2065
T 02 9493 9500

NEWCASTLE
Level 3 175 Scott Street
Newcastle NSW 2300
T 02 4907 4800

BRISBANE
Level 1 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3648 1200

CANBERRA
Suite 2.04 Level 2
15 London Circuit
Canberra City ACT 2601

ADELAIDE
Level 4 74 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE
Suite 8.03 Level 8
454 Collins Street
Melbourne VIC 3000
T 03 9993 1900

PERTH
Suite 9.02 Level 9
109 St Georges Terrace
Perth WA 6000
T 08 6430 4800

Canada

TORONTO
2345 Younge Street Suite 300
Toronto ON M4P 2E5
T 647 467 1605

VANCOUVER
60 W 6th Ave Suite 200
Vancouver BC V5Y 1K1
T 604 999 8297

linkedin.com/company/emm-consulting-pty-limited

emmconsulting.com.au

Appendix E

Preliminary social impact assessment

Design
for a better
future /

EnergyCo

Central-West Orana Renewable Energy Zone Transmission project

Social Impact Assessment Scoping Report

wsp

September 2022

Question today
Imagine tomorrow
Create for the future

Central-West Orana Renewable Energy Zone Transmission project
Social Impact Assessment Scoping Report

EnergyCo

WSP
Level 27, 680 George Street
Sydney NSW 2000
GPO Box 5394
Sydney NSW 2001

Tel: +61 2 9272 5100
Fax: +61 2 9272 5101
wsp.com

	Name	Date	Signature
Prepared by:	Caitlin Treacy	06/09/2022	
Reviewed by:	Carla Martinez	06/09/2022	
Approved by:	Carla Martinez	06/09/2022	

WSP acknowledges that every project we work on takes place on First Peoples lands.
We recognise Aboriginal and Torres Strait Islander Peoples as the first scientists and engineers and pay our respects to Elders past and present.

Table of contents

List of tables

List of figures

List of appendices

Glossary

Acronym/phrase	Description
ABS	Australian Bureau of Statistic
AEMO	Australian Energy Market Operator
AHO	Aboriginal Housing Office
Current Regional Plan	Central West and Orana Regional Plan 2036
CWO REZ	Central West Orana Renewable Energy Zone. The CWO REZ is a geographic area of approximately 20,000 square kilometres centred by Dubbo and Dunedoo and extending west to Narromine and east beyond Mudgee and to Wellington in the south and Gilgandra in the north, that will combine renewable energy generation, storage and HV transmission infrastructure to deliver energy to electricity consumers.
DPE	Department of Planning and Environment
DPIE	The former Department of Planning, Industry and Environment (NSW), now the Department of Planning and Environment
Draft Plan	Draft Central West and Orana Regional Plan 2041
Dubbo Community Strategic Plan	Dubbo Regional Council Towards 2040 Community Strategic Plan
EIS	Environmental Impact Statement
EMFs	Electromagnetic fields
EnergyCo	Energy Corporation of NSW
Energy Hub	An energy hub is a substation where energy exported from renewable generators or storage is aggregated, transformed to 500 kV (where required) and exported to the transmission network.
HV	High Voltage
IRSAD	Index of Relative Socio-economic Advantage and Disadvantage
kV	Kilovolt
LGA	Local Government Area
Local social locality	The area expected to experience the most social change due to the project
Mid-Western Community Plan	Towards 2030 Mid-Western Region Community Plan
NEM	National Energy Market
NSW	New South Wales

Acronym/phrase	Description
Project study area	Extends north to south from Cassilis to Wollar and east to west from Cassilis to Goolma (refer to Figure 1-1). The project study area is generally a one kilometre (km) wide corridor in which the proposed transmission line, energy hubs and switching stations will be located. A refined corridor for the transmission line will be identified in the Environmental Impact Statement (EIS). Additional locations that may be required for specific uses (such as access tracks, construction compounds and workforce accommodation camps) outside the project study area would also be identified in the EIS.
Phase 1 SIA	Refers to the scoping phase of a Social Impact Assessment (SIA).
Phase 2 SIA	Refers to the Social Impact Assessment technical report to inform an EIS.
Regional social locality	The area expected to experience indirect, or secondary benefits and/or impacts due to the project.
REZ	Renewable Energy Zone. REZ is a geographic area with high-quality variable renewable energy resources (such as wind and solar), suitable topography and land use designations for development, and demonstrated interest from project developers.
SEIFA	Socio-Economic Indexes for Areas. The range of indices developed by the ABS showing relative levels of socioeconomic advantage and disadvantage. They summarise key economic and social information about people and households within a defined area and are derived from Census variables.
Sensitive receivers	Land users that are sensitive to potential noise, air and visual impacts, such as residential dwellings, schools and hospitals.
Servicing communities	Localities (towns and centres) with a concentration of residents and services.
SIA	Social Impact Assessment
Social locality	The term ‘social locality’ refers to the geographical area in which the most social impacts are likely to materialise, it includes a local and regional social locality. Refer to Chapter 5 for a description of the social locality for this assessment.
SSC	State suburb
The project	Central West Orana Renewable Energy Zone Transmission, which consist of new high voltage electricity transmission infrastructure, consisting of new 500kV and 330 kV transmission lines and related infrastructure, that would allow renewable energy generators and storage projects in the Central-West Orana REZ to connect to the existing transmission network.
Transmission line easement	Area surrounding and including the transmission lines which is a legal ‘right of way’ and allows for ongoing access and maintenance of the lines
Warrumbungle Community Strategic Plan	Warrumbungle Shire Community Strategic Plan 2017-2032

1 Introduction

New South Wales (NSW) is currently undergoing an energy sector transformation that will change how we generate and use energy. The National Energy Market (NEM) (managed by the Australian Energy Market Operator (AEMO)) is transitioning from a system dominated by a small number of large coal-fired generators located close to metropolitan centres to one of diverse renewable and distributed energy generation and storage located where the resource and environmental constraints permit.

The NSW Government is leading the development of Renewable Energy Zones (REZ) across NSW. REZs are modern day power stations which combine renewable energy generation (such as wind and solar) and energy storage systems (such as batteries and pumped hydro), supported by transmission infrastructure (high voltage (HV) poles and wires). A REZ groups new wind, solar power generation and storage, undertaken by private developers into locations where it can be efficiently transmitted across NSW and the NEM, requiring the coordination of power generation and transmission infrastructure by Energy Corporation of NSW (EnergyCo). EnergyCo is the NSW statutory authority that will lead the delivery of REZs in NSW.

Five REZs have been announced in NSW. This Social Impact Assessment (SIA) scoping report (SIA scoping report) is in respect of a project (described in Section 1.1) to facilitate the Central-West Orana REZ which has an intended network capacity of at least 3,000 megawatts. As the existing transmission network is not capable of transferring this amount of new electricity generation in the Central-West Orana REZ, new transmission infrastructure is needed to connect the new electricity generation and storage projects in the REZ to the NEM.

1.1 Project overview

EnergyCo are proposing the construction and operation of new high voltage electricity transmission infrastructure and new energy hubs and switching stations required to connect energy generation and storage projects within the Central-West Orana REZ to the existing electricity network (the project). The project would enable at least 3,000 megawatts of new network capacity to be unlocked by the mid-2020s and enable generators within the Central-West Orana REZ to export electricity to the rest of the network. The development of renewable energy generation and storage projects in the Central-West Orana REZ are subject to separate approvals.

An overview of the project is shown in Figure 1-1 and key features include:

- a new switching station at Wollar, to connect the project to Transgrid's existing Wollar Substation and onto the NEM
- new twin double circuit 500 kV transmission lines and associated infrastructure to connect to the NEM and single and double circuit 330 kV single lines to connect energy generation and storage projects within the Central-West Orana REZ to the energy hubs
- energy hubs at Merotherie and Elong Elong, to connect energy generation and storage projects within the Central-West Orana REZ to the new 500 kV network infrastructure
- switching stations along the 330 kV network infrastructure to transfer the energy generated from the energy generation projects onto the 330 kV network infrastructure
- establishment and upgrade of access tracks and public roads, and other ancillary works such as laydown and staging areas, earthwork material sites with crushing and screening plants, concrete batching plants, brake/winch sites, site offices and workforce accommodation camps
- utility adjustments required for construction of the new network infrastructure.

It is expected that construction of the project would commence in the second half of 2024 and take approximately three years to complete with initial operations commencing as early as mid-2027.

The project study area is generally a one kilometre (km) wide corridor in which the proposed transmission line, energy hubs and switching stations will be located. A refined corridor for the project would be identified in the Environmental

Impact Statement (EIS). Additional locations that may be required for specific uses (such as access tracks, construction compounds and workforce accommodation camps) outside the project study area would also be identified in the EIS.

The project includes a southern extension of the transmission network between Elong Elong and Mumbil with a connection to the NSW transmission network. This section is under investigation and will be subject to a separate planning approval.

