

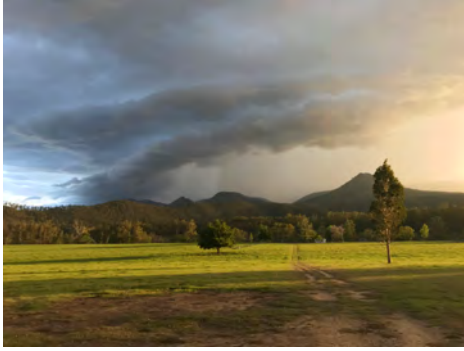

Oven Mountain Pumped Hydro Energy Storage Project
Scoping Report

Prepared for OMPS Pty Ltd
January 2021

EMM
creating opportunities

OVEN MOUNTAIN
PUMPED HYDRO STORAGE

Oven Mountain Pumped Hydro Storage Project

Scoping Report

Report Number

J200096 RP#7

Client

OMPS Pty Ltd

Date

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Version

v3.0 Final

Prepared by	**Approved by**
	
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Senior Environmental Scientist	Director
29 January 2021	29 January 2021

Executive Summary

ES1 Introduction

OMPS Pty Ltd (OMPS) is developing the Oven Mountain Pumped Hydro Energy Storage Project (the Project), a scheme that will provide 600 megawatts (MW) of electricity generating capacity and up to 12 hours of energy storage. The Project is off-river and situated on private land in the Armidale Regional Local Government Area (LGA), near the Kempsey Shire LGA. The location's pumped hydro energy storage potential has been studied and is of superior quality.

The Project will provide significant scale, deep storage and flexible, dispatchable generation to serve New South Wales' (NSW) energy reliability needs and the objectives of the NSW Government's *Electricity Infrastructure Roadmap* and the *EII Act*. The Project will provide network benefits and services directly to the transmission backbone in the New England area, a newly enacted Renewable Energy Zone (REZ).

The Project is located on private land (Lots 18,19 and 37 in Deposited Plan DP 756471) within the Armidale Regional LGA. The Project area is bordered by the Macleay River to the immediate west and the Carrai National Park to the east, approximately 8 kilometres (km) south of Kempsey Road (near Georges Junction). The nearest large regional centres to the Project area are Armidale and Kempsey. Armidale is approximately 60 km north west and Kempsey is about 75 km south east. The nearest community to the Project area is Lower Creek, over 10 km away, and the closest town is Bellbrook which is located east from the boundary of the Project with a travel distance of approximately 50 km.

This scoping report has been prepared by EMM Consulting Pty Limited (EMM) on behalf of OMPS, the proponent for the Project. It has been prepared in accordance with the draft *Environmental Impact Assessment Guidance Series* (June 2017) prepared by the then Department of Planning and Environment (now Department of Planning, Industry and the Environment (DPIE)).

The purpose of this scoping report is to request and inform the content of the Secretary's environmental assessment requirements (SEARs) for the preparation of the environmental impact statement (EIS) for the Project.

ES2 An overview of the Project

The Project comprises of a pumped storage hydropower plant generating and/or consuming 600 MW of electricity to and from the national grid with a capacity of up to 12 hours of storage. This scoping report addresses works associated with the hydropower scheme works and ancillary development (where relevant to those works) for the Project. A separate application (and therefore separate scoping report) will be prepared for the transmission works.

The Project will include upper and lower water reservoirs constructed on an ephemeral tributary of the Macleay River, near Georges Junction, and will operate as a closed-loop circuit. An underground power station will be connected to the reservoirs by power waterways or tunnels.

Water access from the Macleay River will be required for an initial, one-off fill of the reservoirs and minimal top-up will be required thereafter. The initial fill will occur during high flow periods only and in a manner which does not compete against downstream water uses.

Once constructed, operation of the Project will involve the generation of hydroelectricity when water is transferred through underground tunnels from the upper reservoir, through turbines in the proposed underground power station, and transferred to the lower reservoir. The Project will allow water to be pumped back to the upper reservoir so it can be used again. Being 'off river' or a 'closed loop' scheme means that once filled, the Project have little annual water needs over an operational life in excess of 50 years.

