

APPENDICES

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**OVEN MOUNTAIN PUMPED HYDRO  
ENERGY STORAGE EIS**

Landscape and visual impact assessment



**OVEN MOUNTAIN  
PUMPED HYDRO STORAGE**



# **Oven Mountain Pumped Hydro Energy Storage Project**

## **Landscape and visual impact assessment**

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Prepared for OMPS Pty Ltd

March 2023

# Oven Mountain Pumped Hydro Energy Storage Project

## Landscape and visual impact assessment

OMPS Pty Ltd

J210465 OMPS EIS - LVIA

March 2023

Version	Date	Prepared by	Approved by	Comments
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10 December 2023

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# Executive Summary

## ES1 Introduction

OMPS Pty Ltd (OMPS) is proposing to develop the Oven Mountain Pumped Hydro Energy Storage Project (the Project), an off-river pumped hydro energy storage system (referred to as the ‘pumped hydro system’) located approximately half-way between Kempsey and Armidale adjacent to the Macleay River in northern New South Wales (NSW). The Project is located within the New England Renewable Energy Zone (REZ) and the Armidale Regional Local Government Area (LGA), proximate to its border with Kempsey Shire LGA.

The Project will primarily consist of upper and lower water reservoirs, a pipeline connecting them, and a hydro-electric power station connected to the national energy market that is capable of generating or consuming electricity.

The Project has been declared by the NSW Government to be critical State significant infrastructure (CSSI) under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). Infrastructure projects are declared to be CSSI if, in the opinion of the NSW Minister for Planning, they are essential to the State for economic, environmental, or social reasons.

This landscape and visual impact assessment (LVIA) has been prepared to accompany an environmental impact statement (EIS) for the Project. It has been prepared in accordance with the relevant Secretary’s environmental assessment requirements (SEARs), guidelines and policies, and in consultation with the relevant government agencies.

## ES2 Existing conditions

The Project area is situated on the western slope of the Carrai Plateau within the New England Tablelands. The site has steep topography ranging from 140 metres (m) along the Macleay River to 1,147 m above sea level at the highest point of Oven Mountain. The vegetation throughout the area varies from cleared grazing land to heavy bushland.

The Macleay River runs adjacent to the southern part of the Project area on its west side before turning eastward at Georges Junction and flowing towards Lower Creek and Bellbrook. The Macleay River will be used to provide water for the reservoirs during the initial filling as well as during the periodic top ups.

## ES3 Assessment of impacts

The assessment method used in this report is adapted from the GLVIA, VA Bulletin, and Solar Guidelines, which involve information review, consultation, field observations and photography, computer-based data processing and analysis, and application of subjective professional judgement. The assessment involves five key stages:

- visual baseline study to assess the landscape character
- visual catchment definition to determine the visibility of the proposed Project
- viewpoint selection to assess the visual impacts
- visual impact assessment
- mitigation measures to minimise the Project’s impact.

## ES4 Evaluation of the Project

### ES4.1 Landscape impact summary

This study has identified four landscape character zones (LCZs), based on the dominant landform and landscape features. These are:

- Macleay River valley – characterised by the Macleay River along the valley floor with dense vegetation along the banks:
  - views are constrained along the valley due to limited access and to the vegetation and height of the valley walls
  - this LCZ has a **Low** landscape character impact.
- Valleys – characterised by gentle slopes and wider valley floors:
  - the valley floors are cleared for agriculture with wooded slopes and views tend to be fairly open
  - this LCZ has a **Low** landscape character impact.
- Upper slopes – characterised by steep slopes above the Macleay River valley and valley LCZs:
  - these slopes are wooded with difficult access. Views are limited due to dense tree canopies
  - this LCZ has a **Moderate** landscape character impact.
- Plateau – characterised by flattening topography above the upper slopes:
  - dense vegetation and undulating topography limits views
  - this LCZ has a **Negligible** landscape character impact.

### ES4.2 Visual impact summary

A visual impact assessment is not meant to determine whether a Project is visible or not. The objective is to determine how the Project will impact on the existing landscape character and visual amenity. Any potential negative impact must be investigated to determine how it can be mitigated and reduced to an acceptable level.

The Project design, development footprint and placement of the infrastructure has evolved to minimise or avoid visual impacts where possible. The reservoirs and operations buildings are expected to be visible only from a limited stretch of the National Trail and Macleay River.

Nonetheless, the development of the Project will result in some changes to the landscape. Visual impacts will occur during the construction and operational stages of the Project, and the visual landscape will be altered from its current state for the duration of the operation of the Project.

Visual assessments have been conducted from a number of representative viewpoints surrounding the development footprint. The representative viewpoints were selected based on the following criteria:

- proximity to the development footprint
- the location of receptors (i.e. dwellings) and other local features
- the positioning of regional and local roads and potential impacts on passing motorists

- local topography
- presence of vegetation with potential to provide screening.

The representative viewpoints have been assessed to demonstrate the potential visual impacts of the Project. The visual assessment determined that, of the viewpoints assessed, infrastructure may be visible to varying degrees from nine of the ten viewpoints. Based on variable elevation and undulation in the landscape and the presence of vegetation, combined with the size of the power generation infrastructure and height of the transmission towers, the impact assessment predicts:

- a low visual impact from Viewpoints 4, 5, 6, 7, 8, 9 and 10
- a moderate visual impact from Viewpoints 2 and 3
- there were no viewpoint locations with a high impact rating
- Viewpoint 1 had a nil rating as no visual impacts are predicted.

East Kunderang Homestead (Viewpoint 1) had no predicted visual impacts. Marys View (Viewpoint 2) had a moderate predicted visual impact. Both of these sites are located within the Oxley Wild Rivers National Park, which is also a UNESCO World Heritage area.

In addition to the viewpoint assessments, each resident within 8 km of the development footprint is listed with the potential visual impacts (Table 5.3). The assessment for residences predicts:

- no impact to low visual impact from R2–R52
- one residence (R1 – lodging/accommodation) with moderate visual impact
- no residences with a high impact rating.

### ES4.3 Night lighting

Night lighting is required during construction of key infrastructure elements including the reservoir, access roads and transmission infrastructure. Receptors closest to construction activity, such as residences near the access roads or transmission line infrastructure may experience temporary night lighting impacts for the duration of construction near that residence. Any impacts from the construction lighting would be considered minimal and temporary, only occurring while those elements are under construction.

The surrounding topography and use of lighting fixtures would shield the majority of direct lighting impacts at more distant receptors however there may be 'light glow' in the night sky as a result of the varying lighting directions and downward reflection. At the majority of viewpoints surrounding the Project, little or no glow is expected.

The only lighting proposed through the operational phase are for security and maintenance purposes. This will primarily occur at the buildings.

The night lighting would be inwardly focused and shielded so it does not result in light spill impacts to neighbouring properties or the night sky.

#### ES4.4 Cumulative impacts

Cumulative visual impacts can arise from the presence of similar projects and can have a significant visual impact on the landscape when viewed together. The Project is isolated within the Macleay River valley. There are multiple mountain ranges between it and any other energy project. The closest energy project is approximately 30.5 km north of the Project area, and well over an hour's drive away through mountainous terrain.

Because of this isolated location, the distance and the time needed to travel to the Project area, there are no anticipated cumulative landscape and visual impacts.

## Definitions and abbreviations

Item	Definition
ABS	Australian Bureau of Statistics
AC	Alternating current
Access route	The route that will be used to access the Project.
ACHA	Aboriginal cultural heritage assessment
AHIMS	Aboriginal Heritage Information Management System
Associated residence	A residence that is associated with the Project – i.e. they have a landholder agreement with OMPS
DPE	Department of Planning and Environment
DPI	Department of Primary Industries
EEC	Endangered ecological community
EIS	Environmental Impact Statement
EMM	EMM Consulting Pty Limited
EnergyCo	Energy Corporation of NSW
EP&A Act	<i>NSW Environmental Planning and Assessment Act 1979</i>
EPBC Act	<i>Commonwealth Environment Protection and Biodiversity Conservation Act 1999</i>
GLVIA	<i>Guidelines for Landscape and Visual Impact Assessment Third Edition (2013)</i>
Ha	hectares
Km	kilometres
kV	kilovolt
Landscape character	The combined quality of built, natural and cultural aspects which make up an area and provide its unique sense of place.
Landscape character zone	An area of landscape with similar properties or strongly defined spatial qualities distinct from areas immediately nearby.
LEP	Local Environmental Plan
LGA	Local government area
LVIA	Landscape and visual impact assessment
MNES	Matters of national environmental significance
MW	Megawatts
Non-associated residence	A residence that is not associated with the Project.
NSW	New South Wales
PCT	Plant community type

Item	Definition
Study area	The boundary of the Project in terms of lot boundaries, which encompasses all operational components of the Project.
SEARs	Secretary’s Environmental Assessment Requirements
SSD	State significant development
Study area	The initial investigation area identified for preliminary environmental assessment, field survey and constraints analysis.
TEC	Threatened ecological communities.
The Project	Oven Mountain Pumped Hydro Energy Storage Project.
Viewpoint	Viewpoints are representative public and private viewpoints of the study area, which are selected for assessment of the Project’s level of exposure to them. They provide a representative sample of the likely visual landscape changes on the different users of the surrounding areas and their visual exposure to various Project elements. Viewpoints can be representative of views from residential dwellings, public roadways or other local features (e.g. villages, other public recreation areas or scenic vistas of value to the community).
Zone of visual influence (ZVI)	Theoretical assessment of the visibility of the Project elements from the surrounding landscape. It is created using GIS data (digital elevation model and digital surface model) to simulate the Project’s visibility and provides a map indicating the extent of where the Project can be seen.

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# 1 Introduction

## 1.1 The Project

OMPS Pty Ltd (OMPS) is proposing to develop the Oven Mountain Pumped Hydro Energy Storage Project (the Project), an off-river pumped hydro energy storage system (referred to as the ‘pumped hydro system’) located approximately half-way between Kempsey and Armidale, adjacent to the Macleay River in northern NSW. The Project is located within the New England Renewable Energy Zone (REZ) and the Armidale Regional Local Government Area (LGA), proximate to its border with Kempsey Shire LGA.

Figure 1.1 and Figure 1.2 provide the regional and local context of the Project respectively.

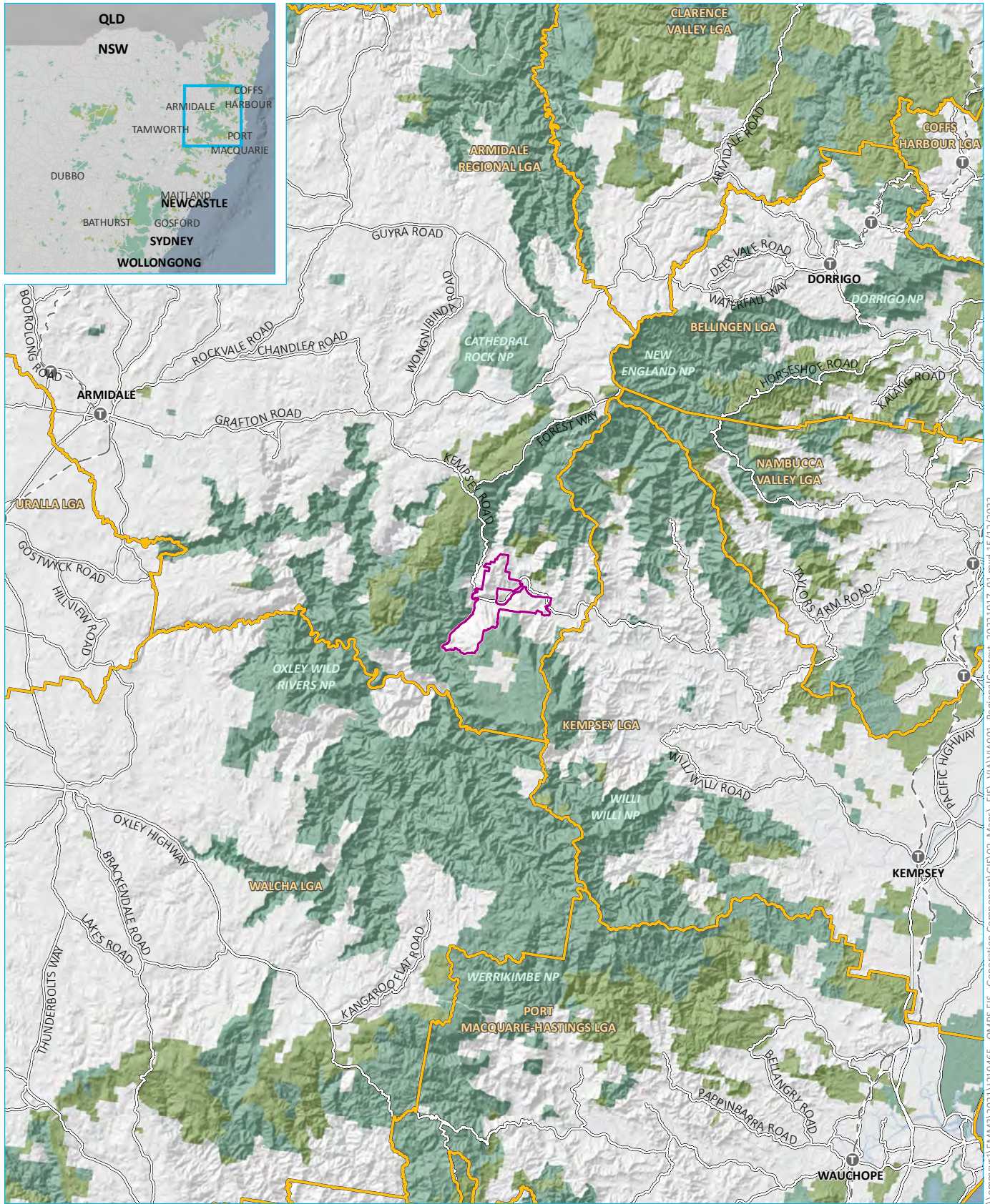
At a basic level, the Project will consist of upper and lower water reservoirs and an underground waterway connecting them via a hydro-electric power station.

The Project has been declared by the New South Wales (NSW) Government to be critical State significant infrastructure (CSSI) under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). Infrastructure projects are declared to be CSSI if, in the opinion of the NSW Minister for Planning, they are essential to the State for economic, environmental, or social reasons. By providing up to 900 MW of electricity generating capacity, the Project will aid in the transition of the NEM towards cleaner, more reliable and affordable electricity. It will also provide up to between eight and 12 hours of dispatchable energy at full generation to be stored and made available to the National Electricity Market (NEM) through the New England REZ. The expected operational lifespan of the Project is in excess of 100 years.

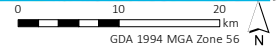
The Project will utilise the highly favourable natural terrain of the site on which it sits to allow electrical energy from the main grid to be stored by pumping water from the lower reservoir to the upper reservoir. Energy can then be generated when needed by allowing water to flow back down to the lower dam and reservoir via the hydro-electric power station, effectively enabling the Project to act as a large battery.

## 1.2 Proponent

OMPS (ABN 22 160 259 174) is developing the Project and is located in Kempsey at 2/28 Clyde Street, Kempsey NSW 2440.



Source: EMM (2022); ABS (2021); DFSI (2020, 2021); GA (2011)



**KEY**

- Project area
- Train station
- Rail line
- Major road
- Named waterbody
- Local government area
- NPWS reserve
- State forest

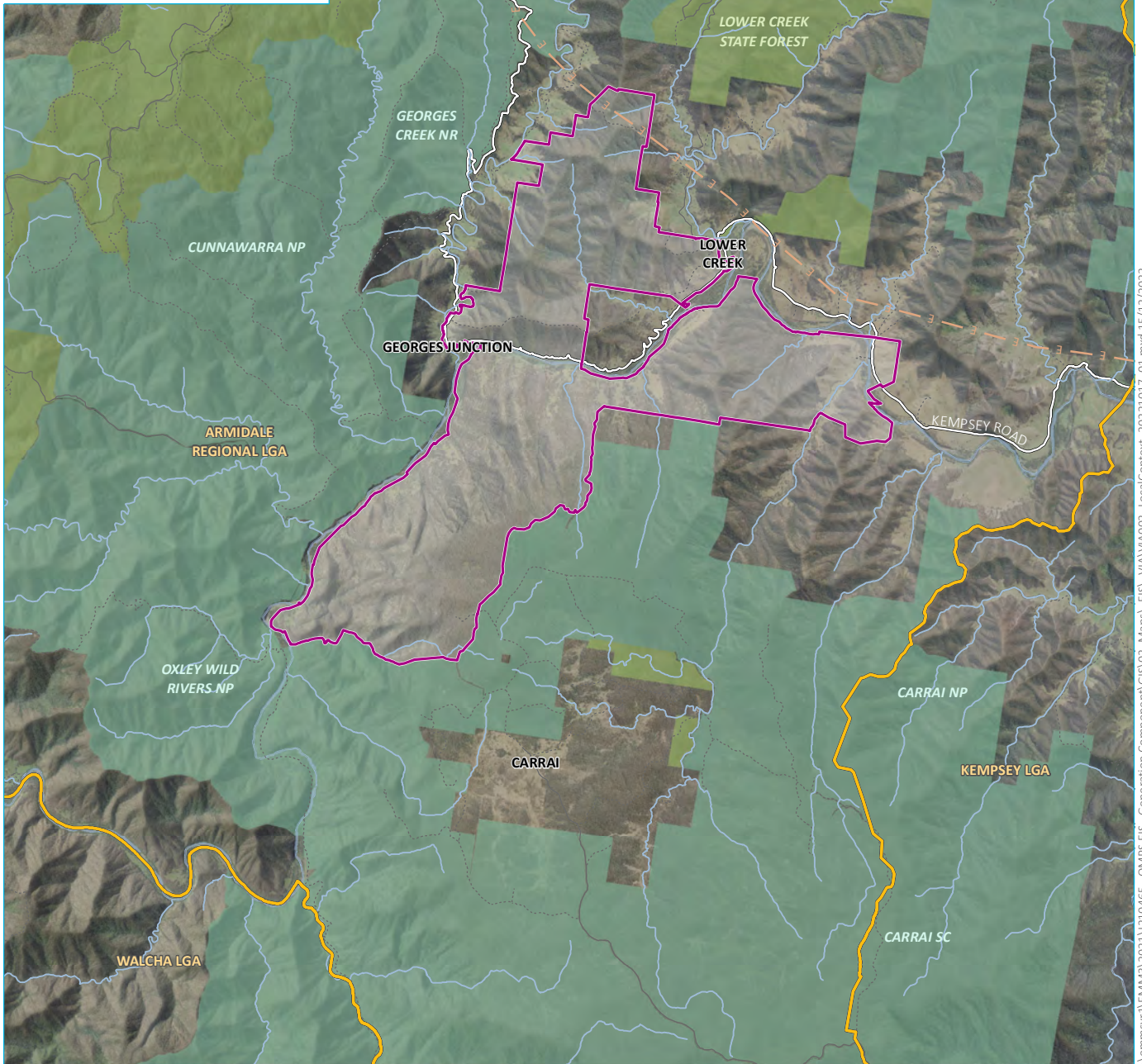
- INSET KEY**
- Major road
  - NPWS reserve
  - State forest

**Regional context**

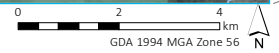
Oven Mountain Pumped Hydro Energy Storage Project  
Landscape and Visual Impact Assessment  
OMPS Pty Ltd  
Figure 1.1



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Source: EMM (2022); ABS (2021); DFSI (2020, 2021); GA (2011, 2020)



**KEY**

- |                            |                       |                  |
|----------------------------|-----------------------|------------------|
| Project area               | Local government area | <b>INSET KEY</b> |
| Existing transmission line | NPWS reserve          | Major road       |
| Major road                 | State forest          | NPWS reserve     |
| Minor road                 |                       | State forest     |
| Vehicular track            |                       |                  |
| Named watercourse          |                       |                  |
| Named waterbody            |                       |                  |

**Local context**

Oven Mountain Pumped Hydro Energy Storage Project  
Landscape and Visual Impact Assessment  
OMPS Pty Ltd  
Figure 1.2



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### 1.3 Purpose and scope of this report

This Landscape and Visual Impact Assessment (LVIA) is an appendix to the Project's Environmental Impact Statement (EIS) and should be read in conjunction with it. It is meant to provide a comprehensive assessment of the Project's potential impacts on the character of the landscape and the impacts on the local visual amenity.

The LVIA documents the assessment of the impacts on the landscape and visual amenity. It then makes recommendations to assist in mitigating the potential impacts resulting from the Project.

### 1.4 Report Structure

The LVIA consists of the following sections:

- Chapter 2 provides an overview of the Project and identifies the key components of the Project
- Chapter 3 describes the LVIA methodology adopted in the preparation of this report
- Chapter 4 describes the existing landscape within which the Project will be sited
- Chapter 5 describes potential visual impacts of the Project from representative viewpoints in and around it
- Chapter 6 describes the mitigation measures proposed
- Chapter 7 provides conclusions.

### 1.5 Assessment approach and requirements

This LVIA has been prepared in accordance with the relevant Secretary's environmental assessment requirements (SEARs), guidelines and policies, and in consultation with the relevant government agencies.