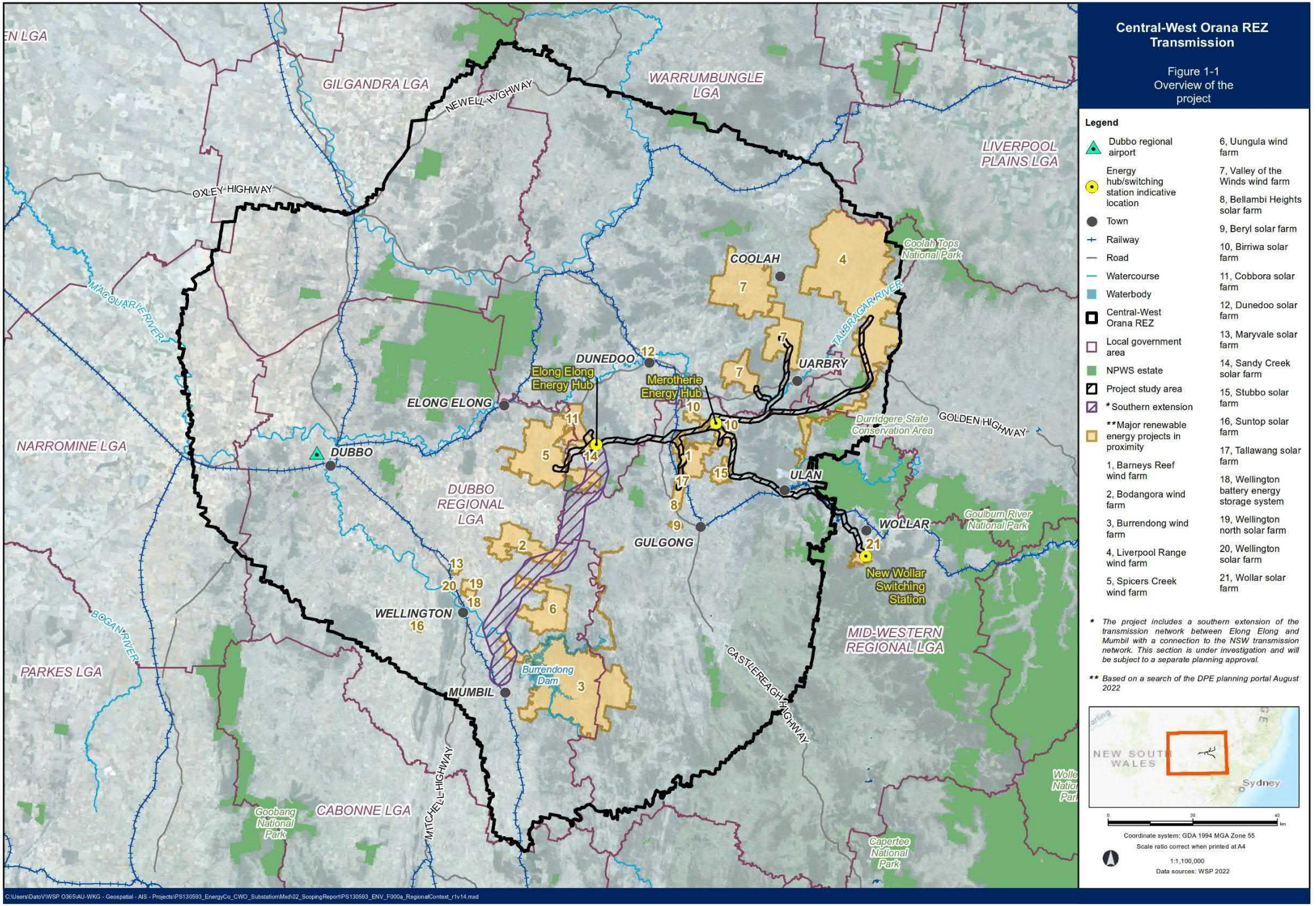
1.2 About this document

This Social Impact Assessment (SIA) scoping report is the first phase of undertaking an SIA for state significant projects under the Department of Planning and Environment (DPE) SIA Guideline (2021). The scoping report is used to focus the SIA on the most relevant and important issues for a project and ensures the scale of assessment required is proportionate to the magnitude of the expected impacts.

The key objective of this report is to gather a high-level understanding of the project's social environment to be able to:

- determine the preliminary local and regional social localities, referred to as the social locality
- identify key communities and potentially affected people, both direct and indirect
- identify potential social impacts requiring further investigation as part of the SIA that will accompany the EIS.

This SIA scoping report identifies the potential impacts and benefits of the project.



C:\Users\DatoV\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\02_ScopingReport\PS130593_ENV_F000a_RegionalContext_r1v14.mxd

2 Methodology

The methodology of this report was informed by the SIA Guideline (DPE, 2021). The scoping of social issues incorporated the following SIA principles:

- life-cycle focus by exploring the likely impacts at all project stages, including pre-construction, construction, and operation
- proportionate by ensuring the scope and scale of the SIA corresponds to the scope and scale of the likely social impacts
- material by focusing on those impacts that matter most for people and/or pose the greatest risk/opportunity to those expected to be affected
- integrated by using and referencing information from other assessments.

This section provides an outline of the steps followed to complete this report.

2.1 Understanding of project context

A review of regional planning policies and strategies was conducted to contextualise the project (see Chapter 3), as well as a review of community feedback received by EnergyCo about the revised study corridor (Chapter 4).

2.2 Scoping of likely social impacts

The SIA Scoping Tool (DPE, 2021) was completed in an iterative process to inform this report. The initial scoping of likely social impacts was informed by:

- understanding the project context and reviewing the outcomes of consultation activities conducted by EnergyCo
- a review of SIAs on energy transmission lines and relevant literature on predicted social impacts, such as:
  - EnergyConnect (Western Section)
  - EnergyConnect (Eastern Section)
  - Abplanalp, J. & Beckman, K. J. 2014. Electric transmission visibility and visual contrast threshold distances in western landscapes
  - AusNet Services, 2015. A guide to living with transmission line easements
  - Elliott, P. & Wadley, D. 2002. The impact of transmission lines on property values: Coming to terms with stigma.

The scoping of social impacts was further refined by:

- a desktop review of the existing environment and outcomes of preliminary assessments completed as part of the Scoping Report for the project; and
- obtaining feedback from EnergyCo.

Scoped social impacts and their required level of assessment are outlined in Chapter 7. The approach used to determine the level of assessment required for an identified social impact has been completed in accordance with the SIA Guideline. This is documented in the SIA Scoping Tool (Appendix A).

2.3 Determining the social locality and description of existing environment

The approach used to determine the SIA social locality considered who is most likely to experience direct and indirect socio-economic impacts as a result of the project and where those groups of people are located, in line with the SIA Guideline (DPE, 2021). The social locality determined in Chapter 5, is informed by the scoping of social impacts, and will be further refined and updated accordingly to project changes and further investigation of impacts in Phase 2 SIA.

The description of the existing environment provides a summary of the social locality, including a high-level overview of regional demographic characteristics, socio-economic backgrounds, land use, key industries, and social infrastructure. The description of the existing environment in Chapter 6 provides an overview of four Local Government Areas (LGAs) intersected by the proposal. Further information about the social locality is provided in Appendix B.

2.4 Determining the complexity of Phase 2 SIA report

Following the completion of the SIA Scoping Tool, the overall complexity of the SIA assessment was reviewed against the criteria outlined in Table 2-1. The level of assessment that would be carried out for the Phase 2 SIA is provided in Chapter 8.

The criteria adopted is informed by Appendix C of the Technical Supplement of SIA Guideline (DPE, 2021) and by the SIA Guideline.

Table 2-1 Level of assessment criteria

Complexity of SIA Report	Level of assessment	Criteria
Complex	Detailed	The project may result in significant social impacts, including cumulative impacts
	Standard	The project is unlikely to result in significant social impacts, including cumulative impacts
Basic	Minor	The project may result in minor social impacts
	Not relevant	The project will have no social impact, or the social impacts of the project will be so small that they do not warrant consideration

2.5 Limitations

The information presented in this report has been based on desktop research. At the time of writing of this report, 2021 Census data had been partially released. While this report has considered the 2021 Census data released to date, the comprehensive list of indicators is yet to be updated and released.

More detailed investigations, including consultation and/or surveys, are proposed be undertaken during the preparation of the EIS for the project to fill any gaps of information if 2021 Census data is not fully released by the time of writing the Phase 2 SIA.

2.6 SIA team and lead author

The SIA will be developed by an experienced team of social scientists. Carla Martinez is the lead author for Phases 1 and 2 of the SIA. Carla holds a Master of Development Practice major in Planning for Social Development from the University of Queensland. Carla has also completed a SIA course from the University of Strathclyde. Carla is a SIA practitioner with experience in the resource and energy sector in Chile and Australia, having led SIAs in NSW, Queensland and South Australia.

Caitlin Treacy will support the development of the SIA. Caitlin holds a Bachelor of Arts (Honors) major in Anthropology from the University of Queensland. Caitlin is a SIA practitioner with experience working on both private and public sector projects in NSW, Queensland and South Australia.

Carla Martinez and Caitlin Treacy are members of the Environmental Institute of Australia and New Zealand.

3 Strategic context

3.1 Regional planning policies and strategies

3.1.1 *Central West and Orana Regional Plan 2036*

The Central West and Orana Regional Plan (current regional plan) sets the strategic framework for the region. The four key goals of the strategy aim to diversify the region's economy, provide quality freight, transport and infrastructure networks, care for the environment and heritage, and ensure healthy communities.

Direction 9 in the plan aims to increase renewable energy generation, and identifies potential for large scale solar, wind and infrastructure projects to support NSW's increasing energy demands.

3.1.2 *Draft Central West and Orana Regional Plan 2041*

The draft Central West and Orana Regional Plan 2041 (draft plan) builds on the current regional plan to address emerging and future challenges that will affect the region. The draft plan considers a twenty-year timeframe with a focus on the next five years. Key areas of emphasis include the region's role supporting NSW's transition to net zero carbon emissions by 2050 through enabling the establishment of a renewable energy zone and ways to respond to changing regional economy and catalyst projects such as Central-West Orana REZ. The final Central West and Orana Regional Plan is anticipated to be finalised in late-2022 and would replace the current regional plan once finalised.

Strategy 12.4 encourages renewable energy proponents to develop projects that are appropriately located and compatible with surroundings land use practices to minimise social and environmental impacts. Strategy 12.3 seeks to facilitate renewable energy industry using strategic and local planning to address the cumulative impacts of major renewable projects and maximise benefits in the region.

3.2 Local Government planning policies and strategies

3.2.1 *Dubbo Regional Council's Towards 2040 Community Strategic Plan*

Dubbo Regional Council's Towards 2040 Community Strategic Plan (the Dubbo Regional Community Strategic Plan) identifies the main aspirations and priorities of the Dubbo Regional community for the future of the region through to 2040. The strategy is aimed to guide and influence the direction of Dubbo Regional Council, the community and other levels of the NSW Government to prioritise the goals and aspirations of the community.

The strategic plan outlines future social, economic and environmental aspirations for the development and growth of the local area, such as housing, infrastructure, economy, community leadership and liveability. The plan highlights the strategic importance of increasing local opportunities for use of renewable energy, including through investment in renewable projects.

3.2.2 *Towards 2030 Mid-Western Region Community Plan*

Mid-Western Regional Council's Towards 2030 Mid-Western Region Community Plan (the Mid-Western Region Community Plan) outlines the community goals and priorities to be implemented over the next 20-years. The plan identifies the future vision for the local government area, incorporating key aspirations and strategies for achieving this vision. The five key themes addressed in the community plan are community, environment, economy, connectivity, and governance. Under the theme of community, the plan identifies the 'effective and efficient delivery of infrastructure' as a key goal to service local and regional needs.

3.2.3 *Warrumbungle Shire Community Strategic Plan (Reviewed) 2017-2032*

The Warrumbungle Shire Community Strategic Plan (Reviewed) 2017-2032 (Warrumbungle Community Strategic Plan) provides a 15-year vision for the Warrumbungle community. The plan identifies the central values of the local community, focusing on community spirit, children, and homes, as well as establishing key goals for the future, such as supporting local growth, resilience and health amongst residents, neighbourhoods, the environment and the economy. Energy production enterprises are identified within the community plan as a means for achieving long term outcomes for the local economy, particularly through the development of renewable energy projects within the Shire.

3.2.4 *Upper Hunter 2032 Community Strategic Plan*

The Upper Hunter Shire Council's Upper Hunter 2032 Community Strategic Plan provides a road map of the community's key aspirations, values and key priorities for the future with the vision to foster a 'quality rural lifestyle in a vibrant, caring and sustainable community'. The plan is organised around the following priorities for the future: connected community, protected environment, thriving economy, quality infrastructure and responsible governance. A reoccurring theme raised in the plan is the region's vulnerability to issues of climate change, and the desire to build resilience across key strategic areas within the community. Increasing, enhancing, and maintaining infrastructure is identified as a key economic goal within the region, focusing on the prioritisation of innovative projects that meet the needs of future generations.