The Project intends to connect at or near the Armidale substation on TransGrid's high voltage transmission backbone which extends from the Queensland-NSW Interconnector (QNI) down to the Hunter Valley. New 330 kilovolt (kV) transmission infrastructure is required with the objective to augment existing 132 kV TransGrid transmission assets back to Armidale. As previously discussed, a separate application will be prepared for these transmission works.

Table ES1 outlines the key elements required for the operation of the Project, which form part of this Scoping Report and subsequent EIS. Consideration will also be given to the decommissioning and rehabilitation of the Project.

Table ES1 Project key elements

Project component	Description
Key project elements – operational infrastructure	• an underground pumped hydro-electric power station complex; • lower reservoir and intake; • upper reservoir and intake; • spillways; • power waterway tunnels, chambers and shafts; • access tunnels; • new and upgraded roads to allow ongoing access and maintenance; and • power and communication infrastructure.
To support the construction of operational infrastructure, the following elements and activities are needed and are referred to as construction elements, and include:	• construction water infrastructure and supply including: – a temporary water store such as a turkey's nest or similar for construction activities; – the ability to fill and maintain temporary water stores such as via surface water, bores, and/or extraction from the Macleay River; – associated infrastructure such as pumps and pipes; • an on-site borrow pit or quarry; • an on-site concrete batching plant; • establishment and removal of temporary structures including coffer dams; • management of cleared vegetation, soils and overburden; • construction compounds including laydown and logistics yards within the Project area boundaries; • supporting services infrastructure including: – construction power supply; – potable water supplies; – waste and wastewater management; – communications infrastructure; – site control infrastructure; – accommodation camps; • emergency infrastructure including: – water tanks for fire control; and – helicopter access.

ES3 Strategic context

To date, most electricity in the National Electricity Market (NEM) comes in the form of coal-fired generation and NSW has the highest dependence on coal of all regions. Most coal generators in NSW are set to retire, as they near the end of their technical and economic life, in the short to medium term starting with Liddell in 2022-2023 and followed by Vales Point (2029), Eraring (2031) and Bayswater (2035). All five NSW coal fired power stations are expected to retire by 2043, while four of these are expected to withdraw by 2035.

NSW faces the largest challenge but also has the greatest opportunity of all NEM regions in the transition away from coal. The *NSW Electricity Infrastructure Roadmap* (Roadmap), issued in November 2020, provides a blueprint for *"an integrated policy framework to secure an affordable, reliable and clean energy future for New South Wales"*. In doing so, the Roadmap paves the way for significant investment and jobs within NSW for the next decade and beyond while also lowering electricity costs to consumers. This is achieved by replacing retiring coal with low cost renewable bulk energy generation plant (primarily wind and solar) and storage.

The Roadmap details plans to efficiently deploy generation, transmission, storage and system services within coordinated REZs. The NSW Government has prioritised the New England REZ. Pumped hydro energy storage strongly supports this approach to assembling dispatchable regions by providing not only energy storage but, by virtue of being a synchronous plant, also providing critical services including system strength, inertia and voltage support. Further, the dispatchable nature of pumped hydro allows for existing and future transmission assets to be operated much closer to their design capability than is currently the case.

The Project is strategically planned to address the pending retirement of NSW coal generators and will act to reduce the risk of emerging energy reliability gaps as highlighted in the *NSW Electricity Strategy*. The anticipated timeline allows for it to be available in time to provide energy security resilience and insurance against not only Vales Point and Bayswater retirement, but also any early retirements (for example, due to economic pressures).

The objective of the *NSW Energy Security Target* is to have sufficient dispatchable generation to cover the loss of NSW's largest generating unit (Eraring – 680 MW). At 600 MW and up to 12 hours storage, the Project provides a combination of scale and sufficient energy storage which cannot be matched by gas generation or batteries.

Additionally, located in the renewables-rich but transmission-congested New England REZ, the Project is able to unlock significant additional renewables generation, thereby assisting the NSW Government to achieve Stage 1 of its *Net Zero Plan*. The Roadmap prioritises the delivery of three REZs including New England.

In December 2020, key elements of the Roadmap were legislated in the NSW *EII Act*.

ES4 Relevant matters to be addressed in the EIS

Preliminary environmental investigations have been carried out to identify the relevant matters to be addressed in the EIS for the Project, and the required level of assessment. This process was guided by the draft guidelines for scoping an EIS as prepared by the then NSW Department of Planning and the Environment (dated 2017) and informed by identifying and characterising relevant matters, taking into account an initial scientific and technical assessment review of the Project area and project description.