The LVIA was prepared with reference to the methods outlined in:

- *Guidelines for Landscape and Visual Impact Assessment Third Edition (2013)* (the GLVIA), prepared by the Landscape Institute and Institute of Environmental Management and Assessment
- *Wind Energy: Visual Assessment Bulletin AB 01 For State significant wind energy development (2016)* (VA Bulletin) prepared by the NSW Department of Planning, Industry and Environment
- *Guideline for landscape character and visual impact assessment (2020)* Centre for Urban Design, Transport for NSW
- *Large-Scale Solar Energy Guideline (2022)* (Solar Guideline), prepared by the NSW Department of Planning and Environment (DPE).

It is noted that the VA Bulletin specifically relates to assessment of visual impacts of wind farms in NSW; however, a number of the methods for describing visual sensitivity and landscape character are considered to be relevant to this assessment. In the absence of other directly applicable guidelines/standards, the relevant elements from the VA Bulletin have been adopted for this assessment.

The Solar Guideline was released by DPE in August 2022 and provides the community, industry, applicants and regulators with guidance on the planning framework for the assessment and approval of large-scale solar energy development proposals under the EP&A Act, which are classified as State significant development (SSD). The Solar Guideline outlines a visual assessment framework for large scale solar energy development. The acceptability of visual impacts, namely impacts on landscape character and values and the amenity of landholders and communities, along with the adequacy of the measures that are proposed to avoid, reduce or otherwise manage these impacts, are identified as key assessment issues within the guideline and have been considered within this LVIA.

As previously stated, this LVIA was prepared in accordance with the SEARs for the Project, issued on 6 June 2022. The SEARs identify matters that must be addressed in the EIS.

A copy of the revised SEARs is attached to the EIS as Appendix A, while Table 1.1 lists the individual requirements relevant to this LVIA and where they are addressed in this report.

**Table 1.1**      **Relevant SEARs**

Requirement	Section addressed
<b>Amenity</b> – visual impacts of the Project, including lighting impacts and potential impacts on views of the Project from key vantage points; including amenity impacts on National Parks and Reserves, Conservation Areas, World Heritage Areas and areas of declared wilderness under <i>the NSW Wilderness Act 1987</i> .	Chapter 4.8

To inform preparation of the SEARs, DPE invited other government agencies to recommend matters to be addressed in the EIS. These matters were considered by the Secretary for DPE when preparing the SEARs. There were no comments regarding visual amenity from the agencies that have not been included in the SEARs.

## 2 Project description

### 2.1 Project overview

The Project involves building two 'off river' water containment structures to create an upper and a lower reservoir (referred to as 'the upper dam and reservoir' and 'the lower dam and reservoir'), on an ephemeral tributary of the Macleay River. An underground hydro-electric power station complex will be connected to the reservoirs by infrastructure including a power waterway and tunnels. During operation, the water will enable the generation of electricity as it passes through the underground power station while moving from the upper to the lower reservoir, from where it is pumped back up via the same waterway in a 'closed-loop circuit'. The pumped hydro system will be connected to the existing transmission network via new overhead high voltage transmission lines.

A detailed description of the Project and its strategic context is provided in the Project's EIS which should be read in conjunction with this report.

An overview of the key components and elements are provided below.

### 2.2 Key Project design elements

Broadly, the Project has been categorised into three key components, which are further broken down into the Project's key elements in Table 2.1 and shown in Figure 2.1.

- pumped hydro-electric and generation works (PHGW) – including:
  - new upper and lower water storage dams and reservoirs
  - a new underground pumped hydro-electric power station and transformer hall
  - water tunnels, access tunnels, portals and adits
  - tailrace
  - intake and outlet structures
  - associated ages, shafts and screens
- transmission connection works – including:
  - new electricity transmission lines to connect the PHGW to the existing electricity transmission network (Line 965)
  - new electricity transmission infrastructure
  - a new substation
- ancillary development – including but not limited to:
  - access roads, tracks and bridge
  - on-site quarries and related infrastructure
  - utilities and communications infrastructure
  - construction pads containing assets such as workshops, concrete batching plants (CBPs), and offices

- laydown and storage areas
- construction accommodation
- pumping infrastructure
- operational facilities such as offices, and camps for staff
- construction and operational power supply.

**Table 2.1 Key Project elements**

Project element	Description
<b>PHGW</b>	
Underground power station complex	<p>An underground pumped hydro-electric power station located below the upstream end of the pumped hydro system to optimise the hydraulic arrangement of the Project. The power station complex consists of:</p> <ul style="list-style-type: none"> <li>• two main caverns comprising; <ul style="list-style-type: none"> <li>– the machine hall</li> <li>– the transformer hall</li> </ul> </li> <li>• interconnecting tunnels, the transformer hall tunnel and isolated phase busbar (IPB) tunnels.</li> </ul>
Dams and reservoirs	<p>Two concrete faced rockfill dams (CFRD) and reservoirs, referred to as the upper dam and reservoir and lower dam and reservoir, with the following specifications:</p> <p>Upper dam and reservoir:</p> <ul style="list-style-type: none"> <li>• CFRD approximately 70 metres (m) high and 780 m long</li> <li>• reservoir covering a total area of approximately 20 hectares (ha) and an inundation extent of approximately 16.7 ha</li> <li>• reservoir height of 881 m Australian Height Datum (AHD) at full supply level (FSL) and 830 m AHD at minimum operating level (MOL)</li> <li>• total reservoir storage capacity of around 5.1 gigalitres (GL) at FSL.</li> </ul> <p>Lower dam and reservoir:</p> <ul style="list-style-type: none"> <li>• CFRD approximately 70 m high and 280 m long</li> <li>• reservoir covering a total area of approximately 24.7 ha and an inundation extent of approximately 21.6 ha</li> <li>• reservoir height of 250 m AHD at FSL, 215 m at MOL and 205 m AHD at lowest operating level (LOL)</li> <li>• total reservoir storage capacity of around 6.5 GL at FSL.</li> </ul>
Water intake structures	<p>Two intake structures, one at each reservoir, including:</p> <ul style="list-style-type: none"> <li>• a morning glory, vertical-type intake structure situated at the upper dam and reservoir</li> <li>• a lateral intake structure, with head gates and stoplog slots, and an intake channel, at the lower dam and reservoir.</li> </ul>
Spillway	<p>Two concrete lined spillway chutes, one for each of the upper and lower dams and reservoirs. Both spillway crests will comprise of ungated ogee-shaped overflow weirs on the upstream ends of the spillway chutes.</p>
Macleay River pump facility	<p>A pump facility on the Macleay River, which will include duty and standby pumps for the first fill and for ongoing reservoir refills.</p>

**Table 2.1 Key Project elements**

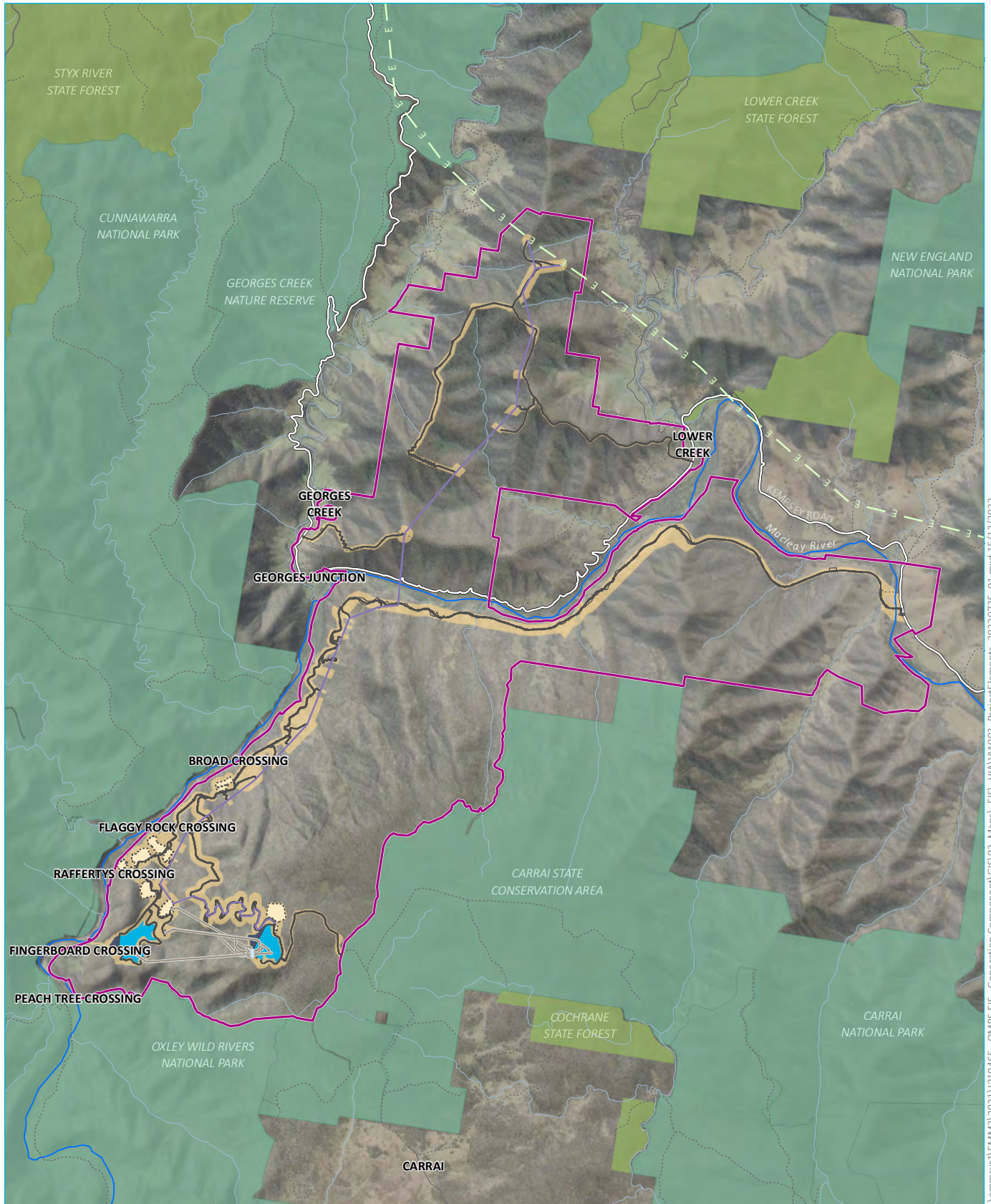
Project element	Description
Tunnels	<p>Three main tunnels comprising of:</p> <ul style="list-style-type: none"> <li>• two main access tunnels (MAT1 and MAT2)</li> <li>• the emergency, cable, ventilation tunnel (ECVT).</li> </ul> <p>The MAT1 and MAT2 will provide loop access to the power station complex from the MAT portal.</p> <p>The ECVT will provide services access and egress between the switchyard portal and the transformer hall. The ECVT portal will contain the station switchyard, control rooms, ventilation and firefighting equipment, with blast walls separating important equipment.</p>
Power waterway	<p>The power waterway will consist of:</p> <ul style="list-style-type: none"> <li>• a 660 m deep, 5.1 m diameter vertical pressure shaft</li> <li>• 250 m concrete and steel lined high-pressure headrace tunnel</li> <li>• three or more 80 m long penstock tunnels</li> <li>• three or more 120 m long draft tube tunnels</li> <li>• an approximately 1,825 m long concrete lined tailrace tunnel.</li> </ul>
<b>Transmission connection works</b>	
Connection works	<p>The connection works will consist of:</p> <ul style="list-style-type: none"> <li>• an approximately 15km long transmission alignment comprising, at a maximum, double circuit single tower 330 kV overhead infrastructure and single circuit single tower 132 kV overhead infrastructure connecting to TransGrid Line 965</li> <li>• up to 25 transmission tower sites (approximately 50 m x 50 m) containing the 132 kV and 330 kV infrastructure</li> <li>• a transmission easement width of a maximum of approximately 105 m.</li> </ul> <p>Note: The upgrade of existing Line 965 will be the subject of a separate application.</p>
Sub-station	Construction of a substation and associated connection infrastructure of up to 330 kV rating.
Switchyard	<p>A high voltage connection linking the connection transmission lines to the cables exiting the underground power station complex. The outdoor air insulated switchyard will likely include:</p> <ul style="list-style-type: none"> <li>• switchgear and control room</li> <li>• cable potheads</li> <li>• disconnectors/earth switches</li> <li>• capacitive voltage transformer (VT)</li> <li>• lightning protection</li> <li>• security fencing, lighting and surveillance</li> <li>• surge arrester.</li> </ul>
<b>Ancillary development (construction and operation)</b>	
Access roads, access tracks and bridge	<p>A variety of road works to improve existing access, and construction of new permanent roads to enable construction access, temporary establishment and use of construction sites, and general access to the Project area including transmission line infrastructure.</p> <p>The proposed main access will be via the construction of a new unsealed two-lane access road located to the east of the site. The main access road will interface with the existing Kempsey-Armidale Road and will require the construction of one new single or two lane low-level bridge crossing over the Macleay River. A temporary bridge may be utilised prior to the construction of the permanent bridge.</p>

**Table 2.1 Key Project elements**

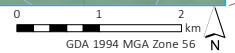
Project element	Description
	<p>There will be approximately 40 km of permanent roads connecting the dams, surface works, portals, transmission assets and spoil sites. Some of these roads are existing roads, however approximately 25 km will be newly constructed roads. The key road components include:</p> <ul style="list-style-type: none"> <li>• Main Access Road (approximately 4.7 km)</li> <li>• Eastern Access Road (up to approximately 11.4 km)</li> <li>• Lower Dam Access Road (approximately 3.6 km)</li> <li>• Upper Dam Access Road (approximately 7.1 km)</li> <li>• access to portals and underground works</li> <li>• Upper Dam Emergency Egress Road (approximately 2.2 km).</li> </ul> <p>Access to the transmission infrastructure north of the Macleay River will be via two roads accessed from the Kempsey-Armidale Road. These two roads include the:</p> <ul style="list-style-type: none"> <li>• Northern Transmission Access Road (approximately 15 km)</li> <li>• Southern Transmission Access Road (approximately 2.3 km).</li> </ul> <p>To support access along the transmission line easement south of the Macleay River and to each of the tower sites, a network of interconnecting access and maintenance tracks will be constructed, to a large extent utilising existing access tracks.</p>
Surface works pads and facilities	<p>There are four main construction pads in addition to surface portals which will be used temporarily during construction for different services (workers camp, construction site offices, workshop area, and laydown storage).</p> <p>Construction works will require the establishment of the following ancillary support infrastructure and areas:</p> <ul style="list-style-type: none"> <li>• main accommodation camp(s), which will temporarily accommodate the majority of workers as required throughout the construction period</li> <li>• temporary or fly camps, which will temporarily accommodate the majority of workers as required throughout the construction period</li> <li>• two works areas including Works Area 1 and Works Area 2, which will contain ancillary facilities such as CBPs, mechanical and electrical workshops, a laboratory and various water treatment and wash areas</li> <li>• spoil emplacement areas</li> <li>• staging area</li> <li>• stockpiling areas</li> <li>• temporary site offices to be used during construction.</li> </ul>
Communications	<p>Communication infrastructure such as fibre optic cables are required for the operation of the Project and will be located:</p> <ul style="list-style-type: none"> <li>• on an overhead line linking the upper and lower dams and reservoirs (in conjunction with the electrical line)</li> <li>• buried in road corridors</li> </ul> <p>The communication network will also include a communications tower near the upper dam and reservoir.</p>
Utilities during construction	<ul style="list-style-type: none"> <li>• Construction water will be supplied either via groundwater bores, or via pumping of water from the Macleay River to support camp operations, the CBP, dust suppressions and other activities across the site.</li> <li>• Construction power will be supplied primarily by use of portable diesel generators and supported where possible by leveraging off existing electricity distribution infrastructure running through the generation site.</li> </ul>
Utilities for operation	<p>Alignment and length of utilities (electricity, water, etc) will be combined into a single corridor (total length of about 5.4 km).</p>

**Table 2.1 Key Project elements**

Project element	Description
Water diversion and water treatment facilities	<ul style="list-style-type: none"> <li>• Site drainage will include a combination of cross drainage culverts, drainage pits and pipe, open channels/open drains (vegetated, rock-lined or concrete), levees/bunds, and detention basins.</li> <li>• Various water treatment plants will be used for construction drainage and water treatment facilities – for the main accommodation camp, temporary or fly camps, CBP, tunnel, etc.</li> <li>• Specific discharge locations are planned for stormwater and surface water runoff.</li> </ul>
Laydown/stockpile areas	Temporary laydown/stockpile areas will be utilised across the Project area with a total allocated stockpile area of around 114,000 m <sup>2</sup> .
Spoil emplacement areas	To accommodate spoil generated through excavation of the underground caverns and tunnels, three permanent spoil placement locations have been identified with a capacity to store around 5.5 million cubic metres (Mm <sup>3</sup> ) of material. Dead storage space within the reservoirs will also be used for spoil placement, with a capacity to store approximately 300,000–400,000 m <sup>3</sup> .
Ancillary operational facilities	Primary operation of the Project can be undertaken remotely and will require minimal onsite operational staff, other than for maintenance activities. Operational facilities include maintenance housing, work area, car parking, workshop and storage, control room and switchgear, water treatment plant, office area, heating, ventilation and air conditioning (HVAC), backup generators and Macleay River pump facility.
<b>Other</b>	
Construction	<ul style="list-style-type: none"> <li>• Construction duration of around four to five years.</li> <li>• Construction workforce of over 600 workers at construction peak.</li> </ul>
Rehabilitation	<p>Rehabilitation of areas disturbed during pre-construction and construction will be undertaken progressively during all stages and phases of the Project. Progressive rehabilitation will occur over about 60 ha including spoil emplacement areas and areas used for construction ancillary facilities no longer needed during operation.</p> <p>At the end of the Project’s life, 192 ha in total will be rehabilitated to native ecosystem (including native vegetation and rock landscape). Approximately 138 ha will be retained permanently for the water storages and access roads, subject to agreement with relevant landowners/land managers.</p>
Operation	<ul style="list-style-type: none"> <li>• The Project will provide up to 900 MW of electricity generating capacity and up to 12 hours of energy storage at full generating capacity.</li> <li>• Maintenance and operational activities will include power station operations, infrastructure inspections, maintenance to assets, vegetation management, auditing and compliance and other activities.</li> <li>• It is expected that the operation of the new power station will require around 30-50 full-time workers, as well as additional contractors for regular and ad hoc maintenance and repairs.</li> </ul>
Hours of operation	<ul style="list-style-type: none"> <li>• Construction of the Project will be 24/7 and 365 days per year.</li> <li>• Operation of the Project will be 24/7 and 365 days per year.</li> </ul>
Project timeline	The Project will involve the construction and operational stages, and numerous phases which are outlined in the Project’s EIS.
CIV	Estimated to be about \$1.8 billion.



Source: EMM (2022); DFSI (2020); GA (2011); SMEC (2022)



**KEY**

- |  |                 |                            |
|--|-----------------|----------------------------|
| Project area                                     | Dam wall        | NPWS reserve               |
| Indicative generation component disturbance area | Reservoir       | State forest               |
| <b>Project operational elements</b>              |                 |                            |
| Power station                                    | Macleay River   | Watercourse/drainage line  |
| Tunnels, portals, intakes, shafts                | Major road      | Minor road                 |
| Transmission overhead lines                      | Vehicular track | Existing transmission line |
| Permanent road                                   |                 |                            |
| Surface works                                    |                 |                            |

**Project elements**

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 Figure 2.1



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## 2.3 Project area terminology

Approval for the Project is being sought based on feasibility and concept designs as is common for Projects of this size and scale. To accommodate minor changes and amendments to the design as it progresses, a 'Project area', 'construction envelope', 'disturbance footprint' and 'operational footprint' approach is being adopted for the Project. This approach is aimed at ensuring environmental impacts are assessed as accurately as possible, whilst accounting for the current level of design and the likelihood of design refinements occurring as the Project progresses towards construction. The terms are explained below.