4 Stakeholder consultation

Engagement with communities and stakeholders about proposed new transmission network infrastructure in the Central-West Orana REZ has been ongoing since 2020.

Between December 2020 and September 2021, community consultation was carried out by Transgrid on the preliminary study area for new transmission network infrastructure in the Central-West Orana REZ. EnergyCo assumed responsibility for engaging communities and stakeholders for the project when it was appointed as Infrastructure Planner for the Central-West Orana REZ in November 2021. Since this time, EnergyCo has carried out a comprehensive program of community and stakeholder engagement to build on the engagement previously carried out by Transgrid.

In February 2022, EnergyCo invited the community and stakeholders to provide feedback on the revised study corridor for new transmission network infrastructure within the Central-West Orana REZ, building upon early consultation carried out by Transgrid on a preliminary study corridor for the transmission route in 2020 and 2021.

Invitation to provide submissions consisted of the delivery of about 350 letters to landowners within the revised study corridor to inform them about the consultation period and invite them to provide feedback, together with published information in the project webpage, a media release, advertisement in local newspapers and email notification to key stakeholders.

In addition, six drop-in information sessions with participation of approximately 130 people in Wellington, Gulgong and Dunedoo were held, together with stakeholder meetings with elected representatives, local Councils, organisations, and interest groups.

Table 4-1 summarises and categorises the feedback received by EnergyCo in line with the SIA Guideline (DPE, 2021) social impact categories.

Table 4-1 EnergyCo consultation summary

Social Impact Category	Consultation feedback
Way of life	Different views on how the construction workforce should be managed to maximise benefits, and minimise impacts, to local community and way of life.
	Concerns over general temporary way of life impacts experienced by the local community during construction.
	Opposition to energy hubs being located near the property due to impacts to traffic volumes on local roads was raised in one submission (Merotherie and Elong Elong energy hubs).
Community	Concern over division within the community was raised by stakeholders due to conflicting views about the project. A number of stakeholders stated their support to the new study corridor moving away from Merriwa Cassilis Plateau, while there were also stakeholders stating their opposition to the project and proposed corridor.
	Concerns about cumulative impacts in the local area from multiple renewable energy projects and existing coal mines.
Accessibility	Stakeholders expressed interest over who will be responsible for road maintenance and upgrades
	Potential disruption to telecommunications in the vicinity of transmission infrastructure, including radio, internet and television was raised in one submission
Health and Wellbeing	Specific concerns over the mental health impacts to landowners was raised by stakeholders.
	Stakeholders raised concerns over health impacts near transmission lines due to exposure to electric and magnetic fields.

Social Impact Category	Consultation feedback
Culture	Impact to cultural heritage sites was raised as a concern by stakeholders.
Surroundings	Multiple stakeholders expressed interest, and support, in the transmission route avoiding environmentally sensitive locations, including biodiversity offset areas, threatened species and local wildlife habitat and areas of remnant vegetation. Special interest was expressed in the development of environmental assessments based on fieldwork instead of desktop research.
	Concerns over local visual amenity and interest on reducing aesthetic impacts by using land and corridors already cleared impacted. Concerns about visual impact studies not accurately representing the visual impacts of the proposed developments.
Livelihoods	Concern over the use of prime agricultural land for the transmission route was raised by stakeholders, and cumulative impacts to prime agricultural land due to other energy-related projects.
	Concern about disruption to agricultural practices, and other business practices, in the vicinity of transmission lines, including fire management and agricultural practices carried out by air.
	Concerned about impacts to property values in the local area.
	Concern over distribution equality of benefits, as the project is supplying energy consumers on the east coast of NSW, therefore not benefiting the communities where the infrastructure is located.
	Potential opportunities for local businesses to provide goods and services to temporary workforce accommodation camps, and the potential use of local accommodation, goods and services generating economic benefits.
	Interest in local employment and business opportunities during construction.
	Concerns about workforce availability during construction and decommissioning.
Decision making systems	Landowner opposition to hosting or being within 2 kms of transmission infrastructure. In particular 4 submissions were received expressing concern on infrastructure to be located in the vicinity of Suzanne Road, Tallawang.
	Concern that compensation provided to landowners for transmission infrastructure will be insufficient or inequitable.
	General feedback about community engagement was provided, key highlights included interest on more communication channels, difficulties to navigate the project website and need for better visualisations to illustrate visual impact. Interest in establishing community reference groups by community. Support to the community in dealing with local impacts and liaising with developers was recommended. Landowners raised that they were not adequately informed about the consultation and that impact to landowners was not communicated clearly at the information sessions.
	Community benefit funding should be determined by community representatives and not just by local councils.

5 Social locality

The SIA social locality was determined after completing the initial scoping of likely social impacts. The SIA social locality considered who is most likely to experience direct and indirect socio-economic impacts as a result of the project and where those groups of people are located.

5.1 SIA social locality

The project is located within the Central West and Orana region and the Upper Hunter Valley LGA. The Central West and Orana region consists of nineteen LGAs: Bathurst Regional, Blayney, Bogan, Cabonne, Coonamble, Cowra, Dubbo Regional, Forbes, Gilgandra, Lachlan, Lithgow, Mid-Western Regional, Narromine, Oberon, Orange, Parkes, Warren, Warrumbungle and Weddin.

The SIA social locality is comprised of the regional and local social locality.

The regional social locality is the area expected to experience indirect benefits or effects as a result of the project during construction and/or operation. The regional social locality includes nine LGAs: Dubbo Regional (previously known as Western Plains Regional LGA until 2016), Narromine, Mid-Western Regional, Upper Hunter, Warrumbungle, Gilgandra Shire, Liverpool Plains, Muswellbrook and Cabonne.

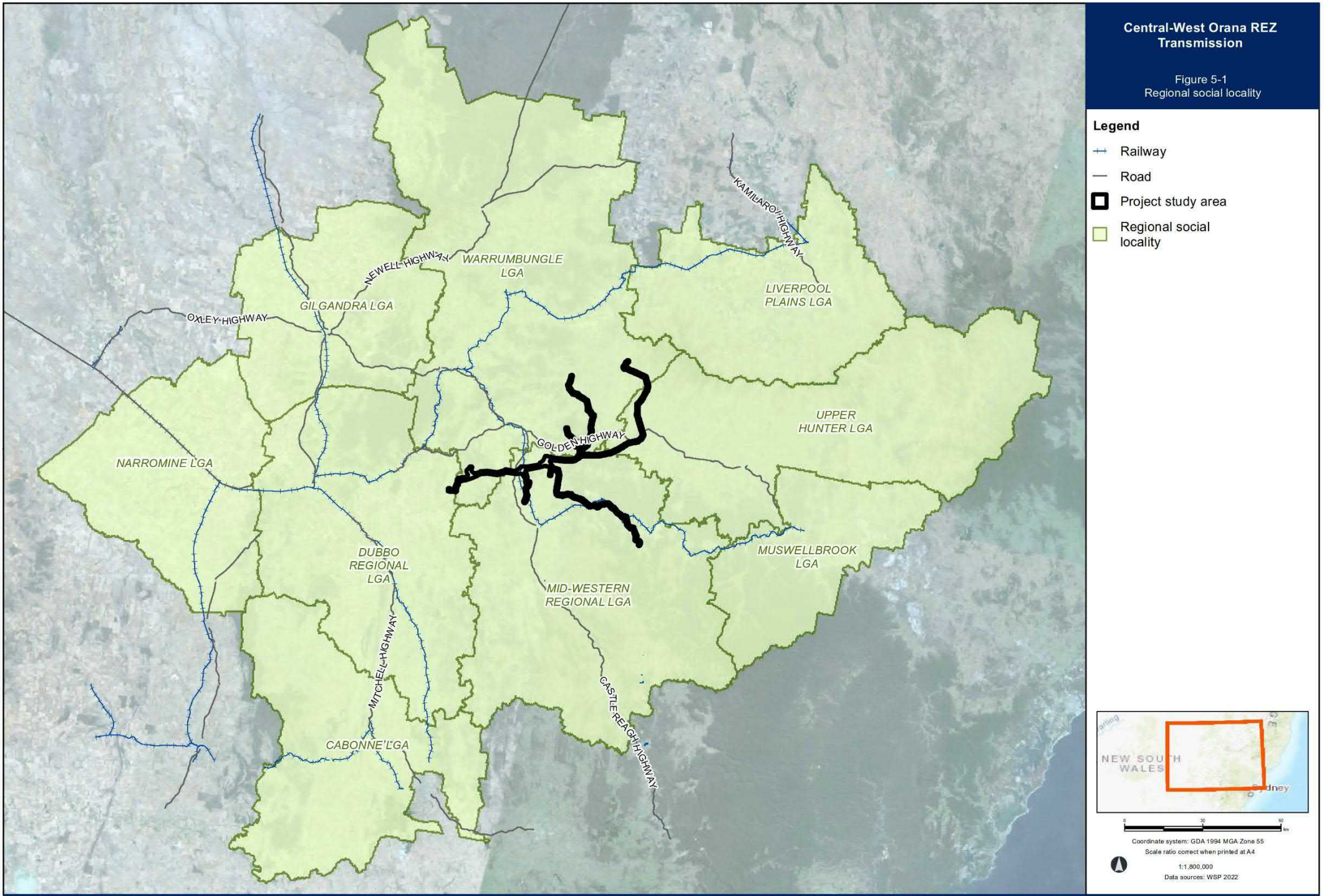
The local social locality is the area expected to experience the most social change as a result of the project during construction and/or operation. It includes the people living and/or accessing services within or in close proximity to the project. Some of the anticipated impacts include changes to visual amenity and health and wellbeing from construction and operation of the project. State Suburbs (SSC) units that spatially intersect project study area are considered to describe the local social locality. The SSC groups within the SIA local social locality area include:

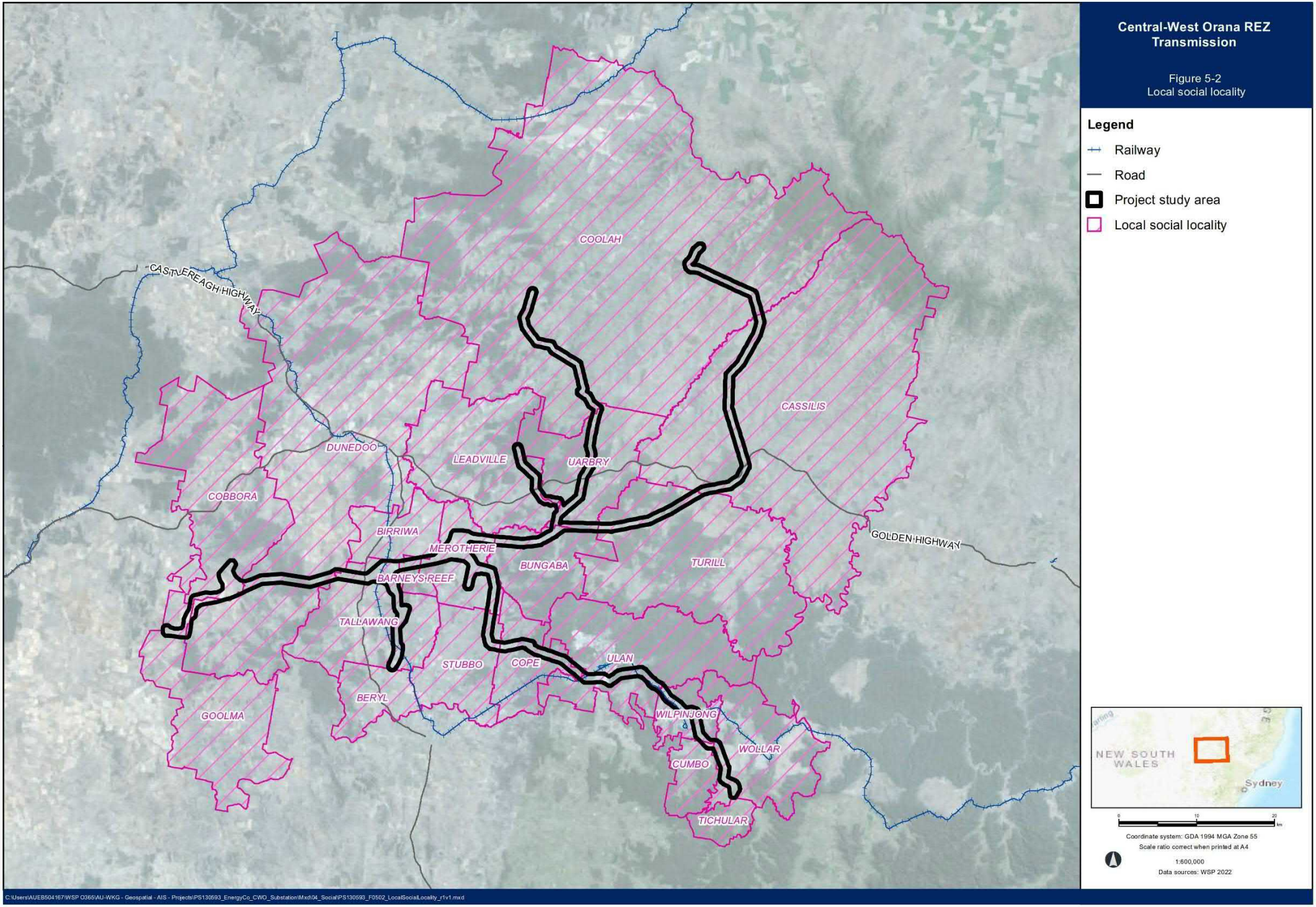
- Barneys Reef
- Beryl
- Birriwa
- Bungaba
- Cassilis
- Cobbora
- Coolah
- Cope
- Cumbo
- Dunedoo
- Goolma
- Leadville
- Merotherie
- Stubbo
- Tallawang
- Tichular
- Turill
- Uarbry
- Ulan
- Wilpinjong
- Wollar

Together, these two areas provide an understanding of:

- the social context without the project, including the existing social environment, and socio-economic trends relevant to the scoped social impacts
- the local area where direct and indirect impacts may occur
- the broader region in which the project is located.

Figure 5-1 and Figure 5-2 shows the regional and local social locality respectively in relation to the project study area.


Central-West Orana REZ Transmission
Figure 5-1
Regional social locality
Legend
Railway
Road
Project study area
Regional social locality
NEWELL HIGHWAY
KAMILAROI HIGHWAY
OXLEY HIGHWAY
GOLDEN HIGHWAY
MITCHELL HIGHWAY
CASTLEREAGH HIGHWAY
WARRUMBUNGLE LGA
GILGANDRA LGA
LIVERPOOL PLAINS LGA
UPPER HUNTER LGA
NARROMINE LGA
DUBBO REGIONAL LGA
MID-WESTERN REGIONAL LGA
MUSWELLBROOK LGA
CABONNE LGA
NEW SOUTH WALES
Sydney
Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:1,800,000
Data sources: WSP 2022
C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\04_Social\PS130593_F0501_RegionalSocialLocality_r1v2.mxd


Central-West Orana REZ Transmission
Figure 5-2
Local social locality
Legend
Railway
Road
Project study area
Local social locality
COOLAH
CASTLEREAGH HIGHWAY
CASSILIS
DUNEDOO
LEADVILLE
UARBRY
COBBORA
BIRRIWA
MEROTHERIE
BUNGABA
TURILL
GOLDEN HIGHWAY
BARNEYS REEF
TALLAWANG
STUBBO
COPE
ULAN
BERYL
GOOLMA
WILPINJONG
WOLLAR
CUMBO
TICHULAR
NEW SOUTH WALES
Sydney
Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:600,000
Data sources: WSP 2022
C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\04_Social\PS130593_F0502_LocalSocialLocality_r1v1.mxd

6 Existing environment

The Central West and Orana region has a diverse economy with an unprecedented opportunity of growth by major investments in the Inland Rail, Parkes Special Activation Precinct and the Central–West Orana Renewable Energy Zone (REZ) (DPIE, 2021). Agricultural production occurs from the vast plains of the Orana in the north and west to the sub-alpine areas of the Central West in the east, from intensive and irrigated crops – including vegetables, fodder, stone fruits, grapes and cotton – to extensive broadacre cropping, meat and wool production and forestry (DPIE, 2021). The Upper Hunter LGA supports a diverse range of agricultural industries, including beef cattle, dairy, equine and sheep.

The region's population lives in a diverse network of centres and rural localities, which range in size from large regional centres to smaller towns and villages. Given the diversity of these towns and centres, this section refers to localities with a concentration of residents and services as 'servicing communities'. Residents within the local social locality rely servicing communities for employment, services and social networks, and as such, may travel to and from towns on a frequent basis.

The project is located across four LGAs; Warrumbungle, Dubbo Regional, Mid-Western Regional and Upper Hunter.

The description of the existing environment focuses primarily on these four LGAs and the servicing communities that are likely to experience flow on benefits or effects as a result of the project – such as provision of accommodation services to temporary workforce, provision of services and employment. The servicing communities of Dunedoo, Dubbo and Gulgong are described in Appendix B.

6.1 Regional social locality

6.1.1 *Demographic overview*

The regional social locality has a total population of 103,988 with 25,405 families across 23,143 private dwellings.

When compared to NSW, using the data available from the 2021 and 2016 Census, local government areas (LGAs) within the regional social locality showed the following key demographic trends:

- overall older median age (all LGAs have a higher median age than NSW overall, except for Muswellbrook and Dubbo Regional)
- relatively high comparative Indigenous population (all LGAs have an Indigenous population higher than NSW overall, the highest of which is 20.4% in Narromine)
- significantly varying median weekly income across LGA areas (varying from $1,068 in Warrumbungle to $1,628 in Muswellbrook) (ABS, 2016).

Table B.1 in Appendix B provides an overview of key demographic indicators across each LGA making up the regional social locality.

6.1.2 *Socio-economic overview (SEIFA IRSAD)*

The Socio-Economic Indexes for Areas (SEIFA) Index of Relative Socio-economic Advantage and Disadvantage (IRSAD) provides an overview of the socio-economic conditions of residents and households within an area, including relative advantage and disadvantage. A low IRSAD score indicates higher levels of disadvantage, whilst a high score will indicate high levels of advantage and relatively low levels of disadvantage. For example, a low score may indicate:

- more households with low incomes, or more people in unskilled occupations
- less households with high incomes, or less people in skilled occupations (ABS, 2018).

Overall, IRSAD scores demonstrate that the regional and local population are likely to experience heightened levels of socio-economic disadvantage (where 1 is the lowest and 5 is the highest). Within the regional social locality, most LGAs sit within the 1st to 3rd quintile, ranging from Gilgandra and Liverpool Plains which are in 1st quintile, to the Upper Hunter which is in 3rd quintile. However, Cabonne LGA demonstrates a higher level of socio-economic advantage and sits in the 4th quintile. Table B.2 in Appendix B shows the IRSAD scores of each LGA in the regional social locality.

6.2 LGAs intersected by the project

6.2.1 *Warrumbungle LGA*

The Warrumbungle LGA encompasses the northern portion of the project study area and includes the community of Dunedoo which is positioned relatively close to the Elong Elong and Merotherie energy hubs. The LGA covers a total area of 12,380 km^2 and has a total population of 9,225, approximately half which live in rural and remote areas (Warrumbungle Shire Council, 2022). The LGA has a comparatively older population, with a median age of 50, and the majority of residents (80%) are Australian born.

The Warrumbungle region also has a rich Aboriginal history, with the LGA home to the Gamilaraay people (also known as Kamilaroi), the Wailwan people and the Wiradjuri people. Aboriginal residents account for approximately 11% of the Warrumbungle population (ABS, 2021).

Just over half (56%) of residents in the Warrumbungle LGA work full-time and 31% part-time, with the most common industry being beef cattle farming. Over half of local residents drive to work (55%) while others (15%) work from home (ABS, 2016). The economy in the LGA relies on rural based industries, such as sheep and cattle farming and cropping. To a lesser extent, other economic drivers include tourism and coal mining in the south of the LGA.

A description of the Dunedoo servicing community is provided in Section B1.1 of Appendix B.

6.2.2 *Dubbo Regional LGA*

The Dubbo Regional LGA, encompasses a small porting portion of the western extent of project study area and includes the community of Dubbo which has a high concentration of goods and services. The LGA covers a total area of 7,536 km^2 and has a total population of 54,922, 79% of which live in the town of Dubbo (SSC). The LGA has a median age of 36, which is three years younger than the NSW median, and the majority of residents (82%) are Australian born (ABS, 2021).

Dubbo Regional LGA is located on the traditional land of the Tubbagah people of the Wiradjuri Nation. Indigenous residents represent over 16% of the LGA's population.

Around 62% of residents in the Dubbo Regional LGA work full-time and 27.2% part-time (ABS, 2016). The most common industry of employment is hospitals, followed by primary education, illustrating the notable presence of health and educational services in the LGA. Almost three quarters of residents drive to work (72%) while others (4.4%) work from home (ABS, 2016). The economy in the LGA relies largely on manufacturing, which represents the highest gross output by industry in the area, followed by rental, hiring and real estate services, then construction (Dubbo Regional Council, 2016). The region is also known for its historical wheat and wool production.

A description of Dubbo servicing community is provided in Section B1.2 of Appendix B.