Those matters relevant to the construction, operation of the Project have been identified and allocated to one of the following categories:

- key matters or issues – these have been defined as requiring detailed assessment, ie will require detailed field surveys and/or quantified modelling techniques to fully understand the impacts and identify project-specific mitigation and/or alternatives. It is assumed at this stage of assessment that each of the listed key issues will require separate technical responses and will be separately attached to the EIS;

- other matters or issues – characterised as matters where the assessment approach and measures to manage impacts are well understood and routinely used on similar projects. Each of these issues will need to be addressed through the EIS process and require investigation, but which may or may not require a technical study; and

- scoping only issues – matters in this group have been considered in this initial scoping assessment and justification is provided as to why it is proposed that they are not investigated further.

Based on the findings of the scoping assessment, the following matters presented in Table ES2 are considered key issues or matters for the EIS.

Table ES2 Key matters for the EIS

Category	Matters
Key issues	• Biodiversity, including: – terrestrial ecology, and – aquatic ecology.
	• Heritage, including: – Aboriginal cultural heritage; and – historic heritage.
	• Water, including: – ground water; and – surface water, including flooding;
	• Land, including: – geology and soils; and – contamination.
	• Amenity, including: – noise and vibration; – air quality; and – landscape and visual amenity.
	• Transport and access;
	• Social; and
	• Economic.
Other issues (unlikely to require a standalone or detailed technical assessment in the EIS):	• Built environment
	• Climate change and other risks

ES5 Overview of the proposed engagement approach

Stakeholder engagement for the Project has been comprehensive to date. Stakeholder engagement commenced with the introduction of the Project to local community members in 2019, including provision of information on the Project's website. Rounds of briefing sessions and meetings with stakeholders and other interested parties have been extensive and will continue as the Project progresses.

OMPS is committed to continuing to engage with stakeholders during the approval process for the Project. Engagement targeted specifically for the Project will comprise several initiatives including newsletters, website updates, production of educational materials and community forums such as community information sessions.

ES6 Overview of the proposed EIS

The Project has been declared critical State significant infrastructure (CSSI) in accordance with the provisions of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act), with the declaration coming into effect on 4 September 2020. As a result, the Project may be carried out without obtaining development consent under Part 4 of the EP&A Act, however is subject to Division 5.2 of the EP&A Act, which requires the preparation of an EIS and the approval of the NSW Minister for Planning and Public Spaces.

With respect to the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), while preliminary biodiversity surveys have been carried out, additional detailed surveys remain to be completed to determine potential impacts on matters of national environmental significance (MNES). Accordingly, OMPS has referred the Project to the Commonwealth Minister for the Environment and conservatively nominated that there is potential to have a significant impact on MNES. Additionally, OMPS has sought to have potential impacts of the Project assessed under an accredited process under the EPBC Act, where the Commonwealth accredits the assessment process under Division 5.2 of the EP&A Act. This will enable DPIE to manage the assessment of the Project, including the issuing of the assessment requirements for the EIS.

Accordingly, a single EIS will be required for the Project, and that EIS will address the requirements of all State and Commonwealth agencies. The EIS will be supported by comprehensive technical reports attached as appendices to the main report and based on the key issues identified in this scoping report.

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Appendices

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1 Introduction

OMPS Pty Ltd (OMPS) is developing the Oven Mountain Pumped Hydro Energy Storage Project (the Project), a scheme that will provide 600 megawatts (MW) of electricity generating capacity and up to 12 hours of energy storage. The Project is off-river and situated on private land in the Armidale Regional Local Government Area (LGA), in close proximity to the Kempsey Shire LGA. The location's pumped hydro energy storage potential has been studied and is of superior quality.