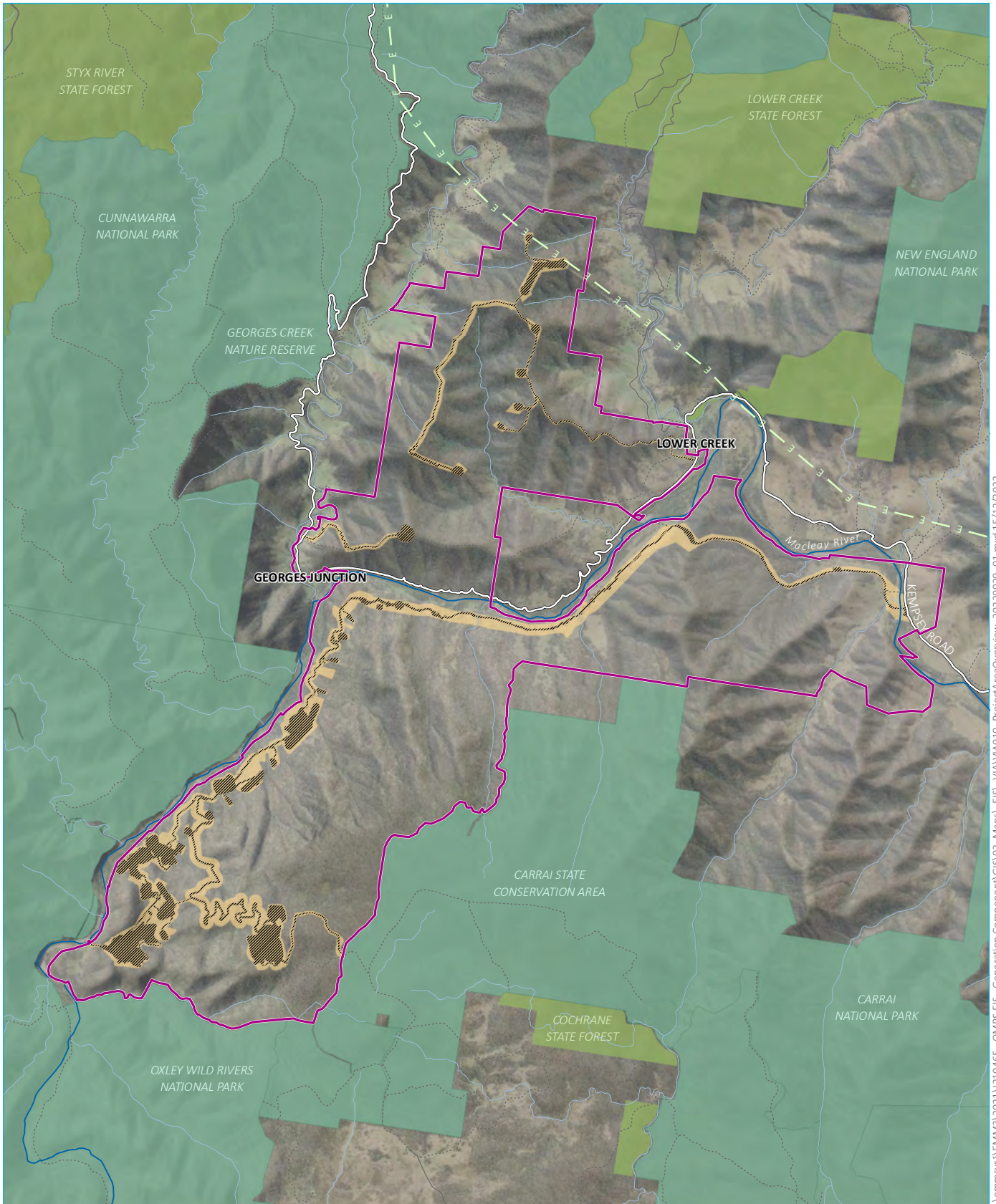
The *Project area* is the broader area within which the Project will be built and operated, and the extent within which direct impacts from the Project are anticipated. Importantly the Project area does not represent a footprint for the construction works, but rather indicates an area that was investigated during environmental assessments. The Project area has been further divided into different areas to facilitate the assessment of direct impacts from the Project.

The *construction envelope* represents the maximum extent of where disturbance may occur during the construction of the Project. In order to derive the construction envelope, buffers have been applied to the key Project elements and infrastructure. The buffers used to derive the final construction envelope area reflect the confidence around the current siting of the asset or infrastructure, and the likelihood that some minor amendments may be required prior to commencing the construction works as a result of the detailed design. The construction envelope for the Project covers an area of around 780 ha.

Located entirely within the bounds of the construction envelope sits the *disturbance footprint*, a smaller area that has been derived directly from the current level of design. The disturbance footprint represents the physical disturbance that can be expected as part of the construction works. As the design is refined, the final siting of the disturbance footprint can move within the construction envelope, subject to the recommended environmental management measures, and provided it does not exceed any limits as defined by the construction envelope. It is proposed that part of the disturbance footprint will be rehabilitated, and land formed at the completion of the Project. However, other parts will be retained after construction which are necessary for the ongoing operation and maintenance of the new power station (operational footprint). The disturbance footprint for the Project covers an area of around 330 ha.

Progressively and at the end of construction, temporary components that are required to support the construction of the Project will be rehabilitated and returned to a state representing its previous use. The exceptions to this are the areas required for permanent operation of the Project, which would be retained (referred to as the *operational footprint*). The operational footprint of the Project covers an area of around 270 ha. Approximately 60 ha would be progressively rehabilitated during and following completion of construction.

The Project area, construction envelope and disturbance footprint are shown in Figure 2.2.



Source: EMM (2022); DFSI (2020); GA (2011); SMEC (2022)

**KEY**

- Project area
- Disturbance footprint
- Construction envelope
- Existing environment
- Macleay River
- Watercourse/drainage line
- Kempsey-Armidale Road
- Minor road
- Vehicular track
- Existing transmission line
- NPWS reserve
- State forest

**Project overview**

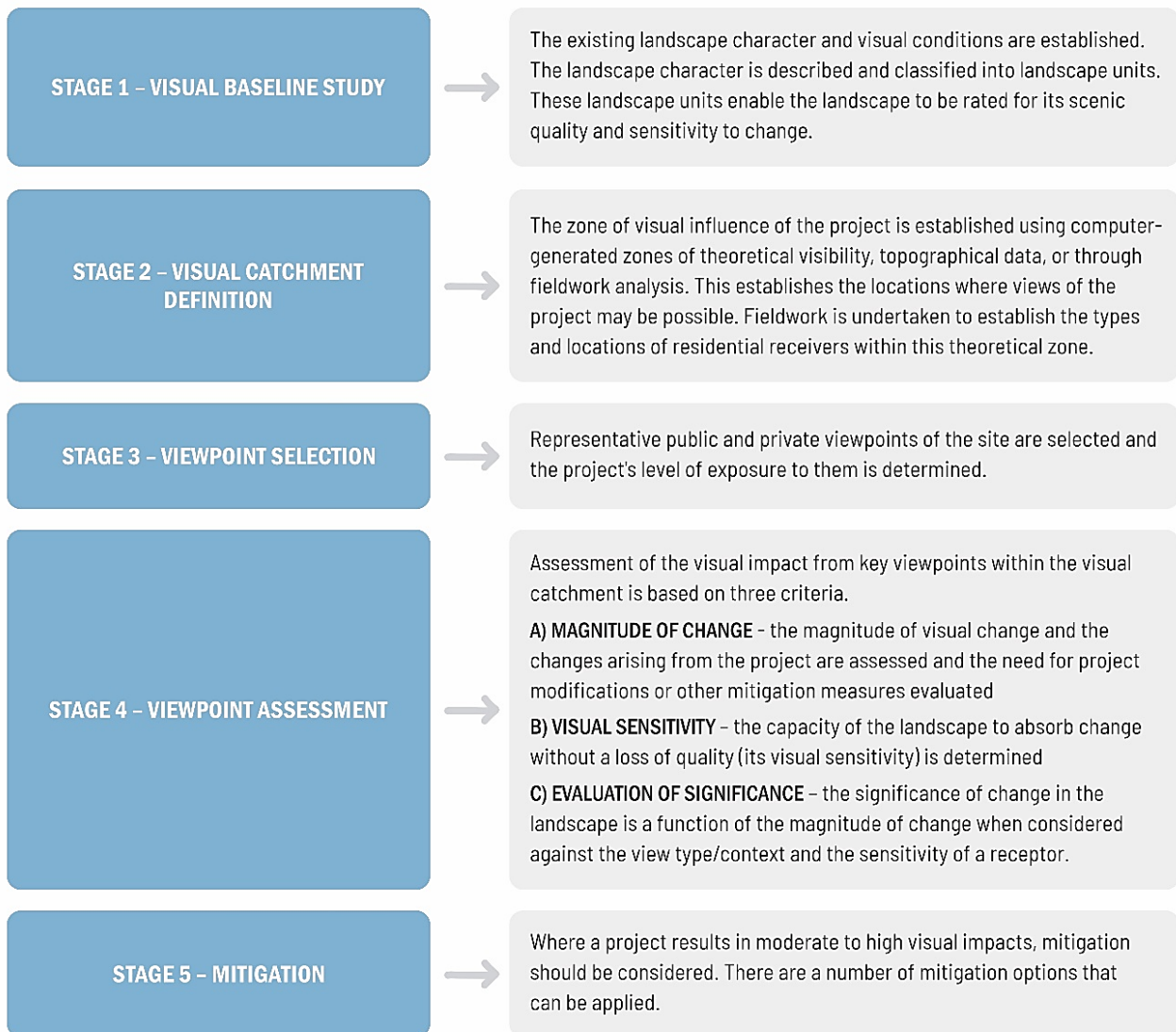
Oven Mountain Pumped Hydro Energy Storage Project  
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 Figure 2.2



# 3 Assessment methodology

## 3.1 Overview

The assessment method used in this report is adapted from the GLVIA, VA Bulletin, and Solar Guidelines, which involve information review, consultation, field observations and photography, computer-based data processing and analysis, and application of subjective professional judgement. The assessment involves five key stages:



## 3.2 Stages in the assessment methodology

### 3.2.1 Stage 1 – visual baseline study

This stage involves recording and analysing the existing landscape features, characteristics, the way in which the landscape is experienced, and the value or importance placed on the landscape and visual resource of the site. The landscape character is determined by the number, size, type and contrast of elements present. Typically, the key elements are topography, vegetation, water features and built elements. Other factors that are important are the consistency of these elements and whether they have developed progressively over time and become well integrated into a harmonious landscape.

In addition, consideration must be given to the prevalence of change, including whether the landscape is experiencing large-scale development (such as residential growth on the urban fringe).

The impact of a Project on the landscape character is based on the combination of the sensitivity of the existing landscape and the magnitude of the proposal on the landscape. According to the *Guideline for landscape character and visual impact assessment (2020)*, sensitivity refers to the quality of an area, and how sensitive the existing character is to change. The context is a primary factor in the visual sensitivity of the view. Generally, sites within higher contrasting landscapes have greater ability to absorb change, whereas sites within a uniform or highly ordered landscape have higher sensitivity and less potential for absorption.

Magnitude refers to the physical scale of the Project in the landscape. This takes into consideration the size of the Project, distance from any viewing areas and the contrast it has to the surrounding landscape. Table 3.1 has been developed to provide a rating for the impact of a Project on landscape character.

**Table 3.1 Landscape character impact**

Sensitivity of the landscape	Magnitude of change in the landscape			
	High	Moderate	Low	Negligible
High	High	High	Moderate	Negligible
Moderate	High	Moderate	Low	Negligible
Low	Moderate	Low	Low	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

Source: Figure 7 from *Guideline for Landscape Character and Visual Impact Assessment (Transport for NSW 2020)*.

### 3.2.2 Stage 2 – visual catchment definition

The studies for visual catchment area establish the area in which the Project may be visible, who will see the Project infrastructure, and the nature of the views at those points. A Zone of Visual Influence (ZVI) is generated using geographic information system (GIS) analysis and is used to simulate the Project’s visibility from the surrounding landscape.

The ZVI is a tool to help determine the extent of visibility, and the locations that may be impacted. It is used as a guide for fieldwork, viewpoint selection and early detection of potential visual impacts.

### 3.2.3 Stage 3 – viewpoint selection

Viewpoints provide a representation of the likely changes a Project will have on the landscape from a specific location. The effect a Project has on the landscape can be illustrated photographically and evaluated consistently across the Project.

Viewpoints are selected to provide representative samples of the likely changes and the exposure to Project elements. The viewpoints presented as part of this assessment are considered representative of potential visual impacts from a number of the locations identified as areas of concern by the local community and include local roads and private viewpoints from residential properties.

Sensitive areas like national parks, heritage sites, conservation areas and wilderness areas are also included in the viewpoint selection to measure any impacts on the visual amenity these areas provide. Two locations have been identified for assessment in Oxley Wild Rivers National Park. These are East Kunderang Homestead and Marys View. Oxley Wild Rivers National Park is also listed as an UNESCO World Heritage area.

This LVIA has identified 10 potential viewpoints. These are key vantage points made up of residences, visitor accommodation, campsites and roadways near the proposed Project area and include East Kunderang Homestead and Marys View lookout on the Carrai plateau.

### 3.2.4 Stage 4 – viewpoint assessment

#### i Visual magnitude

The magnitude of change on the visual landscape is one factor in determining the significance of visual impacts of the Project (refer to Table 3.2 and Table 3.3). In accordance with the GLVIA, this visual assessment considers the following criteria in determining the magnitude of change on a receptor:

- Whether the impact is temporary or permanent – impacts that are for a limited duration are considered less significant than those that occur for an extended period or are permanent.
- Distance of the viewer from the altered elements in the landscape – close proximity to an altered landscape will increase the significance for private residences. In the case of motorists, mid ground changes can be greater than foreground elements as they can result in longer viewing times.
- Length of viewing time – views from a residence are constant, whereas some views from roadways as experienced by motorists may be brief depending upon speed and viewing direction.
- Extent of view affected – impacts that are visible over a greater portion of a view are more significant than those where only a part of the view is impacted. Intervening topography and vegetation will also affect the magnitude of change.
- Scale of change – the loss or addition of features in the view and changes in the proportion of the view affected by the Project.

**Table 3.2 Magnitude of change – viewing experience**

Duration of view	Distance from site (km)				
	0–0.5	0.5–1.0	1.0–2.5	2.5–4.0	>4.0
Long (>20 minutes)	High	High	Moderate	Moderate	Low
Moderate (2–20 minutes)	High	Moderate	Moderate	Low	Low
Short (<2 minutes)	Moderate	Low	Low	Low	Low

**Table 3.3 Magnitude of change – scale**

Scale of change	Extent of view affected		
	High	Moderate	Low
High	High	High	Moderate
Moderate	High	Moderate	Low
Low	Moderate	Low	Low

The two sensitivity ratings above are then combined to form the visual sensitivity rating as indicated in Table 3.4. This combined rating is applied to the visual impact rating shown in Table 3.8.

**Table 3.4 Magnitude of change**

Scale of change	Viewing experience		
	High	Moderate	Low
High	High	High	Moderate
Moderate	High	Moderate	Low
Low	Moderate	Low	Low

ii **Visual sensitivity**

Visual sensitivity is a measure of the landscape’s ability to visually absorb development without a significant change in the character. It is a function of the view type and context. In this assessment, the major factor influencing visual sensitivity is the level of contrast between the Project-related infrastructure and the rural landscape setting in which it will be set.

The physical characteristics of the landscape, including existing development features, are integral components in determining the visual sensitivity. For example, a low visual sensitivity would enable a modification or addition to be made to the landscape which would only cause minimal contrast and result in a high level of integration with the surrounding landscape. Similarly, a high visual sensitivity would mean the same modification or addition to the surrounding landscape would cause high contrast to the surrounding landscape.

The Solar Guidelines identify the type of view as *viewer sensitivity* and the view context as *scenic quality*. Viewer sensitivity relates to the location of the viewer and the relative importance placed on the landscape viewed from that viewpoint by the community or visitors. These viewpoints include public use areas, public travel ways, and private homes.

Visual sensitivity has been assessed based on the viewer sensitivity level classification given in the VA Bulletin and the Solar Guidelines, presented in Table 3.5.

**Table 3.5 Viewer sensitivity level classification**

Viewer sensitivity	Description
High	<ul style="list-style-type: none"> <li>Residential areas and rural villages (defined as land zoned R1, R2, R3, R4, R5 and RU5 in the <i>Standard Instrument Local Environmental Plan</i> [Standard Instrument LEP]).</li> <li>Recreation, cultural or scenic sites and viewpoints of National or State significance such as National Parks, National reserves, and World Heritage areas.</li> <li>Any buildings, historic rural homesteads/residences on the State or local Government Heritage List.</li> </ul>
Moderate	<ul style="list-style-type: none"> <li>Rural dwelling(s).</li> <li>Tourist and visitor accommodation (definition in Standard Instrument LEP).</li> <li>Recreation, cultural or scenic sites and viewpoints of regional significance.</li> </ul>

**Table 3.5 Viewer sensitivity level classification**

Viewer sensitivity	Description
Low	<ul style="list-style-type: none"> <li>• Interstate and state passenger rail lines with daily daylight services.</li> <li>• State highways, freeways and classified main roads, classified tourist roads.</li> <li>• Land management roads with occasional recreation traffic.</li> <li>• Walking tracks of moderate local significance or infrequent recreation usage.</li> <li>• Other low use and low concern viewpoints and travel routes.</li> <li>• Navigable waterways.</li> <li>• Other low use and low concern viewpoints and travel routes.</li> </ul>

Source: Table 5 from VA Bulletin (DPE 2016).

Scenic quality refers to the relative scenic or aesthetic value placed on the landscape by the community. This is based on the presence of key landscape features known to be associated with community perceptions of high, moderate or low scenic quality. The scenic quality classifications used in this assessment are identified in Table 3.6.

**Table 3.6 Scenic quality classification**

Scenic quality	Landforms	Vegetation	Waterbodies
High	<p>Isolated peaks, steep rocky ridges, cones or escarpments with distinctive form and/or colour contrast that become focal points.</p> <p>Larger areas of distinctive rock outcrops or boulders.</p> <p>Well defined, steep sided valley gorges.</p>	<p>Strongly defined patterns with combinations of eucalypt forest, naturally appearing openings, streamside vegetation and/or scattered exotics.</p> <p>Distinctive stands of vegetation that may create unusual forms, colours or textures in comparison to surrounding vegetation.</p>	<p>Visually prominent lakes, reservoirs, rivers, streams and swamps.</p>
Moderate	<p>Steep, hilly and undulating ranges that are not visually dominant.</p> <p>Broad shallow valleys.</p> <p>Moderately deep gorges or moderately steep valley walls.</p> <p>Minor rock outcrops.</p>	<p>Predominantly open forest or woodland combined with some natural openings in patterns that offer some visual relief.</p> <p>Vegetative stands that exhibit a range of size, form, colour, texture and spacing.</p>	<p>Intermittent streams, lakes, rivers, swamps and reservoirs.</p>
Low	<p>Large expanses of flat or gently undulating terrain.</p> <p>Indistinct, dissected or unbroken landforms that provide little illusion of spatial definition or landmarks.</p>	<p>Extensively cleared and cropped areas with very limited variation in colour and texture.</p>	<p>Natural waterbody absent.</p>

Source: Table 3 from VA Bulletin (DPE 2016).

The two visual sensitivity ratings above are combined to form the visual sensitivity rating as indicated in Table 3.7. This combined rating is applied to the visual impact rating shown in Table 3.8.

**Table 3.7 Visual sensitivity rating**

Viewer sensitivity	Scenic quality		
	High	Moderate	Low
High	High	High	Moderate
Moderate	High	Moderate	Low
Low	Moderate	Low	Low

iii Evaluation of significance

The significance of a change in the landscape is a function of the magnitude of that change when considered against the view type/context and the sensitivity of a receptor. Typically, a noticeable change in the landscape in a rural or natural landscape, combined with a high visual sensitivity, would be considered highly significant, whereas a change in an already heavily modified landscape would be considered of low or moderate significance.

Visual impact refers to the change in the appearance of the landscape because of development. This report addresses a number of factors that contribute to the visual impacts and has presented them in a measurable way.

Table 3.8 provides a matrix that combines the visual sensitivity rating with the magnitude of change rating to determine the visual impact rating. This rating is applied to each viewpoint as a way to measure the impacts of a development from particular locations.

**Table 3.8 Evaluation of significance – visual impact rating**

Visual sensitivity	Magnitude of change		
	High	Moderate	Low
High	High	High	Moderate
Moderate	High	Moderate	Low
Low	Moderate	Low	Low

The primary assessment tools for determining the significance of impact of the Project are the site inspections and photographs of the views from the selected viewpoints. This enables an assessment of potential visual impact, taking into consideration the nature of the landscape, topography, the distance between the viewpoint and the proposed infrastructure, as well as the type of view experienced.

iv Photomontages

Visualisations (photomontages) of permanent infrastructure were prepared from key representative viewpoints within the ZVI to support the assessment of visual impacts (refer to Chapter 5). They have been prepared in line with the Land and Environment Court of NSW policy statement for the use of photomontages (LEC 2023).

3.2.5 Stage 5 – mitigation

The final step in the assessment process is to determine additional measures that could be incorporated into the design of the Project to ameliorate, or, where possible, eliminate the visual impact of the Project.

Mitigation measures can be in several forms including:

- design of Project infrastructure to reduce the contrast with the surrounding environment by:
  - moving Project elements to less visible locations
  - removing some Project elements
  - re-sizing the Project elements
  - use finishes and products that minimise or eliminate surface glare
  - select finishes and colours that are appropriate to the location and context to blend the development into surroundings. Neutral colours that blend in with the surrounding landscape will be used where possible, such as khaki, green, beige, or similar
- use of visual buffers and screening by planting vegetation
- designing infrastructure to screen operations and lighting.

Mitigation measures that have been incorporated into the design of the Project are discussed in Chapter 6 of this report.

## 4 Visual baseline study

### 4.1 Sensitive land zoning designations

The Project is located in the Armidale Regional LGA, approximately half way between the towns of Kempsey and Armidale on the Kempsey-Armidale Road. The following provides an overview of the land use zoning within the Project area and its immediate surrounds (refer to Figure 4.1).