6.2.3 *Mid-Western Regional LGA*

The Mid-Western Regional LGA encompasses the eastern portion of the project and includes the servicing community of Gulgong which is positioned relatively close to the project study area and the community of Wollar, which is located in proximity to the New Wollar Switching Station. The LGA covers a total area of 8,737 km^2 and has a total population of 25,713. The median age in the LGA is 42, which is three years older than NSW's median age, and the majority of residents (84%) are Australian born (ABS, 2021). The main servicing communities in Mid-Western Regional LGA are Mudgee, Gulgong, and Bombira.

Other small villages in the LGA include Rylstone, Kandos, Bylong, and Ilford. The largest servicing community is Mudgee with a population of 11,457, and the largest concentration of businesses and services in the LGA.

Mid-Western Regional LGA is home to the Wiradjuri people who are recognised as the traditional owners of the land. Aboriginal residents account for approximately 7% of the LGA's population (ABS, 2021).

Just over half (56%) of residents in Mid-Western Regional LGA work full-time and 31% work part-time. The most common industry of employment is coal mining, which employs 13.7% of the LGA's population, followed by beef cattle farming. Over 65% of local residents drive to work while others (5.9%) work from home (ABS, 2016). The economy in the LGA relies on major industries including mining, agriculture (including viticulture or winegrowing), construction, retail and tourism (YourCouncil NSW, 2020).

A description of Gulgong servicing community is provided in Section B1.3 of Appendix B.

6.2.4 *Upper Hunter LGA*

The Upper Hunter LGA encompasses the north-eastern portion of the project and includes the community of Cassilis which is positioned relatively close to the project study area when compared to other communities in the region. The Upper Hunter LGA covers a total area of 8,096 km^2 of mostly rural land, with a significant portion of the region covered in National Parks and nature reserves (Upper Hunter Shire, 2022). The LGA has a total population of 14,229, with a comparatively older population and a median age of 42 (ABS, 2021). The majority of residents (84%) are Australian born (ABS, 2021).

The Wonnarua people are recognised as the traditional owners of the Hunter Valley and the Upper Hunter LGAs, and the region is home to several sites of significance including the Finchley Trig and Biaime Caves (Welcome to Country, 2019). Aboriginal residents account for approximately 7% of the Upper Hunter LGA population (ABS, 2021).

More than half (60%) of all Upper Hunter LGA residents work full-time and 30% part-time, with the most common industry being coal mining. Most residents in the LGA drive to work (65%) while others (8%) work from home (ABS, 2016). The economy in the LGA relies on rural based industries, such as grazing, dairy farming, horse studs and general farming (Upper Hunter Shire, 2022). Coal mining in the Upper Hunter LGA is also a major source of employment and economic stimulus, with approximately 41 coal mines located in the Hunter Valley region (Australian Mining Review, 2019).

7 Scoped social impacts

This chapter provides a summary of completed SIA Scoping Tool provided in Appendix A. The scoping of social issues was undertaken using the methodology outlined in Chapter 4.

Table 7-1 identifies potential social impacts category as per SIA Guideline (DPE, 2021), their nature, extent, duration, and level of assessment suggested by the SIA Scoping Tool (DPE, 2021).

The social impacts scoped during this SIA phase will be assessed under the SIA Guideline (DPE, 2021) in the Phase 2 SIA. Additional technical studies, and community and stakeholder consultation will assist in further identifying the magnitude and significance of these potential impacts, which will inform the assessment of social impacts as part of the EIS.

Table 7-1 Scoping of potential social impacts

Primary impact category	Potential impacts on people	Nature	Phase	Level of assessment
Way of life	Amenity impacts may temporarily affect sense of place and alter the way neighbouring landowners and residents use and enjoy space.	Negative	Construction	Detailed assessment of the impact
Way of life	Changes to way of life as a result of delays to mobility during construction due to increase traffic and transport of construction workforce, equipment and construction materials (in particular at energy hubs). This may be exacerbated by cumulative impacts of other local and regional projects.	Negative	Construction	Standard assessment of the impact
Community	The perceived unfair distribution of impact and benefit resulting in community division affecting residents' social networks, sense of community and wellbeing. These impacts may be exacerbated by cumulative impacts of the project with other nearby projects.	Negative	Construction and operation	Detailed assessment of the impact
Culture	Cumulative impacts in cultural identity in the region as a result of the increased presence of the renewable energy industry within the landscape.	Negative	Operational	Detailed assessment of the impact
Culture	Impacts on Aboriginal cultural values and wellbeing due to changes to the environment and sites of cultural heritage significance that are not acceptable to Aboriginal people, affecting sense of place and cultural connection to Country.	Negative	Construction and operation	Detailed assessment of the impact

Primary impact category	Potential impacts on people	Nature	Phase	Level of assessment
Access	Increased demand on health/social services due to increase in temporary construction workforce, which may be enhanced by cumulative impacts from other major projects.	Negative	Construction	Detailed assessment of the impact
Access	Potential disruption to telecommunications in the vicinity of transmission infrastructure, including radio, internet and television.	Negative	Construction and operation	Detailed assessment of the impact
Access	Impacts on wellbeing - annoyance amongst residents and impacts to general way of life as a result of potential interruptions to utilities such as water, electricity, gas, telecommunications etc. during the construction phase of the project (if realignment of services required).	Negative	Construction	Minor assessment of the impact
Health and Wellbeing	Detrimental effects on health and wellbeing due to the combined effects of dust and noise during construction, likely to affect neighbouring landowners and residents, especially those with pre-existing respiratory conditions such as asthma and emphysema.	Negative	Construction	Standard assessment of the impact
Health and wellbeing	Impacts to sense of safety due to increase traffic movements associated with the transport of equipment and materials during construction, and the potential degradation of local roads.	Negative	Construction	Detailed assessment of the impact
Health and wellbeing	Mental health issues in the proposal workforce due to feelings of isolation.	Negative	Construction	Detailed assessment of the impact
Health and wellbeing	Detrimental physical and mental health outcomes on landowners subject to acquisition process, physical changes to their properties and way they use and manage their land. This may be exacerbated by cumulative impacts of the project with other nearby projects.	Negative	Construction	Detailed assessment of the impact

Primary impact category	Potential impacts on people	Nature	Phase	Level of assessment
Health and wellbeing	Stress due to perceived health and safety risks associated with the construction of transmission line towers within resident's properties, including concern about potential health impacts of high voltage transmission lines electromagnetic fields (EMFs).	Negative	Construction and operation	Detailed assessment of the impact
Health and wellbeing	Stress due to perceived bushfire risk associated with the construction and operation of power lines, particularly given the agricultural and residential land use in the area.	Negative	Construction and operation	Detailed assessment of the impact
Health and wellbeing	Stress due to perceived uncertainty in the local property market associated with cumulative impacts of the project with other nearby projects and land acquisition.	Negative	Construction	Detailed assessment of the impact
Surroundings	Permanent change of community character due to loss of aesthetic values as a result of visual impacts caused during construction and operation, likely to affect neighbouring landowners and residents within local social locality.	Negative	Construction and operation	Detailed assessment of the impact
Surroundings	Perceived or actual loss of biodiversity values resulting in impacts to the community's sense of belonging and aesthetic values, which may be exacerbated by cumulative impacts.	Negative	Construction and operation	Standard assessment of the impact
Surroundings	Diminished sense of safety during construction due to the increased presence of construction workers in service communities, which affects local perceptions of safety and wellbeing.	Negative	Construction	Detailed assessment of the impact
Livelihoods	Easement and associated transmission line may restrict or alter how some landholders manage their property, potentially decreasing productivity on some portions of land or perceived property value impacts, which could have an effect on livelihoods.	Negative	Construction and operation	Standard assessment of the impact

Primary impact category	Potential impacts on people	Nature	Phase	Level of assessment
Livelihoods	Improvement on landowner's livelihoods due to receiving compensation/leasing payments for transmission towers.	Positive	Construction and operation	Detailed assessment of the impact
Livelihoods	Improved livelihoods of local business owners as result of economic stimulus resulting from the proposal procurement opportunities.	Positive	Construction	Minor assessment of the impact
Livelihoods	Employment opportunities would improve the livelihoods of those employed, improve mental wellbeing, the way they interact with their communities and their ability to access goods and services.	Positive	Construction	Detailed assessment of the impact
Livelihoods	Impacts on local livelihoods due to increased demand in local workforce market resulting in increased cost of labour to small businesses (agriculture) and causing labour shortages for other non-project industries.	Negative	Construction	Detailed assessment of the impact
Livelihoods	Cumulative impacts to livelihood due to cumulative impacts on loss of agricultural land and reduced productivity. Combined land acquisition may impact local livelihoods and overall local agricultural industry (jobs etc)	Negative	Construction	Detailed assessment of the impact
Livelihoods	Improvement in local employment opportunities due to the encouragement of investment into renewable projects and associated industries within the region as a result of the project.	Positive	Operation	Detailed assessment of the impact
Livelihoods	Perceived unequitable distribution of benefits, as the project is supplying energy consumers on the east coast of NSW, therefore not benefiting the communities where the infrastructure is located	Negative	Operation	Detailed assessment of the impact

Primary impact category	Potential impacts on people	Nature	Phase	Level of assessment
Decision-making systems	Landholders may perceive negative impacts in relation to their property and access to remedy rights, regardless of the standards of procedural fairness being met and just compensation terms being in place. This would include adjoining landowners that are in proximity to new transmission infrastructure.	Negative	Construction and operation	Detailed assessment of the impact
Decision-making system	Impacts on procedural fairness and people's capacity to influence changes that may affect their lives.	Negative	Construction and operation	Detailed assessment of the impact

8 Complexity of SIA

A complex social impact report will be undertaken in the Phase 2 SIA to address the identified matters in Chapter 7. The assessment will be undertaken in accordance with the SIA Guideline (DPE, 2021). A standalone social impact assessment technical study will be appended to the EIS.

The key objectives of the SIA report would be to:

- predict and analyse the extent and nature of likely social impacts against baseline conditions using accepted social science methods
- evaluate, draw attention to and prioritise the social impacts that are important to people
- develop appropriate and justified responses (e.g., avoidance, mitigation and enhancement measures) to social impacts, and identify and explain residual social impacts
- propose arrangements to monitor and manage residual social impacts, including unanticipated impacts, over the life of the project (DPE, 2021).

8.1 Consultation and research methods

The Phase 2 SIA will be informed by the following primary and secondary research methods and consultation activities:

- primary SIA data will be collected through the following activities:
  - targeted consultation via a landholder survey. The survey will be distributed to all landowners subject to lease agreements during the construction and/or operational phases of the project. The survey will be made available to participants both online and as a hard copy.
  - targeted consultation via individual and group semi-structured interviews, with key stakeholder groups including:
    - landowners and or residents within project study area
    - local government representatives
    - community representatives
    - First Nations people
    - social service providers (including emergency services); and
    - institutional stakeholders (such as chambers of commerce)
- secondary SIA data will be collected through reviews and analysis of the following:
  - broad consultation findings from EIS engagement activities lead by EnergyCo
  - targeted consultation findings from engagement activities undertaken by specialists to inform technical reports that support the EIS, such as the agricultural assessment and Aboriginal cultural heritage assessment
  - secondary sources of information, including relevant census and demographic data from the Australian Bureau of Statistics
  - regional and local strategic plans, as well as SIA reports prepared for other projects in the local area.