The Project has the potential to be an important facilitator of the NSW Government's vision to deliver cheaper, more reliable and cleaner electricity. It will provide significant scale, deep storage and flexible, dispatchable generation to serve New South Wales' (NSW) energy reliability needs and the *NSW Energy Security Target* established by the *NSW Electricity Strategy* (2019) and enacted in the *Electricity Infrastructure Investment Act 2020* (EII Act). The Project will provide network benefits and services directly to a transmission backbone in the New England area, a Renewable Energy Zone (REZ) prioritised by the *NSW Electricity Strategy and Transmission Infrastructure Strategy* (2018) and, more recently, the *NSW Electricity Infrastructure Roadmap* (Nov 2020) (Roadmap). This Roadmap aims to foster long duration storage and firming capacity to support 8 gigawatts (GW) of renewables growth in the New England REZ alone. In December 2020, key elements of the Roadmap were legislated in the *EII Act.*

The Project has been declared critical State significant infrastructure (CSSI) in accordance with the provisions of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act), with the declaration coming into effect on 4 September 2020. As a result, the Project may be carried out without obtaining development consent under Part 4 of the EP&A Act, however is subject to Division 5.2 of the EP&A Act, which requires the preparation of an environmental impact statement (EIS) and the approval of the NSW Minister for Planning and Public Spaces.

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This scoping report has been prepared by EMM Consulting Pty Limited (EMM) on behalf of OMPS, the proponent for the Project. It has been prepared in accordance with the draft *Environmental Impact Assessment Guidance Series* (June 2017) prepared by the then Department of Planning and Environment (now DPIE). This scoping report addresses works associated with the generation works and ancillary development (where relevant to the generation works for the Project). A separate application (and therefore separate scoping report) will be prepared for the transmission works.

The purpose of this scoping report is to request and inform the content of the Secretary's environmental assessment requirements (SEARs) for the preparation of the EIS for the Project.

2 Project details

2.1 Project title

The Project comprises of a pumped storage hydropower plant generating and/or consuming 600 megawatts (MW) of electricity to and from the national grid with long duration energy storage of up to 12 hours. It is located on private land near the Macleay River between Armidale and Kempsey. There are three key components associated with the Project:

- **Pumped hydroelectric and generation works** – including new upper and lower water storage dams and reservoirs, a new underground pumped hydroelectric power station, water and access tunnels, surge tank, intake and outlet structures, and decommissioning works and rehabilitation of the site.

- **Transmission works** – including new electricity transmission lines to connect the pumped hydroelectric and generation works to the existing electricity transmission network, new electricity transmission infrastructure and upgrades on the existing transmission network back to (or in the vicinity of, the existing substation at Armidale), and augmentation of the existing substation, or the construction and operation of a new substation near Armidale.

- **Ancillary development** – including (but not limited to) access roads, on-site quarry and related infrastructure, utilities and communications infrastructure, construction accommodation, construction compounds and construction power supply.

This scoping report addresses works associated with the generation works and ancillary development (where relevant to the generation works) for the Project. A separate application (and therefore separate scoping report) will be prepared for the transmission works.

2.2 Proponent details

Details on the proponent for the Project, as well as details on the persons who prepared this scoping report, and the site owner are as follows:

Table 2.1 Proponent details

Requirement	Detail
Proponent	OMPS Pty Ltd
Postal address	PO Box 1071, North Sydney NSW 2060
ABN	22 160 259 174
Nominated contact	Anthony Melov and Jeremy Moon Directors
Contact details	Email: info@ompshydro.com
Name and qualifications of persons who prepared scoping report	Brett McLennan Bachelor of Town Planning (Hons), University of NSW, 1995 Emily McIntosh Bachelor of Science / Bachelor of Arts, University of NSW, 2007