#### 4.1.1 RU1 Primary production

The Project area is zoned RU1 – Primary production under the *Armidale Dumaresq Local Environmental Plan 2010* (Armidale LEP). The objectives of the RU1 zoning relevant to landscape and visual impact within the Armidale LEP are:

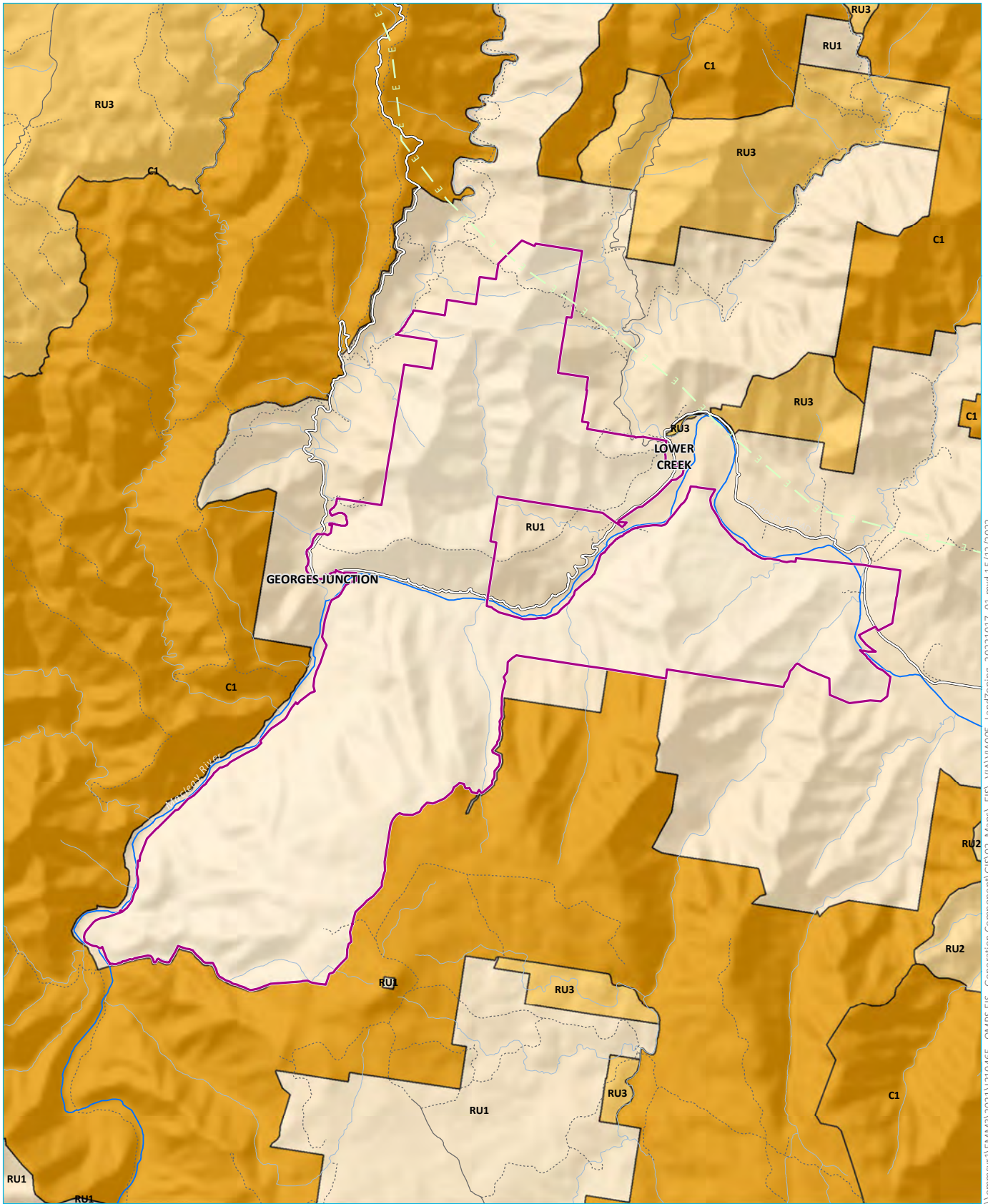
- to encourage sustainable primary production by maintaining and enhancing the natural resource base
- encourage diversity in primary industry enterprises and systems appropriate for the area
- minimise fragmentation and alienation of resource lands
- allow non-agricultural land uses that will not restrict the use of other land for agricultural purposes.

#### 4.1.2 C1 National Parks and Nature Reserves

Beyond the RU1 zoning (approximately 1 km to the east, west and south of the Project area) is zoned C1 – National Parks and Nature Reserves under the Armidale LEP. To the east of the Project area is the Carrai State Conservation Area, with Carrai National Park to the south, and Oxley Wild Rivers National Park to the south-west. To the west, across the Macleay River is the Cunnawarra National Park and Georges Creek Nature Reserve.

These lands are reserved and managed to protect their environmental significance under the *NSW National Parks and Wildlife Act 1974* (NPW Act).

In addition to land zoning, these environmental assets are recognised within the New England North West Regional Plan 2041 (DPE 2022) for their biodiversity value (Objective 12 of the Plan) as well as contributing to the scenic and cultural landscape of the region.



Source: EMM (2022); DFSI (2020); DPIE (2022); GA (2011); SMEC (2022)

**KEY**

- |                                       |                            |
|---------------------------------------|----------------------------|
| Project area                          | Existing environment       |
| Land zoning                           | Macleay River              |
| C1 National Parks and Nature Reserves | Watercourse/drainage line  |
| RU1 Primary Production                | Major road                 |
| RU2 Rural Landscape                   | Minor road                 |
| RU3 Forestry                          | Vehicular track            |
|                                       | Existing transmission line |

**Land zoning**

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## 4.2 Sensitive land use designations

Land uses within and immediately adjacent to the northern part of the Project area are predominantly agricultural, used primarily for sheep and cattle grazing. Land uses near the southern portion of the Project area are designated as national parks and reserves.

### 4.2.1 Agricultural lands

The land along the valley floors adjacent to the northern portion of the Project area is dedicated to grazing pastures with modified vegetation.

Along the Macleay River, adjacent to the southern portion of the Project area is land with limited disturbance. These are steep, wooded slope areas that rise from the river toward the high tableland. There is no prime agricultural land in this area.

### 4.2.2 Nature conservation

Areas zoned C1 – National Parks and Nature Reserves under the Armidale LEP fall under this sensitive land use designation.

Carrai State Conservation Area is located approximately 1 km east of the upper reservoir area.

Oxley Wild Rivers National Park is located south and west of the Project. It is approximately 1 km south of the upper reservoir and 350 m south of the lower reservoir at its nearest location. The national park is located west of the Macleay River where the pumping infrastructure is located.

Cunnawarra National Park and Georges Creek Nature Reserve sit to the west of the northern Project area and west of the private properties along Georges Creek. The transmission corridor is 1.7 km from the national park at its closest point.

### 4.2.3 Rural towns and villages

The nearest town is identified as Bellbrook, approximately 35 km east of the Project area along Kempsey-Armidale Road. According to the 2021 *Census of Population and Housing* (the Census), Bellbrook has a population of 273 people while the Armidale Regional LGA had population of 29,449 people.

There is an agglomeration of residences at Lower Creek, which is located 8 km east of the Project area. Residences are located along both sides of Kempsey-Armidale Road. Census data indicates that Lower Creek had a population of 32 people in 2021.

### 4.2.4 Historic heritage

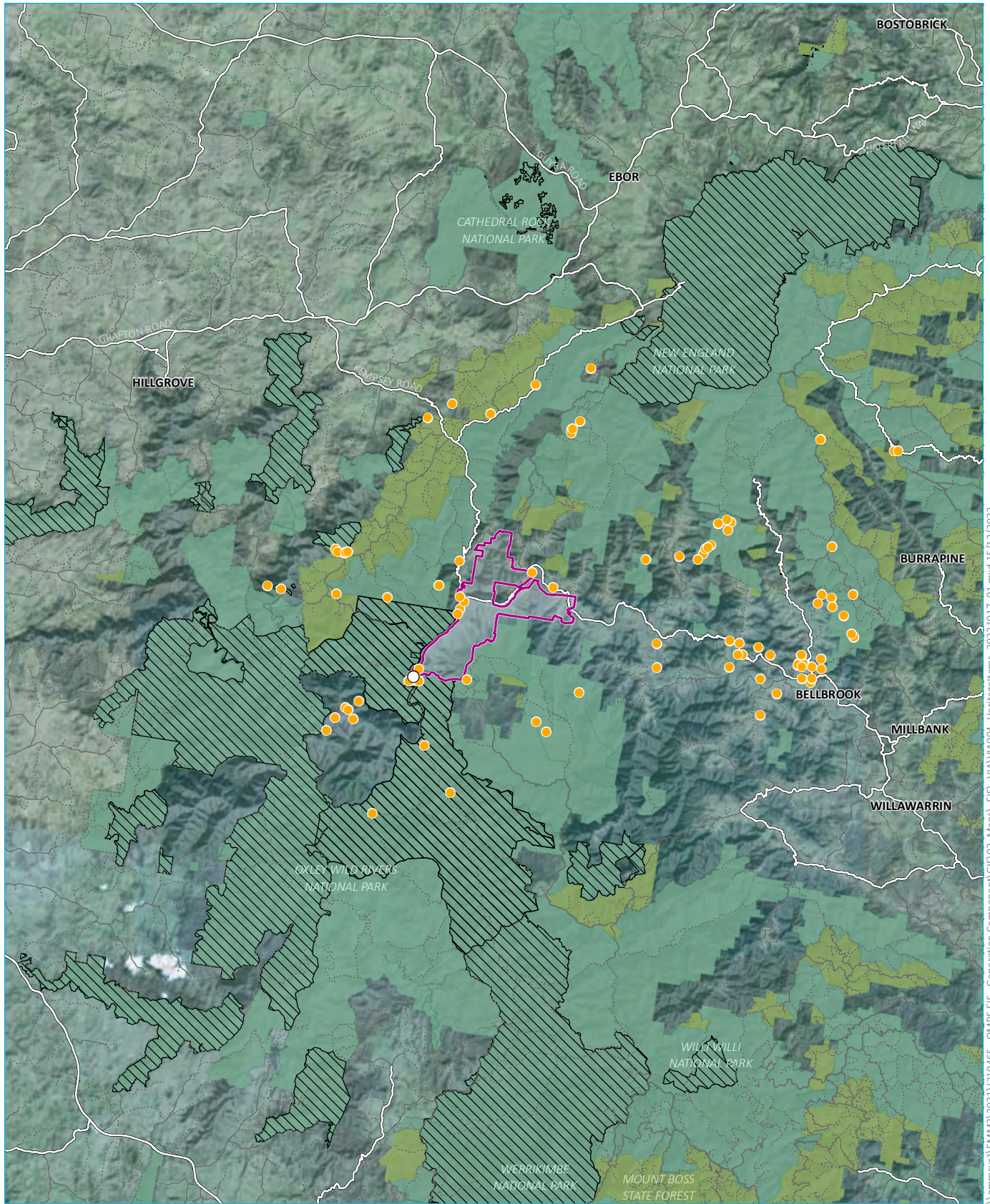
There are no listed historic heritage items within the Project area. The curtilage of two listed heritage items are within 10 km of the Project area with one of those items, East Kunderang Homestead (also known as Kunderang East Pastoral Station), listed on the State Heritage Register (SHI 00996), the Register of the National Estate (302) and is classified by National Trust of Australia (NSW) (3654) (Figure 4.2). The second item, the Gondwana Rainforests of Australia (GRA), is identified on the National Heritage List and World Heritage List (#105704 and #105135 respectively).

The historic heritage assessment of the Project, which is contained within the EIS, identifies the ruins of an early European homestead, known as Long Flat Station as having some local heritage significance given it was one of the earliest established (c.1843) European homesteads on the Macleay River. The ruins have been avoided but are located in the Project area, near the Macleay River.

#### 4.2.5 Aboriginal heritage

The Aboriginal cultural heritage assessment of the Project has identified a number of Aboriginal sites within the Project area, mostly along the edges of the Macleay River (Figure 4.2). Most sites are scatters of stone artefacts, however, one more significant site, an axe quarry, was identified near the Macleay River at Georges Junction. No significant Aboriginal heritage cultural sites were identified within the Project area, however, there are some significant sites proximate to the Project area, including the Carrai Waterholes located on the Carrai Plateau to the south of the Project area.

Avoidance of Aboriginal cultural heritage values has been a key aspect of the Project refinement process and will continue during the detailed design stage.



Source: EMM (2022); DFSI (2020); GA (2011); SMEC (2022)

**KEY**

- Project area
- Registered Aboriginal heritage location
- Kunderang East Pastoral Station
- State heritage listed item
- Major road
- Minor road
- Vehicular track
- NPWS reserve
- State forest

**Aboriginal Cultural heritage locations**

Oven Mountain Pumped Hydro Energy Storage Project  
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 Figure 4.2



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### 4.3 Overview of the bioregion

Bioregions are relatively large land areas characterised by broad, landscape-scale natural features and environmental processes that capture large-scale geophysical patterns at an ecosystem scale. Sub-regions delineate significant geomorphic patterns within a bioregion, and are based on finer differences in geology, vegetation and biophysical attributes (Bannerman & Hazelton 1990).

The Project area is just within the NSW North Coast bioregion with the New England Tableland bioregion to the north and west. Within this bioregion, the Project area sits within the Nymboida subregion, which is characterised by the foothills of the Great Escarpment with steep slopes with relief of up to 750 m. The geology of the subregion consists of faulted bedrock of Devonian slates and quartzites, and Permian mudstones and lithic sandstones both intruded by granodiorites. Areas of Tertiary age basalts can be found along the margins of the Great Escarpment. Typically soils of the subregion are dependent on the underlying geology; on basalts and granodiorites, red earths and red loams are present, and on volcanic and sedimentary rocks soils containing a red and brown texture contrast are present.

The topography of the Project area is dominated the Carrai Plateau, leading into steep slopes that drop sharply and dramatically down to the Macleay River valley bounding the study area to the west. On the Carrai Plateau, the landscape is characterised by rolling hills and flats, with abundant granite and granodiorite rock outcropping. Topographically, elevation on the plateau is between 900 and 1,147 m. West from the Carrai Plateau, the elevation drops sharply; the escarpment is characterised by ridges, hills and drainage basins leading down to the footslopes of the Macleay River valley. Nearer to the Macleay River, the landscape is characterised by flats and banks close to the river, underlain by Quaternary alluvium. Elevation is generally low, between 100 m and 150 m, and local relief is approximately 15 m.

### 4.4 Land use and disturbance

Previous land disturbance has an impact on the landscape of the area. Historically, the Carrai Plateau has been used extensively for logging operations, with a number of disused haul tracks evident on LIDAR imagery. More recently, the properties on the plateau are used for grazing, small scale farming, and/or dry cropping. On the western edge of the Project area, where it abuts the Macleay River, disturbance has largely been constrained to localised impacts, such as dam construction and drainage modification. A powerline easement, with associated tracks and infrastructure, has also been established here. Notably, much of the upper slopes remain undisturbed due to their inaccessibility, but conversely may have been subject to significant erosion as a result of the sharp topography.

### 4.5 Existing landscape character

#### 4.5.1 Nearby settlements

The closest settlement is at Lower Creek, at the junction of Lower Creek Road and Kempsey Road. There are nine dwellings identified and they are located along the Kempsey-Armidale Road.

##### i Residences

Scattered rural residences are located along the Georges Creek valley and along the Dykes River valley. Seven residences occupy Georges Creek valley, with five of these owned by a single landowner. Seven residences are scattered along Dykes River as well.

Bass Lodge is the closest accommodation lodging to the Project area and is located adjacent to Georges Junction campsite. These are near the confluence of Georges Creek and the Macleay River.

On the Carrai Plateau, there are seven additional residences. These are located within 7 km of the upper reservoir, which is the closest Project element.

The locations of the receptors and representative viewpoints considered as part of this assessment are shown on Figure 5.2.

#### 4.5.2 Accessibility

The main transport infrastructure is Kempsey Armidale Road which is the only direct connection between Kempsey to Armidale.

Running through the Project area, the Kempsey-Armidale Road runs east-west, approximately 7 km north of the reservoir locations. Access to the Project will be provided from the Eastern Access Road and transmission access roads off Kempsey Armidale Road.



**Photograph 4.1** Kempsey Armidale Road

#### 4.5.3 Night lighting

The site is relatively removed in proximity to clustered residential dwellings with the nearest townships located approximately 35 km from the site. Sporadic siting of rural residences will account for minimal light spill, as will light from headlights of the traffic using Kempsey Armidale Road.

#### 4.5.4 Airfields

There are no airfields within the vicinity of the Project area that would experience visual impacts from the Project.

#### 4.5.5 Landform

The landscape character falls into four main categories that can be classified as river, valley, slope and plateau based on the landform. Generally, the landform is of narrow valleys with steep, wooded slopes.

South of the Project area is a high elevation plateau (Carrai Tableland) within the Carrai National Park. The land falls from 1,000 m in elevation toward the west and north from the tableland to the Macleay River (150 m elevation) through a series of steep valleys.

North of the Project area are several long valleys separated by high ridges that rise approximately 450 m above the valley floors. The lower slopes of these valleys are predominantly cleared for grazing.

#### 4.5.6 Vegetation

The subject land reflects past land uses and disturbances such as grazing, bushfire (2019) and floodplain inundation in areas adjacent to the Macleay River. Much of the vegetation within the Project area occurs as open grassy *Eucalyptus* forests with smaller wet sclerophyll areas influenced by hydrological surface water flows located on headwater tributaries. These are located throughout the site from higher to lower elevations and vegetation type varies according to landscape position.

The Project area contains three main vegetation communities as identified by Keith and Simpson *Vegetation Classes of NSW 2010*. The upper slopes of the Project area are home to the Northern Tableland Wet Sclerophyll forests, with the North Coast Wet Sclerophyll forests on the foot slopes and the Northern Gorge Dry Sclerophyll forests near the Macleay River.

These three forest communities are characterised by open canopies ranging from about 20 m to m metres in height and are dominated by a large variety of eucalyptus species.

The higher forests are primarily dominated by New England Blackbutt (*Eucalyptus aculate*) and Tallowwood (*Eucalyptus microcorys*) in the south and Spotted Gum (*Corymbia aculate*) and Thick-leaved Mahogany (*Eucalyptus carnea*) in the north. In the mid-slopes, Small-fruited Grey Gum (*Eucalyptus propinqua*) and Broad-leaved Stringybark (*Eucalyptus caliginosa*) extend below the higher forests. Moving to the lower slopes and foothills, the Broad-leaved Stringybark and Silver-top Stringybark (*Eucalyptus laevopinea*) continue to occur with the dominant canopy species Forest Red Gum (*Eucalyptus tereticornis*), which is associated with the lower slopes of the Macleay River.

In the floodplains and foothills of the subject land, native and exotic grasslands also occur, and many are subject to current grazing practices. These grasslands primarily lack a mid and canopy stratum and vary in species density and diversity. On the banks of the Macleay River, the vegetation is primarily dominated by River Oak (*Casuarina cunninghamiana*) and has been observed in high rainfall to be inundated by high river levels.

Much of the upper Project area remains intact with minimal weed disturbance, however due to the alluvial influences of the Macleay River introducing exotic species from upstream and current disturbance practices, exotic species do occur, primarily in the lower elevations of the Project area. Exotic species occurrence is also associated with the existing access tracks for private residents and transmission line access.

More details on vegetation of the Project area can be found in the biodiversity assessment which is appended to the EIS.

#### 4.5.7 Water form – rivers and creeks

The Macleay River is one of the defining landscape features near the Project area. It is fed from the high-elevation lands south and west of the Project area and flows northward along the western edge of the Project area before turning eastward at Georges Junction and flowing toward Lower Creek and Bellbrook.

Georges Creek is a main tributary to the Macleay River. It flows from the north along a wide valley that has been cleared for grazing purposes.

Both rivers are reputed to provide excellent fishing opportunities and draw tourists during the summer. The National Trail also follows the two waterways, providing horse riders and hikers a way through the mountains.

#### 4.5.8 Landscape values

The Armidale Regional Council has prepared a *Local Strategic Planning Statement* (LSPS) that identifies the need for the protection of areas of high natural environmental or biodiversity value. Development should be focused to areas of least biodiversity sensitivity and implement the 'avoid, minimise, offset' hierarchy to biodiversity and areas of high environmental value. This strategic approach identifies a high level of value placed on the natural landscape. Elements such as the Macleay River catchment area would likely be identified as areas of high environmental value.

National parks are reserved under the NPW Act to protect areas containing outstanding or representative ecosystems or cultural features or landscapes (Carrai National Park and State Conservation Area Plan of Management). Conservation areas are also reserved to protect and conserve areas that contain significant ecosystems, landforms or places of cultural significance. By virtue of being reserved under the NPW Act, the lands surrounding the Project area have significant cultural value.

#### 4.6 Key landscape features

Key features in the landscape add to the character and uniqueness of a place. The features may include dramatic natural features like a mountain peak, cliff or waterfall. A feature can also be much smaller in scale like a distinctive tree or stand of trees that stands out visually in the landscape.

The features identified below help define the Project area and its surrounds and thus are key elements in the landscape.