References

Abplanalp, J. & Beckman, K. J. 2014. Electric transmission visibility and visual contrast threshold distances in western landscapes.

AusNet Services, 2015. A guide to living with transmission line easements.

Australian Bureau of Statistics (ABS, 2021), Census of Population and Housing 2021.

Australian Bureau of Statistics (ABS, 2016), Census of Population and Housing 2016.

Australian Bureau of Statistics (ABS, 2018), IRSAD. Available at https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/2033.0.55.001~2016~Main%20Features~IRSAD~20

Australian Mining Review (2019), Mining in the Hunter Valley: the black star, Available at https://australianminingreview.com.au/features/mining-in-the-hunter-valley-the-black-star/#:~:text=Today%2C%20the%20Hunter%20Valley%20is,distance%20of%20up%20to%20380km.

Butcher, G. A. (1992, August 25). Ambient Water Quality Objectives for the Lower Columbia River: Hugh Keenleyside Dam to Birchbank. Retrieved December 4, 2013, from Environmental Protection Division: http://www.env.gov.bc.ca/wat/wq/objectives/birchbank/birchbank.html

Columbia Basin Trust. (2012, September). Climate Change, Impacts and Adaptation in the Canadian Columbia Basin: From Dialogue to Action. British Columbia, Canada.

Department of Planning and Environment (DPE, 2021). Draft Central West and Orana Regional Plan 2041. Available at: https://www.planning.nsw.gov.au/-/media/Files/DPE/Plans-and-policies/Plans-for-your-area/Regional-plans/Draft-Central-West-and-Orana-Regional-Plan-2041.pdf

Department of Planning and Environment (DPE, July 2021). Social Impact Assessment Guideline for State Significant Projects. Available at https://shared-drupal-s3fs.s3.ap-southeast-2.amazonaws.com/master-test/fapub_pdf/SIA+Guideline+20210622v6_FINAL.pdf

Dubbo Shire Council (September 2016), Dubbo Regional Council Local Government area economic profile, Available at https://www.dubbo.nsw.gov.au/ArticleDocuments/358/Dubbo%20Region%20Economic%20Profile%20September%202016.pdf

Elliott, P. & Wadley, D. 2002. The impact of transmission lines on property values: Coming to terms with stigma.

Holms, G. B., Pommen, L. W., & Cf, P. (1999, September). State of Water Quality of Columbia River at Birchbank. Retrieved December 4, 2013, from State of Water Quality of Columbia River at Birchbank : http://www.env.gov.bc.ca/wat/wq/quality/birchbank/index.htm

Ministry of Forests. (1996). Community Watershed Guidebook. Retrieved December 4, 2013, from Community Watershed Guidebook: http://www.for.gov.bc.ca/TASB/LEGSREGS/FPC/FPCGUIDE/WATRSHED/Watertoc.htm

Upper Hunter Shire Council (2022), Our Shire, Available at https://upperhunter.nsw.gov.au/our-shire.aspx

Warrumbungle Shire Council (2022), About Warrumbungle Shire, Available at https://www.warrumbungle.nsw.gov.au/our council/community-and-economic-profile/about-the-shire/about-warrumbungle-shire.

Welcome to Country (2019), Hunter Valley, Available at https://upperhunter.nsw.gov.au/our-shire.aspx

YourCouncil NSW (2020), Mid-Western Regional, Available at https://www.yourcouncil.nsw.gov.au/council-data/mid-western-regional-1632188804/

Appendix A

Scoping of potential impacts

Social Impact Assessment (SIA) Worksheet — Project name: Central-West Orana Renewable Energy Zone Transmission — Date: 23/08/2022