2.3 Site details

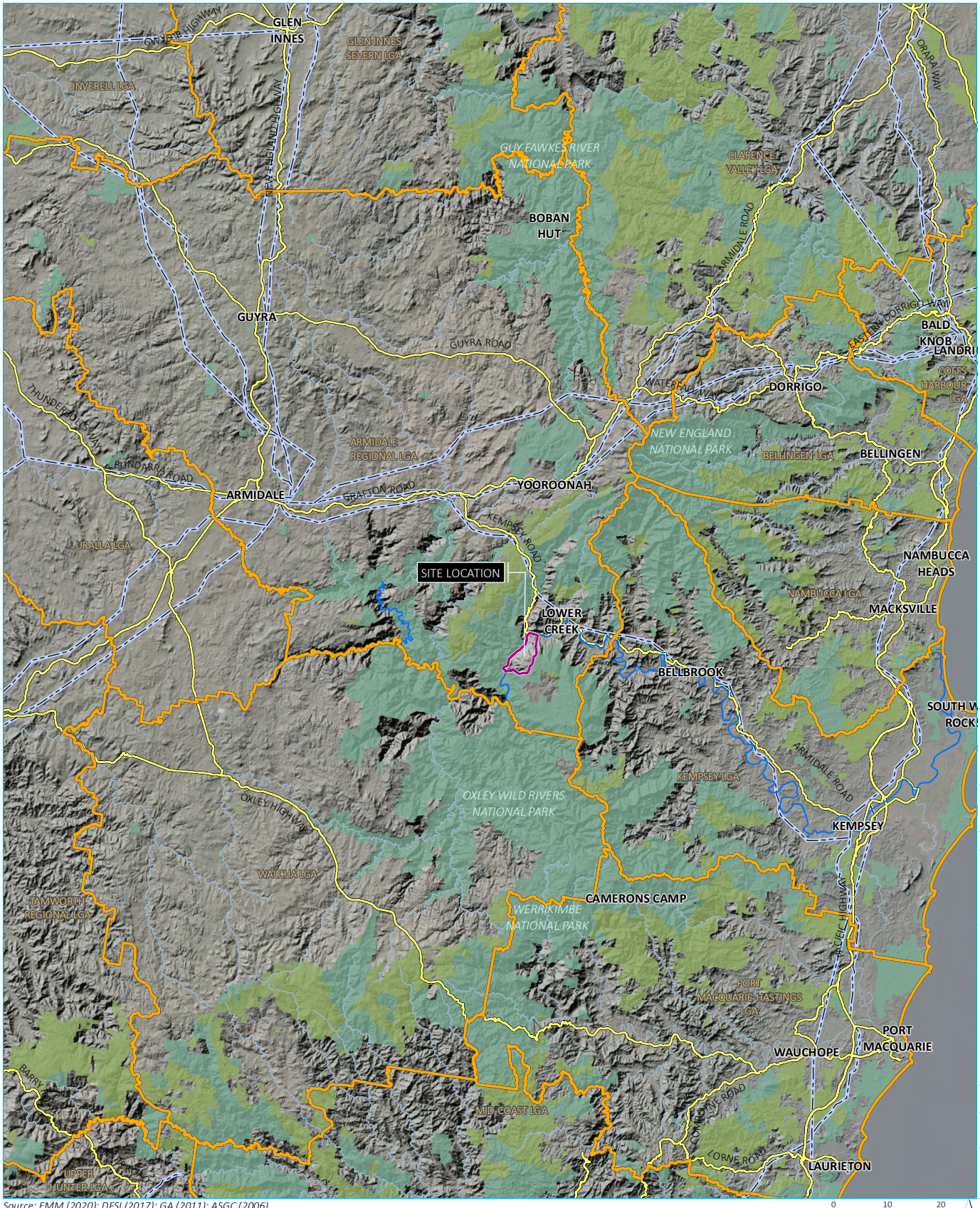
2.3.1 Project location

The Project is located on private land (Lots 18,19 and 37 in Deposited Plan (DP 756471) within the Armidale Regional LGA (herein referred to as the Project area).

The Project area is bordered by the Macleay River to the immediate west and the Carrai National Park to the east, approximately eight kilometres (km) south of Kempsey Road (near Georges Junction). Cunnawarra National Park, Oxley Wild Rivers National Park, and Carrai State Conservation Area are proximate to the Project area. The regional and local context of the Project area is shown in Figure 2.1 and Figure 2.2 respectively.

The nearest large regional centres to the Project area are Armidale and Kempsey. Armidale is approximately 60 km north west and Kempsey is about 75 km south east. As of 2016, Armidale had a population of 23,352 people, a workforce of 10,520 people and a median age of 34 (ABS, 2016). In 2019, Kempsey had a population of 15,378 people, and a median age of 40.4 (ABS, 2019). The nearest community to the Project area is Lower Creek, over 10 km away, and the closest town is Bellbrook which is located east from the boundary of the Project with a travel distance of approximately 50 km. In 2016 Bellbrook had a population of 273 people.