##### 4.6.1 Macleay River

The Macleay River is one of the defining landscape features of the local area. In some places, it runs along the bottom of narrow valleys with steep slopes. Near the Project area, the river's banks are typically heavily vegetated with occasional clearings that offer access to the water. Further downstream, the River becomes more accessible with lower banks and larger clearings.

There are views of the river from elevated locations like Kempsey-Armidale Road and Georges Junction campsite. These offer views of the water for a limited distance as the river winds its way down the valley.

The river itself provides opportunities for recreation, especially fishing in the summer months.



**Photograph 4.2**      **Macleay River**

#### 4.6.2      High plateau

The high plateau of the Carrai tablelands dominates the landscape to the south-east of the Project area. This is accentuated by the escarpments that plunge down into narrow valleys 750–800 m below. There are very few accessible locations along the plateau for tourism. The only accessible location that overlooks the Macleay River is Marys View, which is 4 km south of the Project area.



**Photograph 4.3**      **High plateau**

#### 4.6.3      Ridgelines

North of the Macleay River, the landscape is defined by high ridgelines that separate accessible valleys. They are typically punctuated by cone shaped hilltops that rise above the ridges.

These ridges are heavily wooded along the higher slopes. The lower slopes are generally cleared for grazing.



**Photograph 4.4**      **Ridgelines**

## 4.7      Landscape character zones

The landscape surrounding the Project area has been categorised into four Landscape character zones (LCZ). These are based on the dominant landform and landscape features that create distinct character areas.

For this report, the LCZ areas have been defined as follows.

### 4.7.1      Macleay River valley

The Macleay River valley LCZ is characterised by the steep hillsides that rise from the river. Vegetation along the river is primarily dominated by River Oak (*Casuarina cunninghamiana*). The vegetation is intact, broken only by an occasional trail, access road and existing powerlines.

Views from this LCZ are constrained due to the narrow valley, dense vegetation and steepness of the valley walls. Views are constrained to within the valley due to the height of the valley walls and vegetation.



**Photograph 4.5**      **Macleay River valley landscape character**

#### 4.7.2      Valleys

The valleys LCZ are defined by level or gently undulating land that rises from a river or creek. The woodlands have been cleared to make way for agricultural uses, primarily grazing.

Along the valleys is also where most dwellings and farm structures are located within the landscape. Fencing typically defines various paddocks and boundary lines across the valley.

Views from this LCZ are generally open longitudinally along the valleys. Views across the valleys are confined by the hills and ridges that separate one valley from another.



**Photograph 4.6** Valley's landscape character

#### 4.7.3 Upper slopes

The upper slopes LCZ occurs above the Macleay River valley and the valleys LCZs where the topography becomes too steep for farm use. These slopes contain dense vegetation.

West of the Macleay River, this LCZ occurs within national park lands.

Views from this LCZ are limited because of the dense tree canopy coverage. Access to these areas is also limited to walking trails or service roads accessing the power transmission lines that exist along the ridges. Most views would be toward the upper slopes LCZ as it contains the prominent landscape features in the area.



**Photograph 4.7**      **Upper slopes landscape character**

#### 4.7.4 Plateau

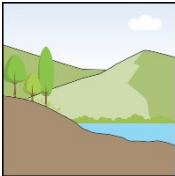
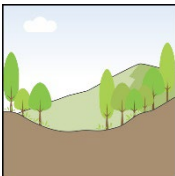
The plateau LCZ is characterised by flattening topography above the upper slopes. The dense vegetation continues along the plateau surrounding the Project area.

The plateau includes the Carrai State Conservation Area and the Carrai National Park adjacent to the Project area. Further away, a small number of residences are located on cleared private land.

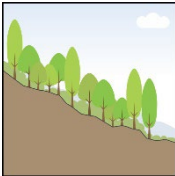
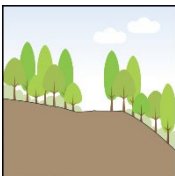


**Photograph 4.8** Plateau landscape character

**Table 4.1 Landscape character zones**

Landscape character zone	Description	Sensitivity	Magnitude	Landscape character impact
<p>Macleay River valley</p> 	<p>Rivers define the bottom of the valleys surrounding the Project area. The Macleay River has cut a narrow valley with steep slopes rising from the river.</p> <p>These are associated with fishing and equestrian/walking trails.</p>	<p>Moderate</p> <ul style="list-style-type: none"> <li>The landscape has minor modifications from its natural state.</li> <li>Portions of the valley include National Park lands.</li> <li>The landscape elements that contribute to its quality will be modified in minor ways.</li> </ul>	<p>Low</p> <ul style="list-style-type: none"> <li>Views of the Project are limited to close range.</li> <li>The extent of the visible Project infrastructure will be minor in relation to the LCZ.</li> </ul>	<p><b>Low</b></p>
<p>Valley</p> 	<p>The valleys have more gentle slopes with flattening areas along the lower slopes. These slopes are typically modified landscapes to accommodate grazing and agricultural activities.</p> <p>Georges Creek and the Dyke River travel through these wider valleys.</p>	<p>Moderate</p> <ul style="list-style-type: none"> <li>The landscape has been modified from its natural state.</li> <li>Human modification is clearly evident through clearance of native vegetation and presence of dwellings, agricultural structures, and roads.</li> <li>The landscape elements that contribute to its quality will remain unchanged.</li> </ul>	<p>Low</p> <ul style="list-style-type: none"> <li>The extent of the visible Project infrastructure will be minor in relation to the LCZ.</li> <li>No Project infrastructure is planned to be installed in this LCZ. Only access roads will disturb the landscape in the LCZ.</li> </ul>	<p><b>Low</b></p>

**Table 4.1** Landscape character zones

Landscape character zone	Description	Sensitivity	Magnitude	Landscape character impact
<p>Upper slope</p> 	<p>Upper slopes are areas with steep topography and are generally wooded. This LCZ includes the ridgelines that help define the character of the area.</p>	<p>High</p> <ul style="list-style-type: none"> <li>The landscape’s natural state is mostly intact.</li> <li>Human modification is evident through clearing of vegetation for transmission infrastructure.</li> <li>Changes to this LCZ will be visible from afar, and therefore it has a low capacity to absorb change.</li> </ul>	<p>Low</p> <ul style="list-style-type: none"> <li>The Project will occupy a very small portion of this LCZ.</li> </ul>	<p><b>Moderate</b></p>
<p>Plateau</p> 	<p>Plateaus are areas of flattening topography above the slopes. This LCZ is limited to the Carrai tableland situated above the Project area.</p>	<p>High</p> <ul style="list-style-type: none"> <li>Much of the area in this LCZ is designated as National Park or Conservation Park.</li> <li>The landscape is not modified from its natural condition.</li> </ul>	<p>Negligible</p> <ul style="list-style-type: none"> <li>The Project is not expected to impact this LCZ.</li> </ul>	<p><b>Negligible</b></p>

## 4.8 Community views

Feedback about the Project was obtained as part of community engagement activities undertaken for the EIS (see Chapter 5 of the EIS for detailed information on consultation activities). Key issues raised relating to visual impacts were identified and have been considered as part of the preparation of this report. The key issues raised included:

- Concerns about the visual impact associated with the Project's generation design (including upper and lower reservoirs and access roads).
- Concerns about the visual impact associated with new transmission lines.
- Queries about possible visual impacts to East Kunderang Homestead and Mary's View.

The assessment of visual impacts and consideration of key viewpoints including East Kunderang Homestead and Mary's View are addressed in Chapter 5 of this report.

## 5 Visual assessment

### 5.1 Zone of visual influence

A zone of visual influence (ZVI) diagram has been prepared for the Project to illustrate the theoretical visibility of the proposed Project infrastructure. The ZVI represents the area over which a development can be seen. Refer to Figure 5.2 for the ZVI.

The ZVI was generated using a digital elevation model (DEM). The DEM is representative of the bare earth surface and only considers the topography of the landscape. It is common practice, and recommended by DPE, to use only a DEM for the theoretical viewsheds. This ensures the worst-case scenarios are identified for further evaluation.

The ZVI modelling used a 3D geodesic viewshed, where observer points were placed every 50 m along the perimeter of the disturbance footprint. Observer points were also placed on structural features such as transmission towers (50 m tall), internal power poles (15 m), and along the top of the dam wall. Observer height was set at 1.6 m.

It is important to note that the ZVI does not consider the diminishing size of the Project elements as the viewer moves further away. It only indicates where the Project elements will be visible. To account for the diminishing effect of distance on the Project elements, distance bands are marked on the ZVI. These provide a general indication of relative size based on the characteristics of the human eye. For example, the ZVI only shows visibility up to 8 km because a 50 m high tower will occupy less than 0.5% of the eye's vertical field of view and will be visually insignificant beyond that distance. Table 5.1 provides general guidelines on the relationship between visibility and distance for a 50 m high transmission tower.

**Table 5.1** Effect of distance on visibility

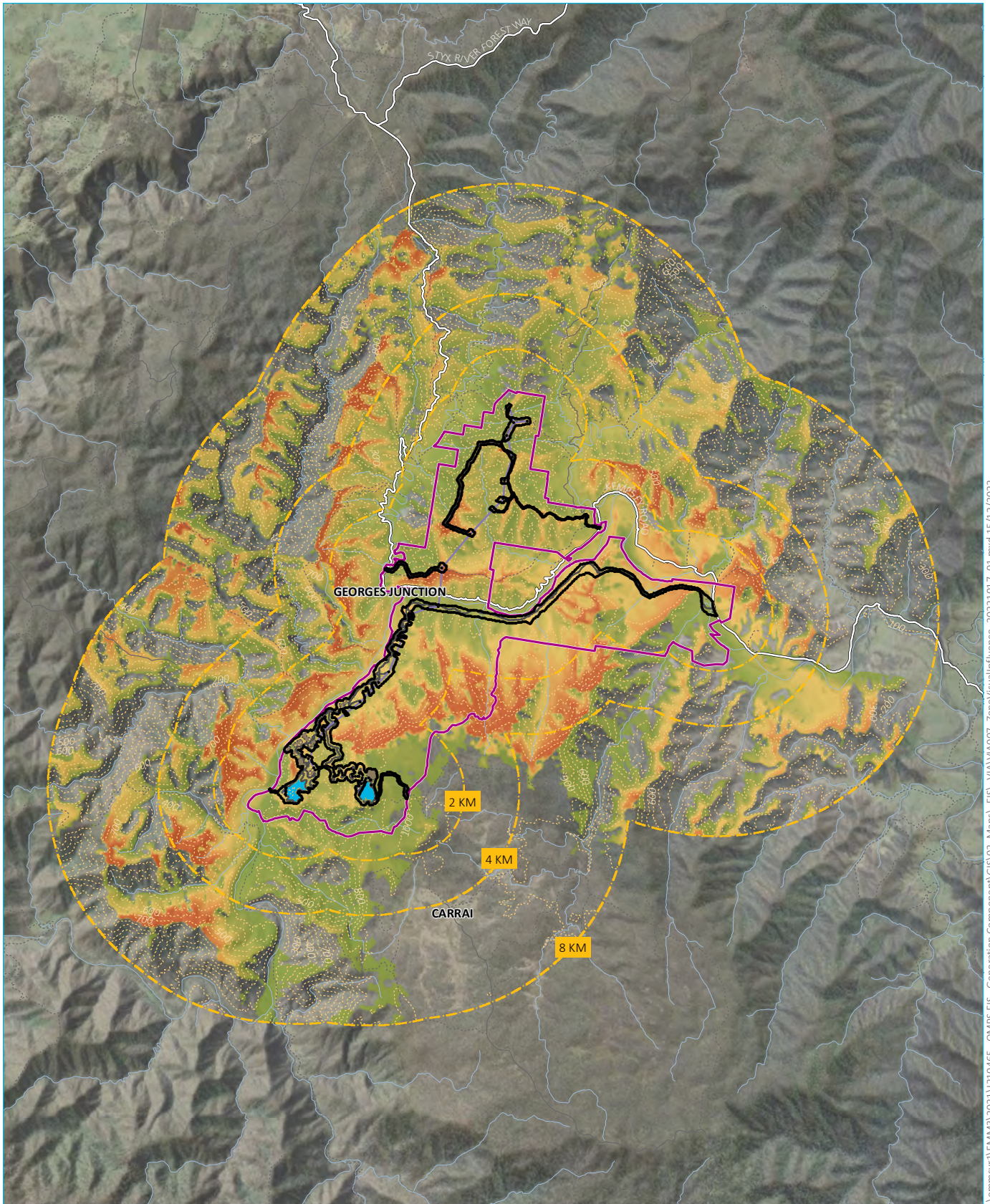
Distance to transmission structure	Vertical angle of view (°)	Visibility of transmission structure
8 km and greater	Less than 0.5	Visually insignificant.
4–8 km	0.5–1.0	Potentially noticeable but will not dominate the landscape.
2–4 km	1.0–2.5	Potentially noticeable and can dominate the landscape.
1–2 km	2.5–5.0	Highly visible and will usually dominate the landscape.
Less than 1 km	More than 5.0	Will always be visually dominant in the landscape.

#### 5.1.1 Summary of ZVI

Due to the scale and elevation of the reservoirs and transmission lines, the ZVI indicates theoretical visibility of the Project for distances up to eight km. Most of the areas from which the Project could be visible are along ridgelines and elevated locations.

The locations with the highest visibility of the Project is identified along the ridgeline located west of the Macleay River, in the Oxley Wild Rivers National Park. Visible elements would include the reservoirs, transmission lines, Project offices and access roads.

The ZVI indicates that the topography of the region limits opportunities to see the Project in its entirety. Most of the areas that would be inhabited or visited by people have limited visibility or can only see a small portion of the Project.

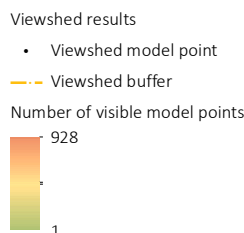


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Source: EMM (2022); DFSI (2020); GA (2011); SMEC (2022)

**KEY**

- |                             |                                      |
|-----------------------------|--------------------------------------|
| Project area                | Existing environment                 |
| Transmission overhead lines | Watercourse/drainage line            |
| Permanent road              | Topographic contour (100 m interval) |
| Surface works               | Major road                           |
| Dam wall                    | Minor road                           |
| Reservoir                   | Vehicular track                      |



**Zone of visual influence**

Owen Mountain Pumped Hydro Energy Storage Project  
Landscape and Visual Impact Assessment  
OMPS Pty Ltd  
Figure 5.1



## 5.2 Visual impacts during construction

A description of the site establishment and construction activities associated with the Project is provided in Chapter 2. These impacts are considered temporary with the construction period estimated to be four to five years. The main temporary visual impacts are identified below.

- Traffic and vehicle movements:
  - Vehicle movements will be a daily occurrence during the construction stage of the Project. Most traffic into the Project area is expected to be from Kempsey in the east along Kempsey-Armidale Road, although some vehicles will travel from Armidale in the west. The majority of traffic will access the Project area from the Eastern Access Road. Other traffic will use access roads to the north of the Macleay River to construct transmission line infrastructure.
  - As construction work proceeds, vehicles may be visible along access tracks. However, due to topography and vegetation, visual impacts from traffic are not expected at these locations.
- Temporary laydown area:
  - Laydown areas and construction yards will be necessary for the construction of the Project. These are located north of the lower reservoir. The visual impacts of these areas are expected to be negligible due to the location along the valley and away from any roadways and residences.
- Construction lighting
  - The use of temporary lighting on poles is expected as construction is planned to occur 24 hours each day.
  - Depending on the location of the night work, lights may be visible from the Georges Junction campground area. This is only predicted while work on the access road is being performed. The Macleay River valley bends to the west obscuring the surface works around the accommodation and laydown areas.
- Temporary workers' accommodation:
  - Workers' accommodation will be required during the construction of the Project infrastructure. The accommodation is sized to house the majority of the workforce. The site chosen for the accommodation is on a flat area of land that has already been cleared of bushland. It is located 3.5 km south of the Georges Junction campsite, in the Macleay River valley. Due to the curve of the valley, with its forested slopes, the accommodation is not expected to be visible from the campsite, Kempsey Road or any existing residences.
- Installation of transmission towers and overhead wires:
  - As construction progresses, machinery movement to install the transmission infrastructure will be visible in various locations across the Project footprint.
  - Access tracks leading to each tower location will be cleared of vegetation to allow vehicles to transport towers to the sites. These access tracks will remain in place to provide maintenance access.
  - Clearing and trimming of vegetation around the towers to allow an unobstructed transmission corridor for the wires may also be visible.

- Construction of substations:
  - A substation is proposed at the emergency cable and ventilation tunnel (ECVT) location. This is approximately 200m northwest of the lower reservoir. Visibility to this location is limited due to the surrounding topography.

Motorists travelling along the local road network may experience views of the construction activity. The activity visible from public roads will be vehicles entering the access roads and the installation of transmission infrastructure. It is assumed the focus of these motorists will be in line with their direction of travel along the road corridors, minimising their views into the Project footprint.

Hikers and horse riders travelling along the National Trail will have views into some parts of the development during construction. Views into the reservoir and generation plant will only occur along a short portion of the trail. However, over the six km distance from Georges Junction to the reservoirs, travellers along the trail will have occasional views of the access road, accommodation camp, laydown areas, and office structures. These views will occur over a longer period of time as travellers make their way along the trail.

As the Project site establishment works and construction activities are considered temporary, landscaping is not proposed to mitigate visual impacts during the construction stage of the Project.

### 5.3 Visual impacts during operation

The operation impacts are considered to be those visual impacts that occur after the construction phase of the Project throughout its operational life. The Project description in Chapter 2 details the items that might be visible.

To assess these impacts, specific viewpoints are used to illustrate what people can see from that location and its immediate surrounds. A 'representative' viewpoint might be selected near a cluster of residences to illustrate the visibility of the Project from those residences. Such a representative viewpoint is selected and assessed in lieu of assessing each residence, and it represents the most sensitive location to illustrate the worst case for the area.

As part of the preparation of this LVIA, a site inspection was carried out on 11–14 July 2022. The purpose of the site inspection was to ground truth the representative viewpoints identified during the initial desktop analysis and photograph the Project area from representative viewpoints. Additional site visits occurred before and after the main one in July 2022.

The viewpoints were selected in part from ongoing discussions with residents. Other viewpoints were selected to represent views from public roads, heritage locations, and viewpoints within national parks.

Photographs from these representative viewpoints were captured and a selection of these photographs has been provided in the following sections as part of the viewpoint analysis. The photographs are used to represent and examine the human experience of the visual changes that may occur from the Project.

Figure 5.2 identifies the photograph locations and viewing directions and Table 5.2 provides the rationale for selecting each photograph location. The representative viewpoints were selected based on the following criteria:

- proximity to Project infrastructure
- the location of dwellings and other local features and important sites (campsites, East Kunderang Homestead and the National Trail)
- the positioning of regional and local roads and potential impacts on passing motorists
- local topography.

Ten representative viewpoints were selected from locations near residences and main roadways near the Project. The viewpoints include assessments for the National Trail, East Kunderang Homestead, Marys View and selected residences that have potential for visual impacts.

The locations of the viewpoints considered as part of this assessment are illustrated on Figure 5.2.

Table 6.1 in Section 6.8 provides a summary of the outcomes of the impact assessment, along with mitigation measures proposed.