PROJECT ACTIVITIES	CATEGORIES OF SOCIAL IMPACTS	POTENTIAL IMPACTS ON PEOPLE		PREVIOUS INVESTIGATION OF IMPACT		CUMULATIVE IMPACTS		ELEMENTS OF IMPACTS - Based on preliminary investigation					ASSESSMENT LEVEL FOR EACH IMPACT				PROJECT REFINEMENT	MITIGATION / ENHANCEMENT MEASURES	MITIGATION / ENHANCEMENT MEASURES
Which **project activity / activities** could produce social impacts ?	what **social impact categories** could be affected by the project activities	What impacts are likely, and what concerns/aspirations have people expressed about the impact? Summarise how each relevant stakeholder group might experience the impact. NB. Where there are multiple stakeholder groups affected differently by an impact, or more than one impact from the activity, please add an additional row.	Is the impact expected to be **positive or negative**	Has this impact previously been investigated (on this or other project/s)?	If "yes - this project," briefly describe the previous investigation. If "yes - other project," identify the other project and investigation	Will this impact combine with others from this project (think about when and where), and/or with impacts from other projects (cumulative)?	If yes, identify which other impacts and/or projects	Will the project activity (without mitigation or enhancement) cause a material social impact in terms of its: You can also consider the various magnitudes of these characteristics					Level of assessment for each social impact	What methods and data sources will be used to investigate this impact?			Has the project been refined in response to preliminary impact evaluation or stakeholder feedback?	What **mitigation / enhancement measures** are being considered? **Responses to submissions**	**Mitigation / enhancement measures** considered in projects within the regional study area (Beryl Solar Farm and Wilpinjong Extension Project)
								extent i.e. number of people potentially affected?	**duration** of expected impacts? **(i.e. construction vs operational phase)**	**intensity** of expected impacts i.e. scale or degree of change?	**sensitivity or vulnerability of people potentially affected?**	**level of concern/interest of people potentially affected?**		Secondary data	Primary Data - Consultation	Primary Data - Research			
Construction activities, access requirements and operational servicing/maintenance Height and size of transmission towers and	Way of life	Amenity impacts may temporarily affect sense of place and alter the way neighbouring landowners and residents use and enjoy space	Negative	Yes - this project	Visual impact assessment - identification of potential visual impacts on sensitive receptors Noise and vibration impact assessment - identification of potential visual impacts on sensitive receptors. Air pollution assessment (if available) -	Yes	Other amenity impacts during construction phase - nose and vibration, traffic, dust etc.	Yes	Yes	Yes	Yes	Yes	Detailed assessment of the impact	Required	Broad consultation	Targeted research	Yes	energic: Once we have further refined the corridor, we will work closely with any potentially affected landowners to come to a mutually acceptable agreement about locations for transmission infrastructure.	•Involvement of the most affected landowners (relevant to medium impact view locations). This may include increased onsite planting density in specific locations suggested by the landowners (for example, where the proposed solar farm would be visible from outdoor recreational areas). •Where possible, landscape plantings will be comprised of local indigenous species with the objective of increasing the diversity of the existing vegetation. Planting
	surroundings	Permanent change of community character due to loss of aesthetic values as a result of visual impacts caused during construction and operation, likely to affect neighbouring landowners and residents within local study area.	Negative	Yes - this project	Visual impact assessment - identification of potential visual impacts on sensitive receptors	Yes	Other amenity impacts during construction phase - nose and vibration, traffic, dust etc.	Yes	Yes	Yes	Yes	Yes	Detailed assessment of the impact	Required	Broad consultation	Targeted research	Yes	To help minimise impacts to landowners and reduce the amount of agricultural land that will be impacted, much of the new corridor is now located on land owned by mining companies, alongside existing transmission lines, or wind and solar development areas. We have also developed the corridor to avoid areas of vegetation where possible	•Involvement of the most affected landowners (relevant to medium impact view locations). This may include increased onsite planting density in specific locations suggested by the landowners (for example, where the proposed solar farm would be visible from outdoor recreational areas). •Where possible, landscape plantings will be comprised of local indigenous species with the objective of increasing the diversity of the existing vegetation. Planting
	health and wellbeing	Detrimental effects on health and wellbeing due to the combined effects of dust, noise and vibration during construction, likely to affect neighbouring landowners and residents, especially those with pre-existing respiratory conditions such as asthma and emphysema.	Negative	Yes - this project	Noise and vibration impact assessment - identification of potential visual impacts on sensitive receptors. Air pollution assessment (if available) - assessment of activities likely to produce dust and sensitive receptors	Yes	Other amenity impacts during construction phase - nose and vibration, traffic, dust etc.	No	No	No	Yes	Unknown	Standard assessment of the impact	Required	Targeted consultation	Potentially targeted research	Yes	Idem as above	•Parking areas, material stock piles and other construction activities would be located as far as practical from nearby residences or screened (by existing vegetation or constructed screens) for the period of construction. •Avoid night works as much as possible, and avoid altogether where in close proximity to residences •Ensure lights (during nightworks and operation) are directed away adjacent residences.
	livelihoods	Easement and associated transmission line may restrict or alter how some landholders manage their property, potentially decreasing productivity on some portions of land or perceived property value impacts, which could have an effect on livelihoods	Negative	Yes - other project	Beryl Solar Farm - addressed impacts on agriculture and properties associated with introducing weeds	Yes	Other livelihood impacts amongst landowners	No	No	No	Unknown	Yes	Standard assessment of the impact	Required	Targeted consultation	Potentially targeted research	Yes	Idem as above	•Involvement of the most affected landowners (relevant to medium impact view locations). This may include increased onsite planting density in specific locations suggested by the landowners (for example, where the proposed solar farm would be visible from outdoor recreational areas). Property valuation based on comparison with properties which offer similar lifestyle values for property owners, such as:
Additional project and workforce vehicles, project deliveries and machinery on local roads and transport of potentially large oversized tower materials (police escort/road closures?)	Way of life	Changes to way of life as a result of delays to mobility during construction due to increase traffic and transport of construction workforce, equipment and construction materials (in particular at EnergyHubs). May be exasperated by cumulative impacts of other local and regional projects.	Negative	Yes - this project	Traffic assessment (if available) - assess current traffic and road conditions, proposed haulage routes to and from site, and workforce transportation strategies	Yes	Compounding impacts on traffic and mobility in the local area (access and health and wellbeing)	Yes	No	No	No	Unknown	Standard assessment of the impact	Required	Targeted consultation	Potentially targeted research	Yes	EnergyCo understand there is concern about the potential impacts to local residents during the construction and operation of the energy hubs. We are still in the early phases of the project and will carry out further investigations to determine the expected impacts and what measures we will take to reduce and manage these impacts. As part of the environmental assessment process for the REZ network infrastructure, we will prepare an Environmental Impact Statement	•Haulage Plan would be developed with input from the roads authority, including but not limited to: •o Assessment of road routes to minimise impacts on transport infrastructure. •o Scheduling of deliveries of major components to minimise safety risks (on other local traffic). •o Traffic controls (signage and speed restrictions etc.). •A Traffic Management Plan would be developed as part of the CEMP and DEMP, in consultation with the Mid Western Regional Council and Roads and Maritime. The plan would include, but not be limited to: •o Assessment of road condition prior to construction on all local roads that would be utilised. program for monitoring road condition, to repair damage exacerbated by the construction and decommissioning traffic. •o The designated routes of construction traffic to the site.
	health and wellbeing	Impacts to sense of safety due to increase traffic movements associated with the transport of equipment and materials during construction, and the potential degradation of local roads	Negative	Yes - this project	Traffic assessment (if available) - assess current traffic and road conditions, proposed haulage routes to and from site, and workforce transportation strategies	Yes	Compounding impacts on traffic and mobility in the local area (access and health and wellbeing)	Yes	No	Yes	No	Unknown	Detailed assessment of the impact	Required	Broad consultation	Targeted research	Yes	EnergyCo are engaging a Network Operator to build and operate the REZ transmission network and will work closely with them to develop and implement mitigation measures to reduce the impacts of the project, including traffic on local roads. We will keep the community informed about any proposed changes or impacts to local traffic conditions as more detailed information becomes available	
Workforce accommodation camps	Access	Increased demand on health/social services due to increase in temporary construction workforce, which may be enhanced by cumulative impacts from other major projects	Negative	Yes - other project	Wilpinjong Extension Project - assessment of impacts on local services (including health and emergency) and related consultation	No	Not required	No	No	Yes	Yes	Unknown	Detailed assessment of the impact	Required	Broad consultation	Targeted research	Yes	The provision of worker accommodation and services is a key consideration for the REZ network infrastructure and generation projects once they reach the construction phase. We are consulting with a range of stakeholders to determine how this will be delivered while meeting the needs of local residents, businesses and Councils. We are engaging a Network Operator to build and maintain the REZ	
	health and wellbeing	Mental health issues in the proposal workforce due to feelings of isolation	Negative	Yes - other project	Energy Connect East	Unknown		No	No	Yes	Yes	Unknown	Detailed assessment of the impact	Required	Broad consultation	Not required	Unknown		
	Surroundings	Diminished sense of safety during construction due to the increased presence of construction workers in service communities, which affects local perceptions of safety and wellbeing	Negative	Yes - other project	Wilpinjong Extension Project - assessment of impacts on local services (including health and emergency) and related consultation	No	Not required	No	No	Yes	Yes	Unknown	Detailed assessment of the impact	Required	Broad consultation	Targeted research	Unknown		
Landowner compensation - properties with proposed transmission tower sites	livelihoods	Improvement on landowners livelihood due to receiving compensation/leasing payments for transmission towers.	Positive	Yes - other project	Wilpinjong Extension Project - assessment of land compensation and property valuation	No	Not required	Unknown	No	Yes	No	Unknown	Detailed assessment of the impact	Required	Broad consultation	Targeted research	yes	EnergyCo will typically need to acquire private land or easements over private land for the purposes of constructing and operating the new REZ infrastructure, including land energy hubs and transmission lines. The property acquisition process is governed by the Land Acquisition (Just Terms Compensation) Act 1991. The Act contains specific	
	health and wellbeing	Detrimental physical and mental health outcomes on landowners subject to acquisition process, physical changes to their properties and way they use and manage their land. This may be exacerbated by cumulative impacts of other nearby projects	Negative	Yes - other project	Wilpinjong Extension Project - assessment of land compensation and property valuation	Yes	Likely to combine with other impacts causing stress and anxiety amongst landholders surrounding/in the project corridor	No	Yes	Unknown	Unknown	Yes	Detailed assessment of the impact	Required	Broad consultation	Targeted research	yes	Idem as above	
Construction of transmission lines, potential realignments and outages of services	Access	Impacts on wellbeing - annoyance amongst residents and impacts to general way of life as a result of potential interruptions to utilities such as water, electricity, gas, telecommunications etc. during the construction phase of the project (if realignment of services required)	Negative	Yes - other project	Potts Hill to Alexandria transmission cable project - TransGrid	Yes	Other impacts to infrastructure and amenity - traffic, dust, visual, noise	No	No	No	No	Unknown	Minor assessment of the impact	Required	Limited - if required (e.g. local council)	Not required	Unknown		
Potential engagement of local contractors, businesses, and local procurement and suppliers during the construction phase of the project	livelihoods	Improved livelihoods of local business owners as result of economic stimulus resulting from the proposal procurement opportunities.	Positive	Yes - other project	Wilpinjong Extension Project - assessment of benefits to local businesses and suggestion to prioritise local suppliers	Yes	May combine with other livelihood impacts to create long term flow on benefits of economic and industry growth in the region	No	No	No	No	Unknown	Minor assessment of the impact	Required	Limited - if required (e.g. local council)	Not required	Yes	To support local employment and businesses, the Network Operator will provide opportunities to engage local workers and suppliers where practical during the construction and operational phases. This is expected to include the use of local training providers to develop a local workforce with new skills. However, with the high number of construction projects anticipated to be carried out with the REZ concurrently in the coming years, it will be necessary to engage	
Potential employment of local workforce	livelihoods	Employment opportunities would improve the livelihoods of those employed, improve mental wellbeing, the way they interact with their communities and their ability to access goods and services	Positive	Yes - this project	Economic impact assessment - assessment of economic inputs and benefits to the region including through local employment	Yes	May combine with other livelihood impacts to create long term flow on benefits of economic and industry growth in the region	No	No	No	Unknown	Unknown	Detailed assessment of the impact	Required	Broad consultation	Targeted research	Yes	Idem as above	
Construction and operation of the Project	health and wellbeing	Stress due to perceived health and safety risk associated with the construction of towers within resident's properties, including concern about potential health impacts of high voltage transmission lines electromagnetic fields (EMFs)	Negative	Yes - other project	Beryl Solar Farm - addressed potential exposure to EMFs amongst residents	Yes	May combine with other amenity impacts and impacts on wellbeing, increased stress and irritation	No	Yes	Unknown	Unknown	Yes	Detailed assessment of the impact	Required	Broad consultation	Targeted research	Yes	We appreciate there is concern in the community about the presence of electric and magnetic fields (EMFs) from power lines. All equipment that has electrical current flowing through it produces EMFs and everyone is exposed to them on a daily basis from household electrical appliances. The presence of EMFs is an essential part of the electricity	Transmission lines would be located as far as practical from residences, farm sheds, and yards to reduce the potential for exposure to Electromagnetic fields EMFs
	health and wellbeing	Stress due to perceived bushfire risk associated with the construction and operation of power lines, particularly given the agricultural and residential land use in the area	Negative	Yes - this project	Bushfire report - determine bushfire vulnerability of the local area and potential sensitive receptors	No	Not required	No	No	Yes	Unknown	Unknown	Detailed assessment of the impact	Required	Broad consultation	Targeted research	Yes	We are considering a number of important factors to determine the locations for new energy hubs and transmission lines: • location of proposed new generators • community and landowner feedback • existing and planned land use • natural hazards (e.g. bushfire or flood prone land).	•Weed management, particularly noxious weeds o Pathogen management / Weed and hygiene protocols will be prepared and implemented •Develop a Bush Fire Management Plan to include but not be limited to: •o Management of activities with a risk of fire ignition. •o Management of fuel loads onsite. •o Storage and maintenance of firefighting equipment, including siting and provision
	Access	Potential disruption to telecommunications in the vicinity of transmission infrastructure, including radio, internet and television	Negative	Yes - this project	Raised by stakeholders during submission	Unknown		No	Yes	Unknown	Unknown	Yes	Detailed assessment of the impact	Required	Not required	Not required	unknown		
	community	The perceived unfair distribution of impact and benefit results in community division affecting residents' social networks, sense of community and wellbeing. These impacts may be exasperated by cumulative impacts of other nearby projects	Negative	Unknown	Unknown	Yes	Other impacts relating to community cohesion, including objection, annoyance, decreased wellbeing and conflict Compounding construction impacts on wellbeing may create heightened annoyance, and contribute to negative feelings about the project and the sentiment of a 'missed	Yes	Yes	No	Unknown	Yes	Detailed assessment of the impact	Required	Broad consultation	Targeted research	Yes	We note there is strong community opposition to transmission infrastructure in some locations, and we are taking this into consideration as we further refine the transmission route. To avoid impacts to residents near the transmission route, we will locate it away from dwellings wherever possible. We will keep local residents informed once further details are known about the proposed locations for transmission lines.	•Implement a Community Consultation Plan, including but not limited to implementing protocols to: •o Keep the community updated about the progress of the proposal and proposal benefits. •o Inform relevant stakeholders of potential impacts (haulage, noise etc.). •o Respond to any complaints received •Liaise with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials •Liaise with local representatives regarding accommodation options for staff, to
	Decision-making systems	Landholders may perceive negative impacts in relation to their property and access to remedy rights, regardless of the standards of procedural fairness being met and just compensation terms being in place. This would include adjoining landowners that are in proximity to new transmission infrastructure	Negative	Yes - this project	Issue raised during submission period	Unknown		No	Yes	Yes	Unknown	Yes	Detailed assessment of the impact	Required	Targeted consultation	Targeted research	Yes	EnergyCo will typically need to acquire private land or easements over private land for the purposes of constructing and operating the new REZ infrastructure, including land energy hubs and transmission lines. The property acquisition process is governed by the Land Acquisition (Just Terms Compensation) Act 1991. The Act contains specific provisions relating to how compensation is to be assessed. This includes an assessment of the market value of the land or property rights being acquired, plus additional forms of compensation depending on individual circumstances.	
Construction activities, potential clearing and civil works	culture	Impacts on Aboriginal cultural values and wellbeing due to changes to the environment and sites of cultural heritage significance that are not acceptable to Aborigine people, affecting sense of place and cultural connection to Country	Negative	Yes - this project	Indigenous and non-Indigenous heritage studies - identify sites, objects and landscapes of cultural/historical/social significance surrounding the project area	Yes	Other impacts relating to disruption of sense of place, cultural landscape and community	Yes	Yes	Yes	Yes	Unknown	Detailed assessment of the impact	Required	Broad consultation	Required	Yes	Heritage impacts are a key consideration in developing the project and will be thoroughly assessed as part of the environmental planning process. We will carry out on-site and desktop assessments to identify local Aboriginal and non-Aboriginal heritage sites. We will also carry out an assessment to determine the potential impacts of the project to cultural heritage during construction and operation, and identify mitigation measures to avoid, minimise and manage these impacts.	
	Surroundings	Perceived or actual loss of biodiversity values resulting in impacts to the community's sense of belonging and aesthetic values, which may be exacerbated by cumulative impacts	Negative	Yes - this project	Issue raised during submission period	Unknown		No	No	Unknown	Unknown	Yes	Standard assessment of the impact	Required	Required	Required	Yes	An assessment of the potential impacts to biodiversity, including local wildlife, will be included as part of the project's Environmental Impact Statement. A biodiversity assessment will be prepared in accordance with the requirements of the Biodiversity Conservation Act 2016. Mitigation measures will also be included as part of the biodiversity assessment, which would be implemented to avoid, minimise and manage any impacts to biodiversity during the construction and	