The Project area is bordered to the south by Oxley Wild Rivers National Park, which forms part of the Gondwana Rainforests of Australia (GRA), shown in Figure 2.3. The GRA is also nearby to the western border of the Project area where the Macleay River is situated between the Project area and the GRA (close to its western bank). The GRA comprises the major remaining areas of rainforest in southeast Queensland and northeast NSW. It represents outstanding examples of major stages of the Earth's evolutionary history, ongoing geological and biological processes, and exceptional biological diversity. Additionally, there are declared wilderness areas (in accordance with section 8 of the Wilderness Act 1987), to the east of project area boundary (also shown in Figure 2.3). The GRA and declared wilderness areas have been identified in the biodiversity scope for the EIS, which will assess potential direct or indirect impacts during the EIS assessment phase (refer also to Section 5.2).



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Source: EMM (2020); DFSI (2017); GA (2011); ASGC (2006)

0 10 20 km

GDA 1994 MGA Zone 56

N

KEY

- Project boundary

Existing environment

- Macleay River
- Transmission line
- Watercourse/drainage line
- Major road
- NPWS reserve
- State forest
- Local government area

Regional location

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Scoping report
OMPS Pty Ltd
Figure 2.1

EMM
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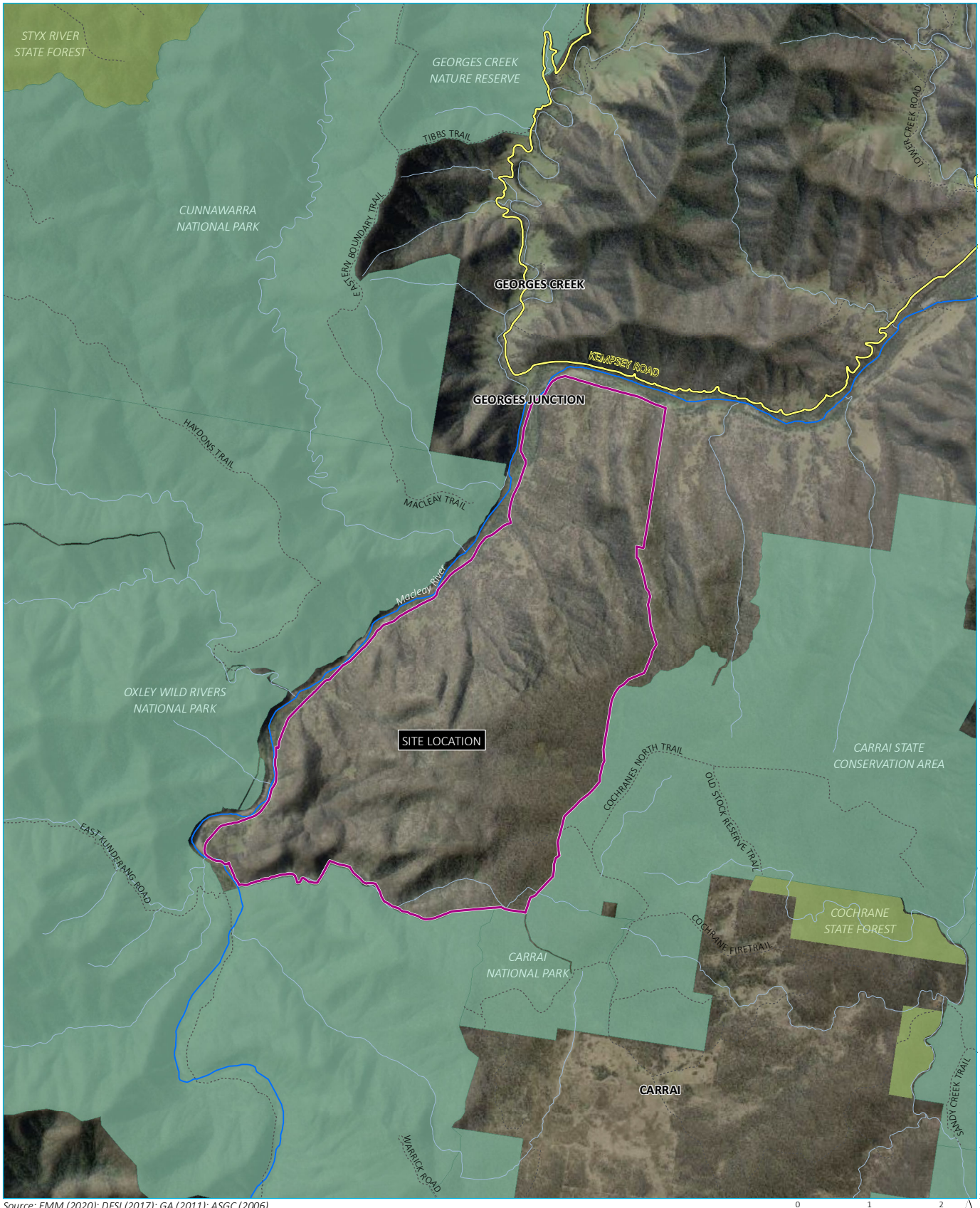