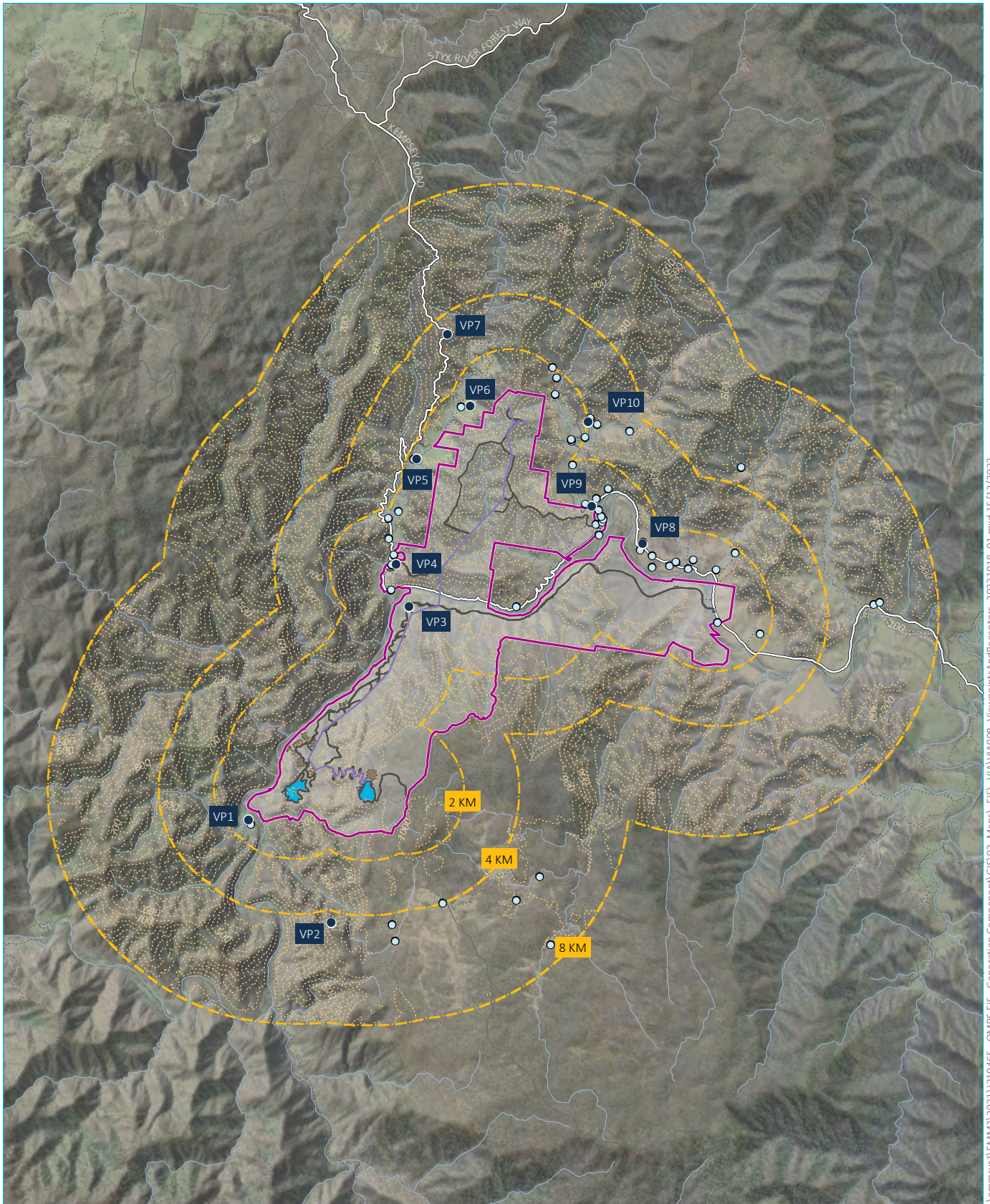
**Table 5.2 Assessed viewpoints, receptors and rationale for selection**

Assessment location	Viewpoint type(s)	Representative receptors	Distance to disturbance footprint*	Rationale for selection
Viewpoint 1	Dwellings, equestrian, hiking	East Kunderang Homestead (operated by the NPWS), National Trail	1.14 km	This is the closest dwelling and heritage site to the reservoir and power generation site. There is potential for the Project infrastructure to be visible from this site. This site is within the Oxley Wild Rivers National Park, which is listed as a UNESCO World Heritage area.
Viewpoint 2	Tourist destination	Marys View (within Oxley Wild Rivers National Park)	4.10 km	This view is a sensitive view from within the Oxley Wild Rivers National Park, which is listed as a UNESCO World Heritage area.
Viewpoint 3	Dwellings, equestrian and motorists	Georges Junction Campground, motorists along Kempsey-Armidale Road, National Trail	575 m to access road 825 m to transmission tower	Georges Junction Campground is a popular campground at the point where George’s Creek meets the Macleay River. There is also a lodge for holiday accommodation located nearby. This viewpoint is also representative of views experienced by hikers and equestrian users of the National Trail.
Viewpoint 4	Dwelling, equestrian and motorists	R2, R3, R4, R5, R6 residence, National Trail	120 m to access road 1.50 km to transmission tower	This is the view from a dwelling west of the transmission investigation area. It is representative of motorists along Kempsey-Armidale Road. This viewpoint is also representative of views experienced by hikers and equestrian users of the National Trail.
Viewpoint 5	Dwellings and equestrian	R7 residence, National Trail	2.90 km to transmission tower	This is the view from a dwelling west of the transmission investigation area. It is also representative of views experienced by hikers and equestrian users of the National Trail.
Viewpoint 6	Dwelling and equestrian	R8 residence, National Trail	1.47 km to transmission tower	This is the view from a dwelling west of the transmission investigation area. It is also representative of views experienced by hikers and equestrian users of the National Trail.
Viewpoint 7	Cyclists and motorists	Motorists along Kempsey-Armidale Road	2.46 km	This represents the typical view from Kempsey-Armidale Road, which climbs along the valley slopes west of the transmission investigation area.
Viewpoint 8	Dwelling, motorists	Motorists along Kempsey-Armidale Road	1.20 km to access road 4.16 km to transmission tower	This is the view east of the transmission investigation area. This represents the typical view from Kempsey-Armidale Road with distant views toward the Project.

**Table 5.2 Assessed viewpoints, receptors and rationale for selection**

Assessment location	Viewpoint type(s)	Representative receptors	Distance to disturbance footprint*	Rationale for selection
Viewpoint 9	Dwelling, motorists	R21, R22, R23, R24, R25, R26, R27, R28 residences along Lower Creek, motorists along Lower Creek Road	320 m to access road 2.81 km to transmission tower	This is the view from the Kempsey-Armidale Road bridge as it crosses Lower Creek. There are four residences nearby with similar views toward the transmission towers, west of the viewpoint.
Viewpoint 10	Dwelling, motorists	R10, R11, R12, R13, R14, R15, R16, R17, R18, R19 residences along Lower Creek, motorists along Lower Creek Road	1.62 km	This is the view from east of the transmission investigation area. This is the view from Petroi Road, near Lower Creek Road. There are four residences nearby with similar views toward the transmission towers, west and south of the viewpoint.

\* The distances shown in the table are taken from the nearest Project elements.



\\emmsvr1\EMMS\2021\210465 - OMPS EIS - Generation Component\GIS\02\_Maps\EIS\_VIA\A008\_ViewpointsAndReceptors\_2022.10.18\_01.mxd 15/12/2022

Source: EMM (2022); DFSI (2020); GA (2011); SMEC (2022)

**KEY**

- |   |  |
|---|--|
| <span style="border: 1px solid magenta; display: inline-block; width: 15px; height: 10px;"></span> Project area                         | Existing environment   |
| <span style="display: inline-block; width: 10px; height: 10px; background-color: black; border-radius: 50%;"></span> View point         | <span style="border: 1px solid grey; display: inline-block; width: 10px; height: 10px; border-radius: 50%;"></span> Sensitive receptor |
| <span style="border-bottom: 1px dashed yellow; display: inline-block; width: 20px;"></span> Viewshed buffer                             | <span style="border-bottom: 1px solid blue; display: inline-block; width: 20px;"></span> Watercourse/drainage line                     |
| <span style="border-bottom: 1px solid purple; display: inline-block; width: 20px;"></span> Transmission overhead lines                  | <span style="border-bottom: 1px dashed yellow; display: inline-block; width: 20px;"></span> Topographic contour (100 m interval)       |
| <span style="border-bottom: 1px solid grey; display: inline-block; width: 20px;"></span> Permanent road                                 | <span style="border-bottom: 2px solid grey; display: inline-block; width: 20px;"></span> Major road                                    |
| <span style="background-color: brown; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> Surface works | <span style="border-bottom: 1px solid grey; display: inline-block; width: 20px;"></span> Minor road                                    |
| <span style="background-color: black; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> Dam wall      | <span style="border-bottom: 1px dotted grey; display: inline-block; width: 20px;"></span> Vehicular track                              |
| <span style="background-color: cyan; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> Reservoir      |  |



Viewpoint locations and receptors

Oven Mountain Pumped Hydro Energy Storage Project  
 Landscape and Visual Impact Assessment  
 OMPS Pty Ltd  
 Figure 5.2



### 5.3.1 Viewpoint 1 - East Kunderang Homestead



-  Indicative extent of development footprint likely to be visible
-  Indicative extent of development footprint likely to be screened



Distance from development footprint	1.14 km
Duration of view	Long (Residence)
Viewing experience	Moderate
Scale of change	None
Magnitude of change	<b>Nil</b>
Viewer sensitivity	High
Scenic quality	High
Visual sensitivity	<b>High</b>
Visual impact rating	<b>Nil</b>

#### View type and context:

This view is from the lawn just north of the homestead. The view is oriented along the Macleay River with the hills west of the river visible.

The river is lined with trees that screen views along the valley floor.

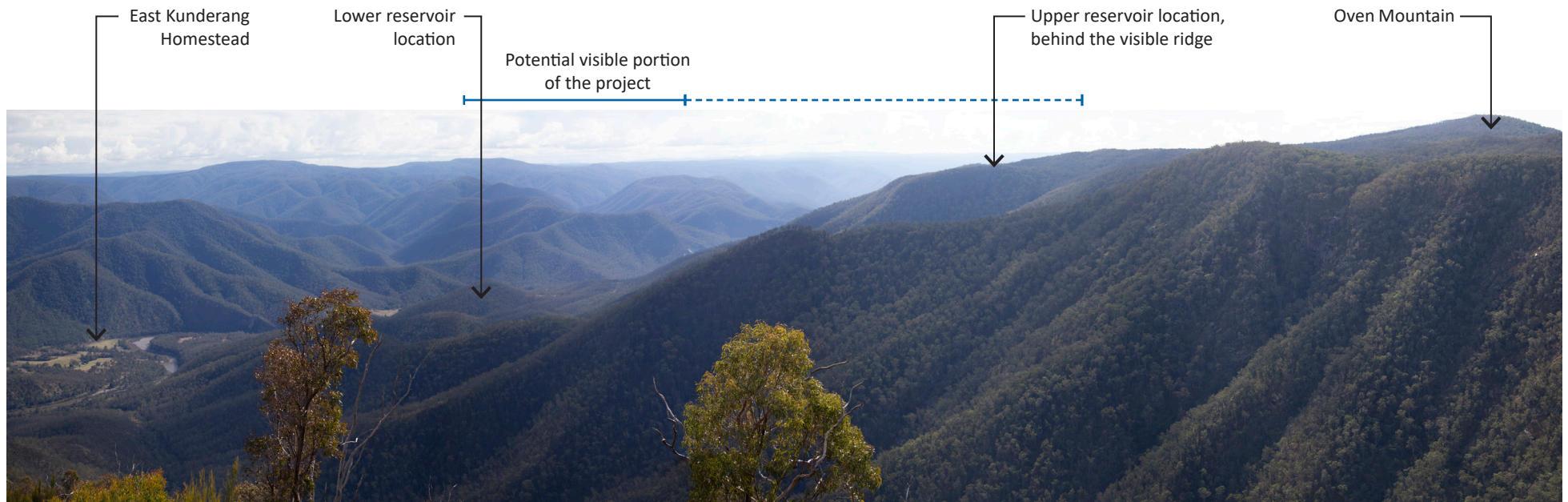
#### Potential visual impact:



From this location, the Project is located to the north, beyond the visible ridge line.

Views are screened by the ridge and the trees in the foreground.

No portion of the Project will be visible from this location.

### 5.3.2 Viewpoint 2 - Marys View



-  Indicative extent of development footprint likely to be visible
-  Indicative extent of development footprint likely to be screened



Distance from development footprint	4.1 km
Duration of view	Moderate
Viewing experience	Low
Scale of change	Low
Magnitude of change	<b>Low</b>
Viewer sensitivity	High
Scenic quality	High
Visual sensitivity	<b>High</b>
Visual impact rating	<b>Moderate</b>

#### View type and context:

This view is from Marys View, an important lookout in the Oxley Wild Rivers National Park. The park is also listed as a World Heritage site. The view overlooks the Macleay River as it winds northward toward Georges Junction.

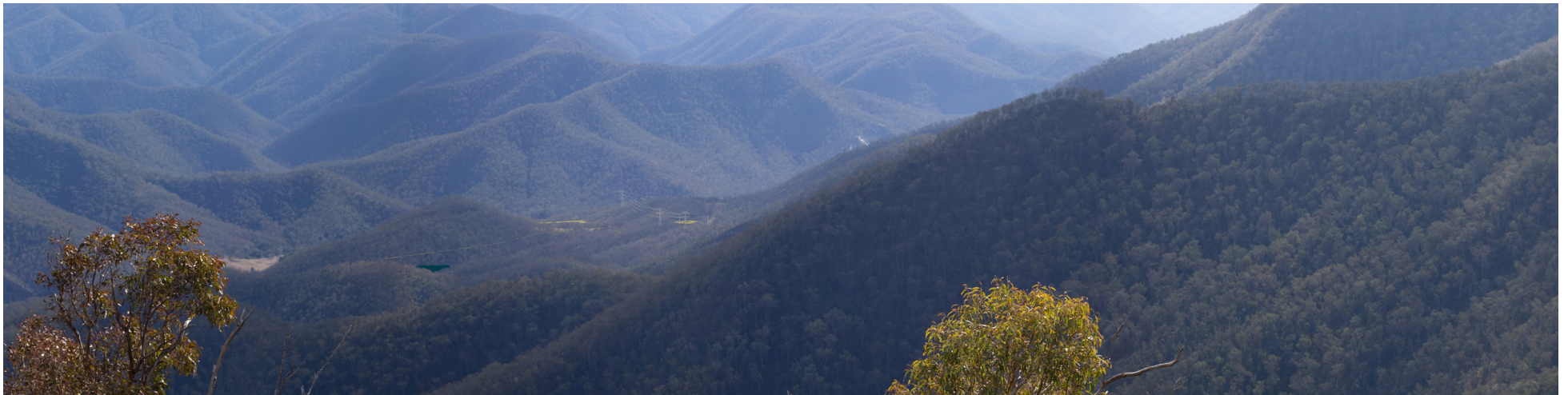
#### Potential visual impact:

From this location, the project is located to the west of the viewer. A small portion of the water in the lower reservoir may be visible along with transmission towers and roads.

## Viewpoint 2 - Marys View photomontage



Photomontage at same scale as the viewpoint analysis.



Enlargement of the photomontage to illustrate visible project elements.

### 5.3.3 Viewpoint 3 - Georges Junction camp site

Trees along the river screen project elements that area close to the viewer

Transmission towers will traverse the hillside and may be visible above the trees

Trees along the river screen project elements at lower elevations

Potential visible portion of the project



— Indicative extent of development footprint likely to be visible

- - - Indicative extent of development footprint likely to be screened



Distance from development footprint	575 m (access road) 825 m (tower)
Duration of view	Short - road Long - camp site
Viewing experience	High
Scale of change	Low
Magnitude of change	<b>Moderate</b>
Viewer sensitivity	Moderate
Scenic quality	Moderate
Visual sensitivity	<b>Moderate</b>
Visual impact rating	<b>Moderate</b>

#### View type and context:

This view is from the camp site looking south along the river. Georges Creek is visible in the foreground with the Macleay River beyond.

This view is representative of views for motorists using Kempsey Road and people along the Bicentennial national Trail.

#### Potential visual impact:

The project infrastructure will be located along an existing transmission line, which dictates its location in the landscape. Potentially five sets of towers will be visible along the lower slopes opposite the viewer (refer to photomontage on following page).

### Viewpoint 3 - Georges Junction camp site photomontage

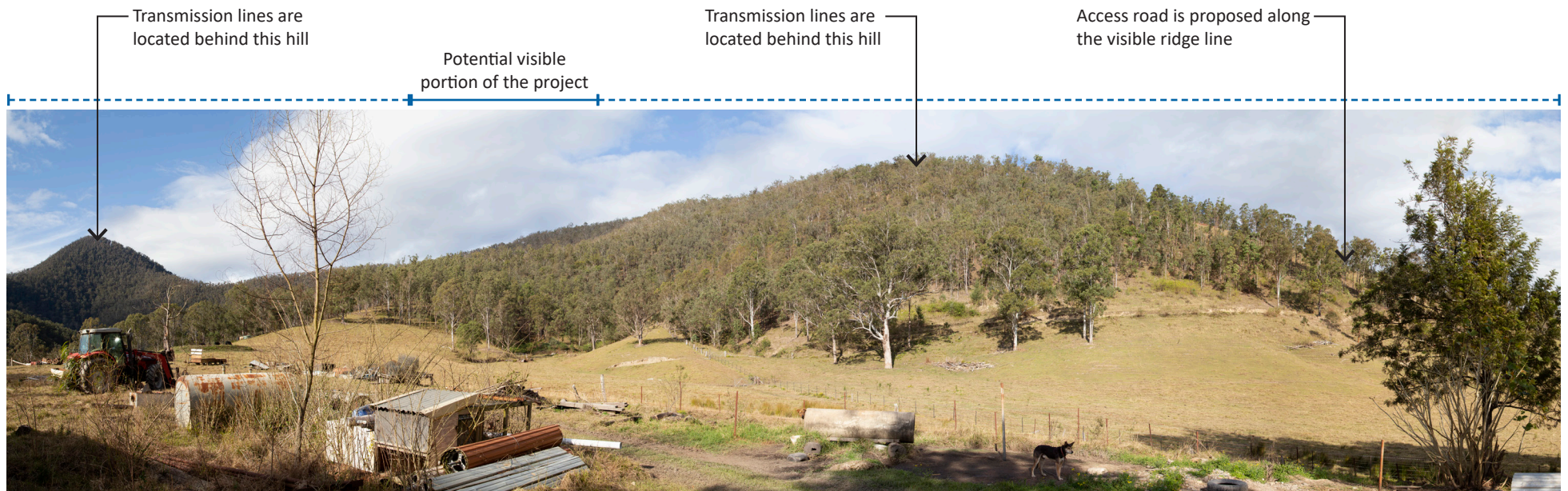




Photomontage at the same scale as the viewpoint analysis.



Enlargement of the photomontage to illustrate visible project elements.

### 5.3.4 Viewpoint 4 - R2 residence



 Indicative extent of development footprint likely to be visible  
 Indicative extent of development footprint likely to be screened



Distance from development footprint	120 m (access road) 1.50 km (tower)
Duration of view	Long - residence
Viewing experience	Moderate
Scale of change	Low
Magnitude of change	<b>Low</b>
Viewer sensitivity	Moderate
Scenic quality	Moderate
Visual sensitivity	<b>Moderate</b>
Visual impact rating	<b>Low</b>

**View type and context:**  
 Immediate views from this location represent a typical rural setting for the area, with land cleared for agricultural uses. The upper slopes are forested with mature trees.  
 The view is facing east from the valley floor. It illustrates views from the yard of a residence.  
 This view represents views for motorists using Kempsey Road and people along the Bicentennial national Trail.

**Potential visual impact:**  
 Project infrastructure may be visible above the tree line with a tower located along the ridge (refer to photomontage on following page).

## Viewpoint 4 - R2 residence photomontage





Photomontage at the same scale as the viewpoint analysis.



Enlargement of the photomontage to illustrate visible project elements.

### 5.3.5 Viewpoint 5 - R7 residence



-  Indicative extent of development footprint likely to be visible
-  Indicative extent of development footprint likely to be screened



Distance from development footprint	2.90 km
Duration of view	Long
Viewing experience	Moderate
Scale of change	Low
Magnitude of change	<b>Low</b>
Viewer sensitivity	Moderate
Scenic quality	Moderate
Visual sensitivity	<b>Moderate</b>
Visual impact rating	<b>Low</b>

#### View type and context:

This view is from a residence located on the valley floor. It is typical of other residences along the valley.

#### Potential visual impact:

Views of the project infrastructure may be visible along distant ridge (3.32 km). No visible disturbance is anticipated along the ridge.

## Viewpoint 5 - R7 residence photomontage



Photomontage at same scale as the viewpoint analysis.



Enlargement of the photomontage to illustrate visible project elements.

### 5.3.6 Viewpoint 6 - R8 residence



- Indicative extent of development footprint likely to be visible
- - - Indicative extent of development footprint likely to be screened



Distance from development footprint	1.47 km
Duration of view	Long
Viewing experience	Low
Scale of change	Low
Magnitude of change	<b>Low</b>
Viewer sensitivity	Moderate
Scenic quality	Moderate
Visual sensitivity	<b>Low</b>
Visual impact rating	<b>Low</b>

#### View type and context:

View from the residence closest to the connection point into the existing power grid. Existing transmission corridor is visible with trees cleared along the ridge (left in photograph)

#### Potential visual impact:

Project infrastructure may be visible above the tree line with three tower locations along the ridge (refer to photomontage on following page).

## Viewpoint 6 - R8 residence photomontage

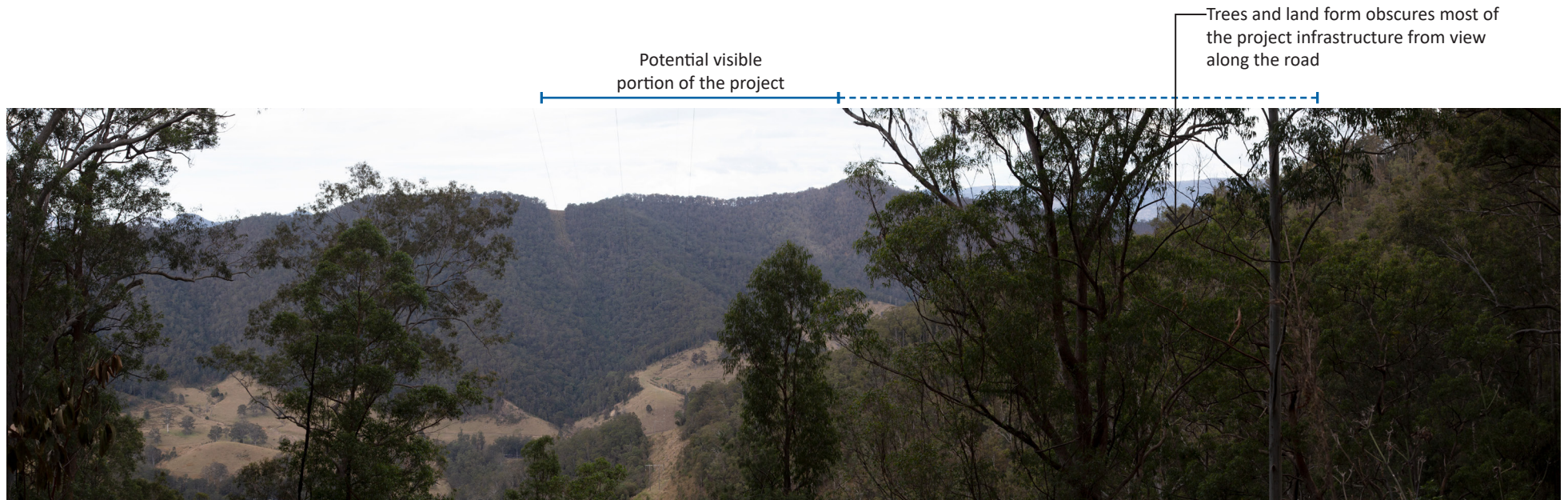




Photomontage at the same scale as the viewpoint analysis.