PROJECT ACTIVITIES	CATEGORIES OF SOCIAL IMPACTS	POTENTIAL IMPACTS ON PEOPLE		PREVIOUS INVESTIGATION OF IMPACT		CUMULATIVE IMPACTS		ELEMENTS OF IMPACTS - Based on preliminary investigation					ASSESSMENT LEVEL FOR EACH IMPACT				PROJECT REFINEMENT	MITIGATION / ENHANCEMENT MEASURES	MITIGATION / ENHANCEMENT MEASURES
Which **project activity / activities** could produce social impacts ?	what **social impact categories** could be affected by the project activities	What impacts are likely, and what concerns/aspirations have people expressed about the impact? Summarise how each relevant stakeholder group might experience the impact. **NB. Where there are multiple stakeholder groups affected differently by an impact, or more than one impact from the activity, please add an additional row.**	Is the impact expected to be **positive or negative**	Has this impact previously been investigated (on this or other project/s)?	If "yes - this project," briefly describe the previous investigation. If "yes - other project," identify the other project and investigation	Will this impact combine with others from this project (think about when and where), and/or with impacts from other projects (cumulative)?	If yes, identify which other impacts and/or projects	Will the project activity (without mitigation or enhancement) cause a material social impact in terms of its: You can also consider the various magnitudes of these characteristics					Level of assessment for each social impact	What methods and data sources will be used to investigate this impact?			Has the project been refined in response to preliminary impact evaluation or stakeholder feedback?	What **mitigation / enhancement measures** are being considered? **Responses to submissions**	**Mitigation / enhancement measures** considered in projects within the regional study area (Beryl Solar Farm and Wilpinpong Extension Project)
								extent i.e. number of people potentially affected?	**duration** of expected impacts? **(i.e. construction vs operational phase)**	**intensity** of expected impacts i.e. scale or degree of change?	**sensitivity** or vulnerability of people potentially affected?	**level of concern/interest** of people potentially affected?		Secondary data	Primary Data - Consultation	Primary Data - Research			
	Culture	Cumulative impacts in cultural identity in the region as a result of the increased presence of the renewable energy industry within the landscape.	Negative	Unknown	Unknown	Yes	Other impacts relating to disruption of sense of place, cultural landscape and community	Yes	Yes	Yes	Yes	Unknown	Detailed assessment of the impact	Required	Broad consultation	Targeted research	unknown		
Cumulative impacts of other nearby projects including REZ projects	livelihoods	Impacts on local livelihoods due to increased demand in local workforce market resulting in increase cost of labour to small businesses (agriculture) causing shortages for other industries.	Negative	Unknown	Likely will be investigated for other active projects in the region	Yes	May combine with overall heightened demand for other local services from the SNI and other projects in the region	Yes	No	Yes	Yes	Unknown	Detailed assessment of the impact	Required	Broad consultation	Targeted research	unknown		
	livelihoods	Cumulative impacts to livelihoods due to cumulative impacts on loss of agricultural land and reduced productivity. Combined land acquisition may impact local livelihoods and overall local agricultural industry (jobs etc)	Negative	Unknown	Likely will be investigated for other active projects in the region	Yes	May combine with other impacts on livelihood and changed land use due to the SNI and other projects in the region	Yes	Yes	Yes	Unknown	Unknown	Detailed assessment of the impact	Required	Broad consultation	Targeted research	Yes	EnergyCo has developed the revised study corridor for the REZ transmission network infrastructure with the aim of minimising impacts to the community wherever possible. This includes locating the transmission route along mining areas, next to existing transmission easement corridors and within renewable generation projects where practical. In doing so, we are looking to minimise the amount of agricultural land that needs to be impacted or acquired to build the new	
	health and wellbeing	Stress due to perceived uncertainty in the local property market associated with cumulative impacts of nearby projects and land acquisition	Negative	Unknown	Likely will be investigated for other active projects in the region	Yes	Likely to combine with other impacts causing stress and anxiety due to the SNI and other projects in the region	Yes	No	No	Unknown	Yes	Detailed assessment of the impact	Required	Broad consultation	Targeted research	yes	**EnergyCo will locate transmission lines away from dwellings wherever possible to minimise impacts to neighbouring properties. We will also work with affected landowners when determining the locations for transmission infrastructure to help minimise any impacts to the remaining land use. Impacts to property values will be considered as part of the social impact assessment in the Environmental Impact Statement for the REZ transmission network infrastructure.**	
	Livelihoods	Improvement in local employment opportunities due to the encouragement of investment into renewable projects and associated industries	Positive	Unknown	Likely will be investigated for other active projects in the region	Yes	Likely to combine with projects in the REZ and other projects in the regional area creating opportunities for renewable energy	Yes	Yes	No	Unknown	Yes	Detailed assessment of the impact	Required	Broad consultation	Targeted research	yes	The electricity generated from the Central-West Orana REZ will be connected to the Transgrid shared network which has 14,000 kilometres of transmission lines traversing much of NSW and supplies electricity to each of the three NSW distribution network providers. This means the electricity generated from the Central-West Orana REZ will benefit all energy consumers in NSW, not just those in cities or along the east coast. In addition to securing cheap and reliable energy for NSW, the REZ will: • Bring in more than $5 billion of new investment to the region • Deliver more than 3,900 jobs in construction • Provide dedicated funding for community benefit purposes which will be funded by the REZ and the renewable generation projects • Provide opportunities for local employment and suppliers. EnergyCo is committed to ensuring the REZ delivers positive outcomes for local communities in the Central-West Orana Region.	
	Livelihoods	Perceived unequitable distribution of benefits, as the project is supplying energy consumers on the east coast of NSW, therefore not benefiting the communities where the infrastructure is located	Negative	Yes - this project	Raised during submissions	Yes	Likely to combine with projects in the REZ and other projects in the regional area creating opportunities for renewable energy	Yes	Yes	No	No	Yes	Detailed assessment of the impact	Required	Broad consultation	Targeted research	yes		
Decision-making systems		Impacts on procedural fairness and people's capacity to influence changes that may affect their lives	Negative	Yes - this project	Raised during submissions	Yes	Likely to combine with projects in the REZ	Yes	Yes	No	Yes	Yes	Detailed assessment of the impact	Required	Broad consultation	Targeted research	yes	Community reference group has been established and a stakeholder engagement plan for the EIS has been developed	
INSERT NEW ROWS ABOVE THIS ROW																			

Appendix B

Existing social environment

B1 Social localities

B1.1 Dunedoo

The Dunedoo community has a population of 1,097, and is located approximately 18km to the north to the two of the proposed energy hubs (Merotherie, and Elong Elong). Dunedoo's primary industries are agriculture, with significant mixed farming and cattle and sheep industries.

Dunedoo is located at the junction of the Golden and Castlereagh Highways and is often a travel stopover location with a variety of accommodation offerings, local pubs, and the Dunedoo Museum. The Dunedoo Show and bush poetry festival attract visitors from across the region each year (Visit NSW, 2020).

B1.2 Dubbo

The Dubbo community, with a population of 43,516, host one of the largest variety and choice of services, including a public and private hospital, mental health and psychology services, Aboriginal and Torres Strait Islander health services, dental and oral health services, a community health centre, and physiotherapy and rehabilitation services.

It is anticipated that the project may rely on Dubbo for local goods and services, as well as workforce and temporary accommodation needs.

Dubbo's railway station connects to Sydney in 6.5 hours, with services running daily. The Dubbo airport also undertakes around 66 flights to Sydney every week (AHO, 2022). Annual festivals and events in Dubbo include the Red Ochre Festival, which celebrates local and regional Aboriginal culture, art, and music (AHO, 2022), and the annual Dubbo show.

B1.3 Gulgong

Gulgong is a former gold mining town, with a small resident population of 2,680. The community is relatively close to the project study area, as well as the existing high voltage lines that run through the area.

Today Gulgong's primary industry is coal mining, however the area also attracts notable tourist attention due to its rich settler history and reputation as the childhood home of the well-known Australian poet and writer Henry Lawson. The town holds a number of annual historical festivals and celebrations, including the Henry Lawson Heritage Festival in June, the Gulgong Folk festival in December, and the Gulgong Gold and mining Festival in October.

B2 Existing environment data

Table B.1 Regional social locality – demographic overview

	Regional social locality (LGAs)									State
	Dubbo	Narromine	Mid-Western	Upper Hunter	Warrumbungle	Gilgandra	Liverpool Plains	Muswellbrook	Cabonne	NSW
Population	54922	6,360	25,713	14229	9225	4295	7551	16,357	13766	2829637
Families	13,749	1551	6800	3821	2252	1102	1936	4222	3721	755789
Private dwellings	22,693	2,835	12,207	6752	4711	2113	3686	7,298	5881	1,281,496
Indigenous population	16.6%	20.4%	6.8%	7.0%	10.7%	14.5%	14.8%	11.7%	5.0%	3.4%
Median age	36	41	42	42	50	46	47	37	44	39
Average people per household	2.5	2.5	2.4	2.4	2.3	2.3	2.3	2.5	2.6	2.4
Median weekly household income	$1,597	$1,308	$1,486	$1,429	$1,068	$1,149	$1,165	$1,628	$1,538	$1,434

Table B.2 SEIFA IRSAD scores by LGA

	Regional social locality (LGAs)								
	Dubbo	Narromine	Mid-Western	Upper Hunter	Warrumbungle	Gilgandra	Liverpool Plains	Muswellbrook	Cabonne
IRSAD Score	953	927	942	958	912	906	906	917	997
IRSAD quintile	3	2	2	3	1	1	1	2	4

*Note: *Socio-Economic Indexes for Areas (SEIFA) Index of Relative Socio-economic Advantage and Disadvantage (IRSAD)*

About Us

WSP is one of the world's leading professional services consulting firms. We are dedicated to our local communities and propelled by international brainpower. We are technical experts and strategic advisors including engineers, technicians, scientists, planners, surveyors and environmental specialists, as well as other design, program and construction management professionals. We design lasting solutions in the Transport & Water, Property & Buildings, Earth & Environment, and Mining & Power sector as well as offering strategic Advisory, Engagement & Digital services. With approximately 6,100 talented people in more than 50 offices in Australia and New Zealand, we engineer future ready projects that will help societies grow for lifetimes to come. www.wsp.com/en-au/.

EnergyCo

GPO Box 5469,
Sydney, NSW 2001.

E: contact@energyco.nsw.gov.au

W: www.energyco.nsw.gov.au

NSW GOVERNMENT