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Source: EMM (2020); DFSI (2017); GA (2011); ASGC (2006)

0 1 2 km

GDA 1994 MGA Zone 56

N

KEY

- Project boundary (Lots 18, 19 & 37 of DP756471)

Existing environment

- Macleay River
- Watercourse/drainage line
- Road
- Track
- NPWS reserve
- State forest

Project area

Oven Mountain Pumped Hydro Energy Storage Project
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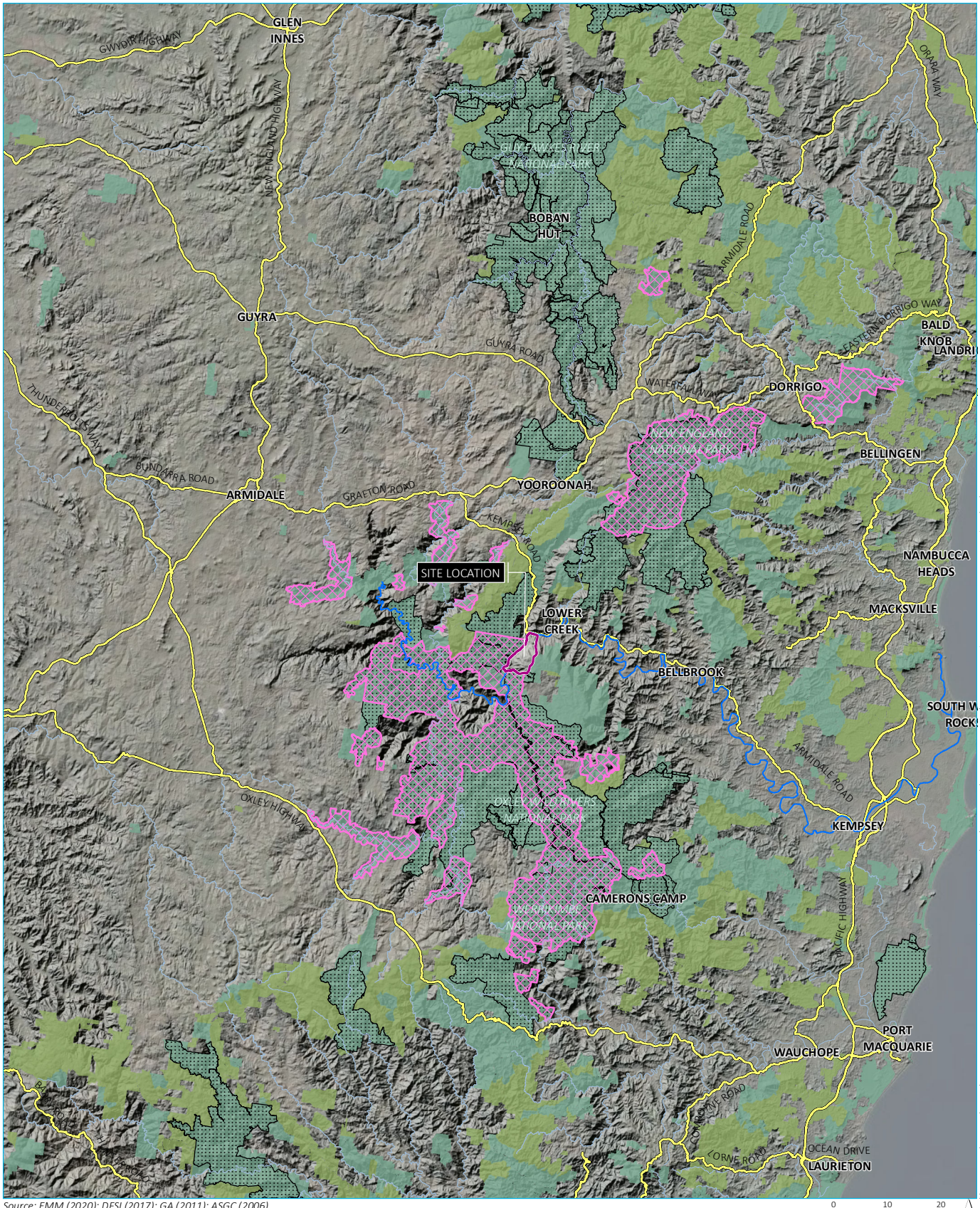
Figure 2.2