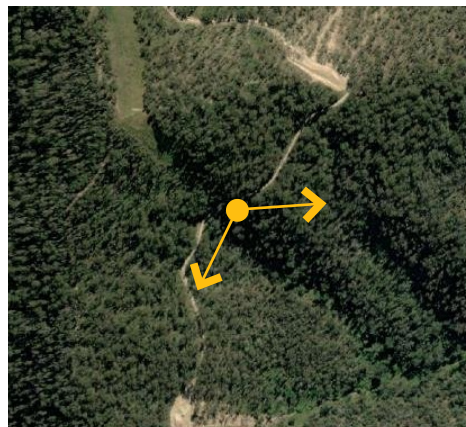


Enlargement of the photomontage to illustrate visible project elements.

### 5.3.7 Viewpoint 7 - Kempsey Road



-  Indicative extent of development footprint likely to be visible
-  Indicative extent of development footprint likely to be screened



Distance from development footprint	2.46 km
Duration of view	Short
Viewing experience	Low
Scale of change	Low
Magnitude of change	<b>Low</b>
Viewer sensitivity	Low
Scenic quality	Moderate
Visual sensitivity	<b>Low</b>
Visual impact rating	<b>Low</b>

#### View type and context:

This viewpoint represents views from Kempsey Road west of the project area. Only glimpses of the transmission line are available as motorists wind their way down the valley slopes toward Georges Junction.

#### Potential visual impact:

Views of the transmission towers may be visible along the ridge line.

## Viewpoint 7 - Kempsey Road photomontage

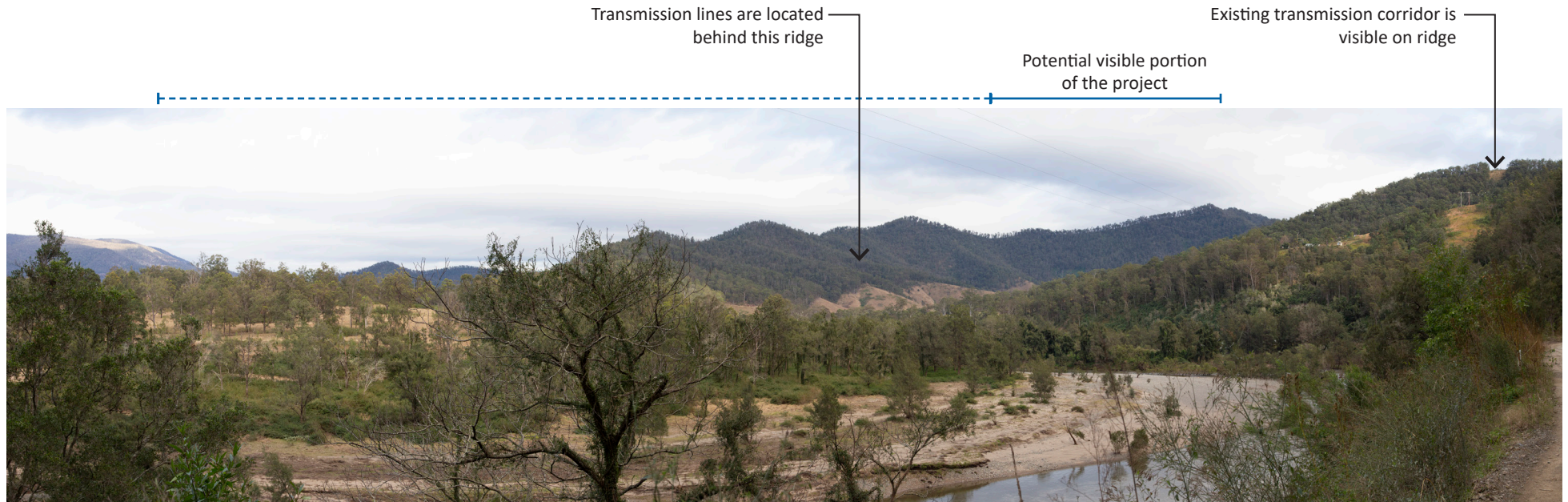


Photomontage at the same scale as the viewpoint analysis.



Enlargement of the photomontage to illustrate visible project elements.

### 5.3.8 Viewpoint 8 - Kempsey Road



- Indicative extent of development footprint likely to be visible
- Indicative extent of development footprint likely to be screened



Distance from development footprint	1.2 km 4.16 km (tower)
Duration of view	Short
Viewing experience	Low
Scale of change	Low
Magnitude of change	<b>Low</b>
Viewer sensitivity	Low
Scenic quality	High
Visual sensitivity	<b>Moderate</b>
Visual impact rating	<b>Low</b>

#### View type and context:

This view represents views from the road and residences east of Lower Creek. From the road, glimpses of the river and hills are available where there are gaps in the roadside vegetation.

#### Potential visual impact:

Views of the existing transmission line are apparent due to the cleared corridor on the ridge.  
Views of the proposed transmission line will be distant and limited.

## Viewpoint 8 - Kempsey Road photomontage





Photomontage at the same scale as the viewpoint analysis.



Enlargement of the photomontage to illustrate visible project elements.

### 5.3.9 Viewpoint 9 - Kempsey Road at Lower Creek Bridge



-  Indicative extent of development footprint likely to be visible
-  Indicative extent of development footprint likely to be screened



Distance from development footprint	320 m (access road) 2.81 km (tower)
Duration of view	Short
Viewing experience	Low
Scale of change	Low
Magnitude of change	<b>Low</b>
Viewer sensitivity	Moderate
Scenic quality	Moderate
Visual sensitivity	<b>Low</b>
Visual impact rating	<b>Low</b>

**View type and context:**  
 Tracts of grazing land stretch across the valley floors with trees marking waterways, residences.  
 Views are available across the valley to the ridges, where towers may be visible.

**Potential visual impact:**  
 Views of the transmission towers may be visible in the distance.  
 An access track is proposed 320 m south of this location, along a wooded ridge. No visual impact is anticipated from the access track.

## Viewpoint 9 - Kempsey Road at Lower Creek Bridge photomontage

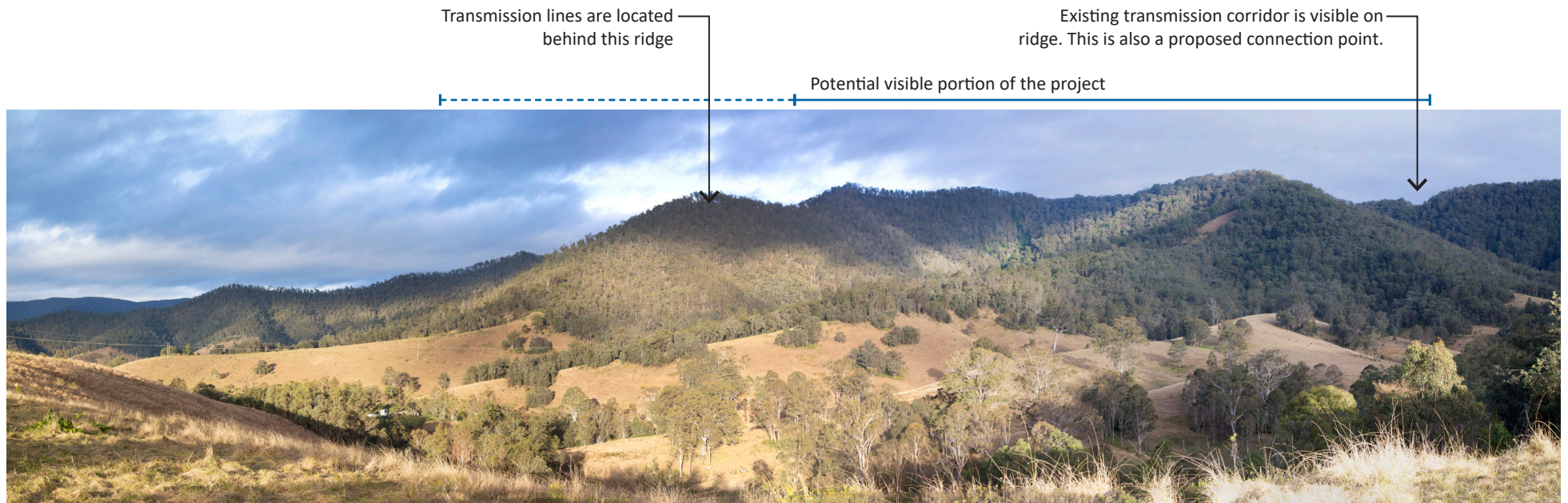


Photomontage at same scale as the viewpoint analysis.



Enlargement of the photomontage to illustrate visible project elements.

### 5.3.10 Viewpoint 10 - Petroi Road



——— Indicative extent of development footprint likely to be visible  
- - - - - Indicative extent of development footprint likely to be screened



Distance from development footprint	1.62 km
Duration of view	Short
Viewing experience	Low
Scale of change	Low
Magnitude of change	<b>Low</b>
Viewer sensitivity	Moderate
Scenic quality	Moderate
Visual sensitivity	<b>Low</b>
Visual impact rating	<b>Low</b>

#### View type and context:

This represents views from the valley east of the proposed connection point. There are four residences with similar views, varying slightly with topographical differences.

There is a visible existing transmission line traversing the scene from left to right, with the cleared ridges plainly visible.

#### Potential visual impact:

There is the potential for up to five sets of towers to be visible from this road and nearby residences (refer to photomontage on following page).

The existing transmission line is a mitigating factor along with the distance of the towers from the viewer.

## Viewpoint 10 - Petroi Road photomontage



Photomontage at the same scale as the viewpoint analysis.



Enlargement of the photomontage to illustrate visible project elements.

### 5.3.11 Visual impacts on residences

The residences near the Project area are likely to have varying degrees of visibility toward the Project. Some of these will have fragmented views that are broken by existing vegetation, orientation of the dwelling or topography.

There are a total of 52 residences within 8 km of the Project area (refer to Figure 5.2). One dwelling is located within 1 km and 12 are located between 1 km and 2 km from the disturbance footprint. No residences are located near the southern portion of the disturbance footprint, and residents to the north are in areas of low visibility.

The highest visual impacts are likely to be experienced from the dwellings closest to the Project. The closest residence is 984 m from the nearest Project element (transmission tower). This residence is used for lodging with no permanent resident on site. The next closest residences are 1.4 km and further from the Project elements (transmission towers).

Each resident has been listed in Table 5.3.

**Table 5.3 Dwellings within 8 km of the disturbance footprint**

Dwelling	Location	Distance to nearest Project element	Visual assessment	Recommended mitigation measures
R1 – Accommodation	9829 Kempsey Road	984 m	The residence sits north of Kempsey-Armidale Road with views of the river. There are trees along Macleay River banks between the residence and the Project to screen views of the closest transmission towers. Five towers have the potential to be visible across the valley, however there are existing trees along the road that screen a portion of the valley from view. Refer to Viewpoint 3 (Section 5.3.3).	None recommended since there are trees along the road and any additional screening trees planted near the residence will block views of the river and valley.
R2	9950 Kempsey Road	1,550 m	Refer to Viewpoint 4 (Section 5.3.4).	Not required.
R3	9986 Kempsey Road	1,520 m	There is potential for one tower to be visible. Topography and existing vegetation along upper slopes will likely screen the balance of the Project infrastructure.	Not required.
R4	10039 Kempsey Road	1,870 m	There is potential for one tower to be visible. Topography and existing vegetation along upper slopes will likely screen the balance of the Project infrastructure.	Not required.
R5	Kempsey Road	2,260 m	Topography and existing vegetation along upper slopes will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R6	9986 Kempsey Road	2,200 m	Topography and existing vegetation along upper slopes will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R7	10550 Kempsey Road	2,890 m	Refer to Viewpoint 5 (Section 5.3.5).	Not required.
R8	10790 Kempsey Road	1,495 m	Refer to Viewpoint 6 (Section 5.3.6).	Not required.
R9	9400 Kempsey Road	2,435 m	Topography and existing vegetation along upper slopes will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.

**Table 5.3 Dwellings within 8 km of the disturbance footprint**

Dwelling	Location	Distance to nearest Project element	Visual assessment	Recommended mitigation measures
R10	277 Petroi Road	1,830 m	There is potential for two towers to be visible. Topography and existing vegetation along upper slopes will likely screen the balance of the Project infrastructure.	Not required.
R11	275 Petroi Road	1,615 m	Topography and existing vegetation along upper slopes will likely screen the Project infrastructure. There is potential for two towers to be visible.	Not required.
R12	179 Petroi Road	1,200 m	There is potential for three towers to be visible. Refer to Viewpoint 10 (Section 5.3.10).	Not required.
R13	367 Lower Creek Road	1,455 m	There is potential for five towers to be visible. Refer to Viewpoint 10 (Section 5.3.10).	Not required.
R14	333 Lower Creek Road	1,515 m	There is potential for three towers to be visible. Refer to Viewpoint 10 (Section 5.3.10).	Not required.
R15	237 Lower Creek Road	1,890 m	There is potential for two towers to be visible. Topography near the residence will likely screen the balance of the Project infrastructure.	Not required.
R16	400 Lower Creek Road	1,840 m	Topography and existing vegetation around the residence will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R17	478 Lower Creek Road	1,970 m	Topography and existing vegetation along upper slopes will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R18	500 Lower Creek Road	2,165 m	Topography and existing vegetation along upper slopes will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.

**Table 5.3 Dwellings within 8 km of the disturbance footprint**

Dwelling	Location	Distance to nearest Project element	Visual assessment	Recommended mitigation measures
R19	2 Lower Creek Road	3,190 m	Topography and existing vegetation along upper slopes will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R20	4 Lower Creek Road	2,550 m	Refer to Viewpoint 9 (Section 5.3.9).	Not required.
R21	8851 Kempsey Road	2,890 m	Topography and existing vegetation along upper slopes will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R22	8853 Kempsey Road	3,150 m	Topography and existing vegetation along upper slopes will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R23	8899 Kempsey Road	2,975 m	Topography and existing vegetation along upper slopes will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R24	8919 Kempsey Road	3,095 m	Topography and existing vegetation along upper slopes will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R25	8929 Kempsey Road	3,170 m	Topography and existing vegetation along upper slopes will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R26	8937 Kempsey Road	3,150 m	Topography and existing vegetation along upper slopes will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.

**Table 5.3 Dwellings within 8 km of the disturbance footprint**

Dwelling	Location	Distance to nearest Project element	Visual assessment	Recommended mitigation measures
R27	8920 Kempsey Road	2,980 m	Topography and existing vegetation along upper slopes will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R28	8969 Kempsey Road	3,180 m	Topography and existing vegetation along upper slopes will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R29	8574 Kempsey Road	4,550 m	Topography and existing vegetation will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R30	8574 Kempsey Road	4,540 m	Topography and existing vegetation will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R31	8575 Kempsey Road	4,940 m	Topography and existing vegetation will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R32	8573 Kempsey Road	5,090 m	Topography and existing vegetation will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R33	8493 Kempsey Road	5,570 m	Topography and existing vegetation will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R34	8476 Kempsey Road	5,720 m	Topography and existing vegetation will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R35	8421 Kempsey Road	6,145 m	Topography and existing vegetation will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R36	8404 Kempsey Road	6,180 m	Topography and existing vegetation will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.

**Table 5.3 Dwellings within 8 km of the disturbance footprint**

Dwelling	Location	Distance to nearest Project element	Visual assessment	Recommended mitigation measures
R37	8314 Kempsey Road	6,950 m	Topography and existing vegetation will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R38	8314 Kempsey Road	7,365 m	Topography and existing vegetation will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R39	350 Smiths Creek Road	6,810 m	Topography and existing vegetation will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R40	8148 Kempsey Road	7,655 m	Topography and existing vegetation will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R41	7986 Kempsey Road	9,015 m	Topography will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R42	7456 Kempsey Road	11,985	Topography will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R43	7380 Kempsey Road	12,140 m	Topography will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R44	West Kunderang	8,070 m	Topography will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R45	East Kunderang Homestead	1,160 m	Topography and existing vegetation will likely screen the Project infrastructure. There is no visual impact expected at this homestead.	Not required.
R46	577B Cochrane Firetrail	3,850 m	Topography and existing vegetation will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R47	410 Warrick Road	4,380 m	Topography and existing vegetation will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.

**Table 5.3 Dwellings within 8 km of the disturbance footprint**

Dwelling	Location	Distance to nearest Project element	Visual assessment	Recommended mitigation measures
R48	1311 Cochrane Firetrail	3,830 m	Topography and existing vegetation will likely screen the Project infrastructure. There is no visual impact expected at this residence.	Not required.
R49	1308 Cochrane Firetrail	4,420 m	Topography and existing vegetation will likely screen the Project. There is no visual impact expected at this residence.	Not required.
R50	1310 Cochrane Firetrail	5,400 m	Topography and existing vegetation will likely screen the Project. There is no visual impact expected at this residence.	Not required.
R51	2152 Cochrane Firetrail	5,665 m	Topography and existing vegetation will likely screen the Project. There is no visual impact expected at this residence.	Not required.
R52	2150 Cochrane Firetrail	7,115 m	Topography and existing vegetation will likely screen the Project. There is no visual impact expected at this residence.	Not required.

## 5.4 Night time lighting assessment

Lights have the potential to alter the night time landscape character of the region.

Potential sources of light sources include:

- lighting for safety and security on Project infrastructure
- lighting for safety and security on ancillary structures.

### 5.4.1 Overview of potential impacts from night lighting

New light sources related to the Project have the potential to extend visual impacts into the night. Due to the relatively isolated location of the Project, there is a very small number of existing light sources to illuminate the night sky. The existing light sources are associated with residences and motor vehicles travelling along Kempsey Armidale Road. People would generally experience the night sky with minimal light sources.

Visual impacts from night lighting would likely be experienced by people who are outside in the landscape. The impact of night lighting is unlikely to be experienced from inside dwellings since internal lights reflect off windows and limit views of the exterior at night. The highest impact is expected to be on people who enjoy the outdoors at night, specifically night-sky enthusiasts, photographers, star gazers and campers.

The dark sky is a valued quality of the rural landscape.

### 5.4.2 Lighting during construction

During the construction period, construction activity is expected to continue through the night every day of the week.

#### i Power generation facility and related works

As mentioned in Section 5.1, the construction sites are expected to be shielded from view by ridgelines and the curve of the Macleay River valley. Therefore, the lights used during the night construction, will also be hidden from view.

Even though the lights are not expected to be visible, there may be a glow of light in the night sky. This would occur from light spill if lighting fixtures are not shielded to block any light from shining outward or upward. Light glow can also occur if light is shining downward and reflects off a light-coloured or reflective surface. Locations that may be impacted from the light glow, are East Kunderang Homestead and residences on the Carrai tablelands south-east of the Project area.

The East Kunderang Homestead is approximately 1.2 km from the Project and is separated from the lower reservoir by a ridge. Depending on atmospheric conditions, this location is likely to experience a low amount of light glow during construction of the Project. During nights with low cloud cover, fog, or particulates in the air, the light glow is expected to be present. During clear nights, little or no glow is expected at the homestead site.

The residences on the tablelands are approximately 3.8 km from the upper reservoir. Because of the undulating topography and thick vegetation, impacts from construction lighting are expected to be negligible.

#### ii Access roads

##### Eastern access road

The construction of access roads is expected early in the Project's construction stages. The main access road runs south of the Macleay River, from Georges Junction eastward to join Kempsey Road near Carollis Creek. The access road is approximately 11 km long (refer to Figure 2.1).

The construction lighting along this access road has the potential to impact 12–15 residences located on Kempsey Road, which runs along the northern banks of the river. The construction lighting is expected to impact a residence only while the construction takes place near that residence.

### **Transmission line access roads**

Secondary access roads that provide access to the transmission tower sites are also a consideration as a source of lighting impacts. These roads typically are located along ridgelines between tower locations. If these are constructed during the night-time hours, lights from the machinery and stationary lights may be visible from residences in the adjacent valleys.

Lighting from the construction of these access roads have the potential to be seen from residences within the Georges Creek valley and the Dyke River valley. Any impacts from the construction lighting would be considered minimal and temporary, only occurring while the roads are under construction.

### **iii Transmission infrastructure**

With a 24 hour a day construction schedule, it is conceivable that some of the transmission infrastructure will be installed during the night.

Lighting from the construction of transmission infrastructure have the potential to be seen from residences within the Georges Creek valley and the Dyke River valley (refer to Section 5.3 for the viewpoints and residences with views of transmission tower locations). Any impacts from the construction lighting would be considered minimal and temporary, only occurring while the transmission infrastructure is under construction.

### **5.4.3 Project infrastructure lighting**

The Project infrastructure that may need lighting at night includes the reservoirs, generation components, and substations.

The Project infrastructure has been sited to minimise visibility from existing residences, homesteads, and public viewpoints. It is unlikely that the proposed lighting will create a noticeable impact on the existing night time lighting.

### **5.4.4 Ancillary lighting**

In addition to Project infrastructure, night lighting may be required on ancillary buildings, compounds, and roadways. These include permanent operations and maintenance (O&M) buildings, temporary construction compounds and permanent compounds.

At this stage of the Project, the location and type of lighting required on these ancillary elements is yet to be confirmed. It is assumed that low-level lighting for security, maintenance, and emergency purposes. Permanent lighting locations will be determined by AS requirements.

### **5.4.5 Lighting design principles**

Lighting design principles to reduce or mitigate the visibility of lighting have been developed and are outlined in Section 6.5.1.

## 5.5 Cumulative impacts

It is important to consider the effect of multiple projects on the visual character of the landscape. Multiple projects near each other can result in cumulative visual impacts that impact the way a landscape is experienced. Cumulative visual impacts can arise from the presence of similar projects that may have a low impact individually, but when viewed together, can have a significant visual impact on the landscape. Generally, this occurs when:

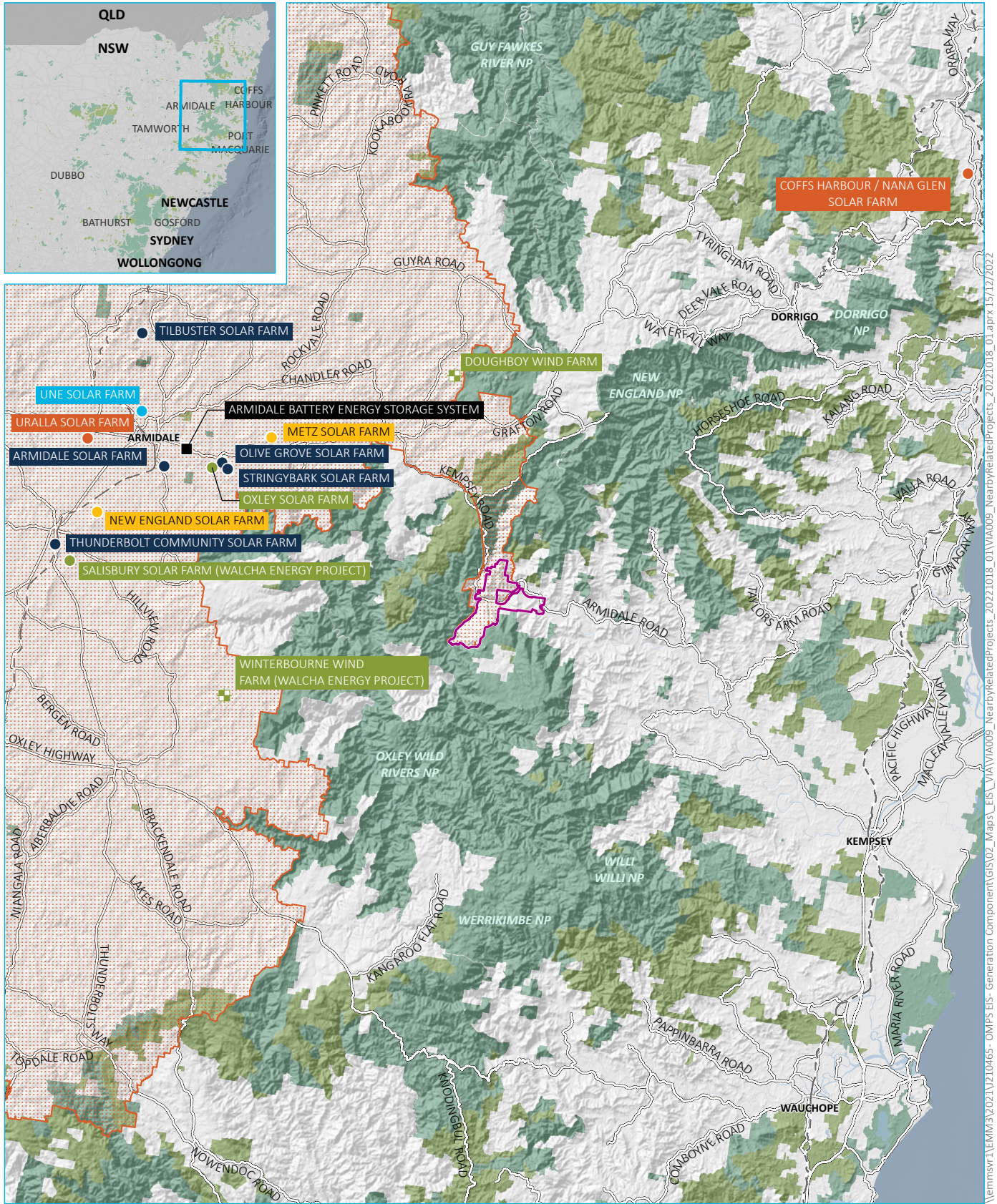
- Multiple renewable energy projects are located within an area, and they change perceptions of the area due to repeated exposure to similar projects – this can be referred to as ‘sequential viewing’ and projects do not have to be seen simultaneously.
- Simultaneous views of multiple renewable energy projects from public or private viewing locations.

Proposed, approved, under construction and operational developments (known at the time of this EIS preparation) within, and in the vicinity of, the Project area are shown on Figure 5.3 with the developments listed in Table 5.4. The nearest energy project to the Project is Doughboy Wind Farm, which is located 30.5 km north of the Project area.

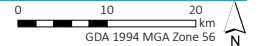
The Project is isolated within the Macleay River valley. There are multiple mountain ranges between it and any other energy project. Because of this isolated location, there are no anticipated cumulative landscape and visual impacts.

**Table 5.4** Local renewable energy projects

Project	Relative location (distance from the Project area)	Status	Cumulative impact Potential and timing
Doughboy Wind Farm	30.5 km north of the Project area.	Planning stages	None anticipated
Winterbourne Wind Farm	37 km south-west of the Project area.	Planning stages	None anticipated
Metz Solar Farm	40.5 km north-west of the Project area.	Construction stages	None anticipated
Stringybark Solar Farm	45.5 km north-west of the Project area.	Approved	None anticipated
Olive Grove Solar Farm	46 km north-west of the Project area.	Approved	None anticipated
Oxley Solar Farm	47 km north-west of the Project area.	Planning stages	None anticipated
Armidale BESS	52 km north-west of the Project area.	Planning stages	None anticipated
Armidale Solar Farm	54 km north-west of the Project area.	Approved	None anticipated
New England Solar Farm	61 km west of the Project area.	Construction stages	None anticipated
Salisbury Solar Farm	62 km west of the Project area. area.	Planning stages	None anticipated
Thunderbolt Community Solar Farm	67.5 km west of the Project	Approved	None anticipated
Tilbuster Solar Farm	68 km north-west of the Project area.	Approved	None anticipated
Thunderbolt Energy Hub – Solar Farm	72 km west of Project area	In planning	None anticipated
Thunderbolt Wind Farm	72 km west of Project area	Under assessment	None anticipated
Guyra Solar Farm	78 km north-west of Project area	Under construction	None anticipated
Bendemeer Solar farm	92 km south-west of Project area	In planning	None anticipated
Rangoon Wind Farm	93 km north-west of Project area	In planning	None anticipated



Source: EMM (2022); ABS (2021); DFSI (2020, 2021); GA (2011)



- KEY**
- Project area
  - Energy infrastructure projects
  - Battery - In Planning
  - Solar - Approved
  - Solar - In Planning
  - Solar - Operational
  - Solar - Under Construction
  - Solar - Withdrawn
  - Wind - In Planning
  - Renewable energy zones
  - New England
  - Existing environment
  - Rail line
  - Major road
  - NPWS reserve
  - State forest

### Major projects in surrounding region

Oven Mountain Pumped Hydro Energy Storage Project  
 Landscape and Visual Impact Assessment  
 OMPS Pty Ltd  
 Figure 5.3



## 6 Mitigation measures

A range of visual impact mitigation methods are available to screen development. As a general rule, mitigation should aim first at reducing the visible changes to the landscape. Secondly, mitigation should screen new infrastructure introduced by the Project to present a landscape that is as similar to the existing landscape as possible.

Mitigation measures specific to the Project have been identified and are outlined below. The mitigation measures presented below are made notwithstanding issues raised by other environmental aspects (e.g. biodiversity and construction and operational noise).

### 6.1 Design considerations

Good design principles applied to the Project during the design stages can help keep the visual impacts to a minimum. This is done primarily through careful siting of Project elements to take advantage of the topography and existing vegetation for screening.

### 6.2 Construction mitigation

The potential for the greatest visual impact occurs during the construction stages of a Project. This is when the changes to the landscape occur, and there is a lot of movement of vehicles and equipment. Even though construction is viewed as temporary, practical steps should be taken to reduce the impacts during this stage. These practices include:

- locate laydown areas in areas with limited visibility from residences and public roads
- minimise creation of dust from vehicles and wind
- restore or remediate any earthworks undertaken during construction
- keep clearing and trimming of vegetation to a minimum.

### 6.3 Pumped hydro-electric and generation works

The size of the PHGW, with two reservoirs, spillways and connecting infrastructure present a challenge when trying to reduce its visibility. The primary mitigation measure is the siting of each Project element to ensure it is visible to the smallest number of people possible.

This LVIA study has found that the pumped hydro-electric and generation works has been sited in a place where it is only visible from two observation points. These are Marys View (refer to Section 5.3.2) and along the National Trail (directly across from the lower reservoir).

### 6.4 Transmission infrastructure

The transmission infrastructure is necessary to connect the PHGW with the existing power grid at TransGrid Line 965. The closest existing connection point is located 12.7 km north-east of the generation plant.

Transmission infrastructure consists of towers and overhead wires. These are necessarily routed along ridges and high points to enable vegetation trimming or clearance around the suspended wires. The most effective way of minimising visibility is the careful selection of the transmission corridor.

The tower locations for the Project have been located along ridges that are not in plain view from any single location. While there are locations where up to five towers are visible, the number of visible towers from most locations has been kept to a minimum.

## 6.5 Lighting

Lighting design principles outlined below should be followed to minimise any light spill from the Project.

### 6.5.1 Lighting design principles

Minimising light pollution of the night sky needs to be included in the design phases of the Project.

Siting Project elements can play a large role in reducing the visibility of any required lighting. Good use of the landscape to reduce lighting impacts include:

- use of landform to shield the Project from view
- use of landscape elements (trees, mounding, walls) to shield effects of lighting from view.

Good lighting design can also minimise, and in some cases eliminate light pollution of the night sky. Design standards like AS 4282 *Control of obtrusive effects of outdoor lighting*, *National Light Pollution Guidelines for Wildlife* (2020), and the *Dark Sky Planning Guideline* (2016) should be applied during the design of Project elements.

The *Dark Sky Planning Guideline* (2016) was developed by DPE to provide design guidelines that maintain the dark sky, and to improve lighting practices. The guidelines are directed at Projects within the Siding Spring Observatory Dark Sky Region, which covers a radius of 200 km from the observatory. While the Project is not within the Dark Sky Region, the guidelines do provide relevant guidance that can be applied to the lighting design. Design guidelines adapted from the guidelines include:

- eliminating upward spill light
- directing light downwards, not upwards
- use of shielded fittings
- avoiding 'over' lighting
- switching lights off when not required
- use of energy efficient bulbs
- use of asymmetric beams, where floodlights are used
- ensuring lights are not directed towards reflective surfaces
- use of warm white colours.

## 6.6 Vegetation retention

The landscape character of the area consists of dense bushland along the slopes of steep hillsides leading down to the Macleay River. North of Georges Junction the valleys have wooded slopes with cleared grazing pastures along the valley floors. To retain the character of the landscape, existing vegetation should be retained where possible. This will also help maintain existing levels of screening.

Specific areas to target for vegetation retention are:

- Ridges – transmission lines typically are located along ridgelines where they can traverse large distances between towers. However, clearing ridgelines of vegetation creates a highly visible notch in the vegetation. Minimising the amount of clearing will help reduce the visibility of the transmission corridor.

- Road corridors – trees adjacent to roads should be considered for retention as they form an existing screen.
- Macleay River – trees along the river form an effective screen from the river and the National Trail.

## 6.7 Landscaping

Using planting as a visual screen is a beneficial mitigation measure used to reduce the visibility of a renewable energy project from a specific vantage point. It is effective in screening views from a fixed point, like a residence, or a sequence of points, like travelling along a roadway. Generally, the planted screen needs to be close to the viewing point to be effective.

It should be noted that people living and visiting the Macleay River area value views of the landscape. It may therefore be detrimental to install plants to screen the view of transmission towers, which will also block views of the landscape. Care must be taken when proposing landscape screening that may create other adverse effects. It is therefore recommended that if any landscape screening is to be done it should be carried out in consultation with the landowners and/or people affected by the Project.

Recommendations for landscape screening are not considered necessary and have not been developed, but may consider, pending recommendations that come out of the ongoing consultation process. Landscape screening would only apply to residences that have potential visual impacts listed in Table 5.3.

## 6.8 Impact and mitigation summary

**Table 6.1 Summary of results of visual impacts at each viewpoint**

Viewpoint	Distance to disturbance footprint	Representative receptors	Residential or public	Project infrastructure visible based ZVI/ photomontage	Magnitude of change	Visual sensitivity	Visual impact rating	Predicted impact	Mitigation proposed Refer to Table 5.2 and Table 5.3	Visual impact rating after mitigation	Potential for cumulative impacts
Viewpoint 1	1.14 km	East Kunderang Homestead (operated by the NPWS), National Trail	Residential and public	No	Nil	High	<b>Nil</b>	None	None	<b>Nil</b>	No
Viewpoint 2	4.1 km	Marys View (within Carrai NP)	Public	Yes	Low	High	<b>Moderate</b>	Moderate	None	<b>Moderate</b>	No
Viewpoint 3	575 m to access road 825 m to transmission tower	Georges Junction Campground, motorists along Kempsey Armidale Road, National Trail	Public	Yes	Moderate	High	<b>Moderate</b>	Moderate	None	<b>Moderate</b>	No
Viewpoint 4	120 m to access road 1.50 km to transmission tower	R2 residence, National Trail	Residential and public	Yes	Low	Moderate	<b>Low</b>	Low	None	<b>Low</b>	No

**Table 6.1** Summary of results of visual impacts at each viewpoint

Viewpoint	Distance to disturbance footprint	Representative receptors	Residential or public	Project infrastructure visible based ZVI/ photomontage	Magnitude of change	Visual sensitivity	Visual impact rating	Predicted impact	Mitigation proposed Refer to Table 5.2 and Table 5.3	Visual impact rating after mitigation	Potential for cumulative impacts
Viewpoint 5	2.90 km to transmission tower	R7 residence, National Trail	Residential and public	Yes	Low	Moderate	<b>Low</b>	Low	None	<b>Low</b>	No
Viewpoint 6	1.47 km to transmission tower	R8 residence, National Trail	Residential and public	Yes	Low	Low	<b>Low</b>	Low	None	<b>Low</b>	No
Viewpoint 7	2.46 km	Motorists along Kempsey Armidale Road	Public	Yes	Low	Low	<b>Low</b>	Low	None	<b>Low</b>	No
Viewpoint 8	1.2 km to access road 4.16 km to transmission tower	Motorists along Kempsey Armidale Road	Public	Yes	Low	Moderate	<b>Low</b>	Low	None	<b>Low</b>	No
Viewpoint 9	320 m to access road 2.81 km to transmission tower	R21, R21, R22, R23, R24, R25, R26, R27, R28 residences along Lower Creek, motorists along Lower Creek Road	Residential and public	Yes	Low	Low	<b>Low</b>	Low	None	<b>Low</b>	No

**Table 6.1 Summary of results of visual impacts at each viewpoint**

Viewpoint	Distance to disturbance footprint	Representative receptors	Residential or public	Project infrastructure visible based ZVI/ photomontage	Magnitude of change	Visual sensitivity	Visual impact rating	Predicted impact	Mitigation proposed Refer to Table 5.2 and Table 5.3	Visual impact rating after mitigation	Potential for cumulative impacts
Viewpoint 10	1.62 km	R10, R11, R12, R13, R14, R15, R16, R17, R18, R19 residences along Lower Creek, motorists along Lower Creek Road and Petroi Road	Residential and public	Yes	Low	Low	Low	Low	None	Low	No

## 7 Conclusion

This LVIA has been prepared to assess the visual impacts of the Project, including lighting impacts and potential impacts on views of the Project from key vantage points; including amenity impacts on National Parks and Reserves, Conservation Areas, World Heritage Areas and areas of declared wilderness under the NSW *Wilderness Act 1987*.

### 7.1 Landscape impact summary

This study has identified four LCZs, based on the dominant landform and landscape features. These are:

- Macleay River valley – Characterised by the Macleay River along the valley floor with dense vegetation along the banks:
  - views are constrained along the valley due to difficult access and to the vegetation and height of the valley walls
  - this LCZ has a **Low** landscape character impact.
- Valleys – characterised by gentle slopes and wider valley floors:
  - the valley floors are cleared for agriculture with wooded slopes and views tend to be fairly open
  - this LCZ has a **Low** landscape character impact.
- Upper slopes – characterised by steep slopes above the Macleay River valley and valley LCZs:
  - these slopes are wooded with difficult access. Views are limited due to dense tree canopies
  - this LCZ has a **Moderate** landscape character impact.
- Plateau – characterised by flattening topography above the upper slopes:
  - dense vegetation and undulating topography limits views
  - this LCZ has a **Negligible** landscape character impact.

### 7.2 Visual impact summary

A visual impact assessment is not meant to determine whether a Project is visible or not. The objective is to determine how the Project will impact on the existing landscape character and visual amenity. Any potential negative impact must be investigated to determine how it can be mitigated and reduced to an acceptable level.

The Project design, development footprint and placement of the infrastructure has evolved to minimise or avoid visual impacts where possible. The reservoirs and operations buildings are expected to be visible only from a limited stretch of the National Trail and Macleay River. The proposed pump facility will also be partly visible from this location as it will be located on the river bank below the lower reservoir.

Nonetheless, the development of the Project will result in some changes to the landscape. Visual impacts will occur during the construction and operational stages of the Project, and the visual landscape will be altered from its current state for the duration of the operation of the Project.

Visual assessments have been conducted from a number of representative viewpoints surrounding the development footprint. The representative viewpoints were selected based on the following criteria:

- proximity to the development footprint
- the location of receptors (i.e. dwellings) and other local features
- the positioning of regional and local roads and potential impacts on passing motorists
- local topography
- presence of vegetation with potential to provide screening.

The representative viewpoints have been assessed to demonstrate the potential visual impacts of the Project. The visual assessment determined that, of the viewpoints assessed, infrastructure may be visible to varying degrees from nine of the ten viewpoints. Based on variable elevation and undulation in the landscape and the presence of vegetation, combined with the size of the power generation infrastructure and height of the transmission towers, the impact assessment predicts:

- a low visual impact from Viewpoints 4, 5, 6, 7, 8, 9 and 10
- a moderate visual impact from Viewpoints 2 and 3
- there were no viewpoint locations with a high impact rating
- Viewpoint 1 had a nil rating as no visual impacts are predicted.

East Kunderang Homestead (Viewpoint 1) had no predicted visual impacts. Marys View (Viewpoint 2) had a moderate predicted visual impact. Both of these sites are located within the Oxley Wild Rivers National Park, which is also a UNESCO World Heritage area.

In addition to the viewpoint assessments, each resident within 8 km of the development footprint is listed with the potential visual impacts (Table 5.3). The assessment for residences predicts:

- no impact to low visual impact from R2 – R52
- one residence (R1 – lodging/accommodation) with moderate visual impact
- no residences with a high impact rating.

### 7.2.1 Night lighting

Construction night lighting is temporary and would impact a limited number of residences for duration of construction of roads and transmission line near to each property.

The only lighting proposed through the operational phase are for security and maintenance purposes. This will primarily occur at the buildings.

The night lighting would be inwardly focused and shielded so it does not result in light spill impacts to neighbouring properties or the night sky.

## 7.2.2 Cumulative impacts

Cumulative visual impacts can arise from the presence of similar projects and can have a significant visual impact on the landscape when viewed together. The Project is isolated within the Macleay River valley. There are multiple mountain ranges between it and any other energy project. The closest energy project is approximately 30.5 km north of the Project area, and well over an hour's drive away through mountainous terrain.

Because of this isolated location, the distance and the time needed to travel to the Project area, there are no anticipated cumulative landscape and visual impacts.

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