EMM
creating opportunities



Source: EMM (2020); DFSI (2017); GA (2011); ASGC (2006)

0 10 20 km

GDA 1994 MGA Zone 56

N

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KEY

- Project boundary
- Existing environment
  - Macleay River
  - Watercourse/drainage line
  - Major road
- Gondwana Rainforests of Australia
- Declared wilderness area
- NPWS reserve
- State forest

Location of Gondwana Rainforests of Australia and declared wilderness areas

Oven Mountain Pumped Hydro Energy Storage Project
Scoping report
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Figure 2.3

EMM creating opportunities

The land zoning in proximity and within the Project area is shown in Figure 2.4. The Project area is zoned RU1 Primary Production. The Project area is freehold land and currently used for recreational purposes, logging and livestock agistment. Predominant land uses in the surrounding area include agriculture, forestry, national parks and reserves and rural residential development. The land use across and in proximity to the Project is shown in Figure 2.5. There is no proposed land subdivision within the Project area.

2.3.2 Project area description

The Project area is identified in Figure 2.2 and will include all of the construction and operational elements for the Project. Key features of the Project area are:

- Kempsey Road runs parallel to a portion of the northern border, and will likely be a key access point to the Project.

- The Project area boundary reflects the private land boundary and is generally bound to the west by the Macleay River and Oxley Wild Rivers National Park, to the south by Oxley Wild Rivers National Park, to the south-east by Carrai National Park and to the east by Carrai State Conservation Area. Much of the Project area contains undulating and steep terrain ranging from approximately 150 m to 1,000 metres (m) above sea level with vegetation ranging from heavy to cleared.

- There are several fire trails in proximity to the Project area. The Cochranes North Trail and Old Stock Reserve Trail traverse the Carrai State Conservation Area to the east of the Project area. The East Kunderang Road Trail is to the south of the Project area and Macleay River traversing the Oxley Wild Rivers National Park. The Haydons Trail and the Eastern Boundary Trail which turns into the Macleay Trail as it approaches the Macleay River traverse the Cunnawarra National Park to the west of the Project area.

- The Project area is located within the New England tablelands (New England Orogen geological province), which forms part of the New England fold belt (refer to Figure 5.4). Geology consists of extensively faulted Carboniferous and Permian sedimentary rocks, granite intrusions and extensive Tertiary basalts. This geology has strongly influenced the variability in topography (hills and plains ranging from 600–1,500 m elevation), soil types, and rainfall and temperature patterns in the region (DPIE 2016). The Project area is located on the western slope of the Carrai Plateau, which is underlain by a middle Triassic aged granodiorite intrusion. The top of the intrusion forms a flat tableland, surrounded by deeply incised creeks and tributaries associated with the Macleay River. The Carrai Plateau is part of a chain of north west – south east trending belt of intrusive I-type granitoid bodies between Wauchope and Round Mountain (Gilligan et al. 1992). Mapping completed by the Geological Survey of NSW (GSNSW) indicate two geological units underly the proposed project alignment: the Carrai Granodiorite, and the Parrabel Beds, which are a formation within the Nambucca Beds Group. Overlying these units are soils comprising of alluvium, colluvium and landslide debris. This soil layer was suggested to be relatively shallow (< 5.0 m).

- The Proposal area is located within the Nambucca Block of the New England Orogenic Province. The Nambucca Block is a 3-4 km thick sequence of Early Permian to late Carboniferous sedimentary rocks, with minor felsic and mafic volcanic and rare calcareous horizons (Gilligan et al. 1992). The Nambucca Block has undergone multiple phases of deformation and thermal metamorphism.

Other details on the Project area is provided in Table 2.2.

Table 2.2 Project area – other details

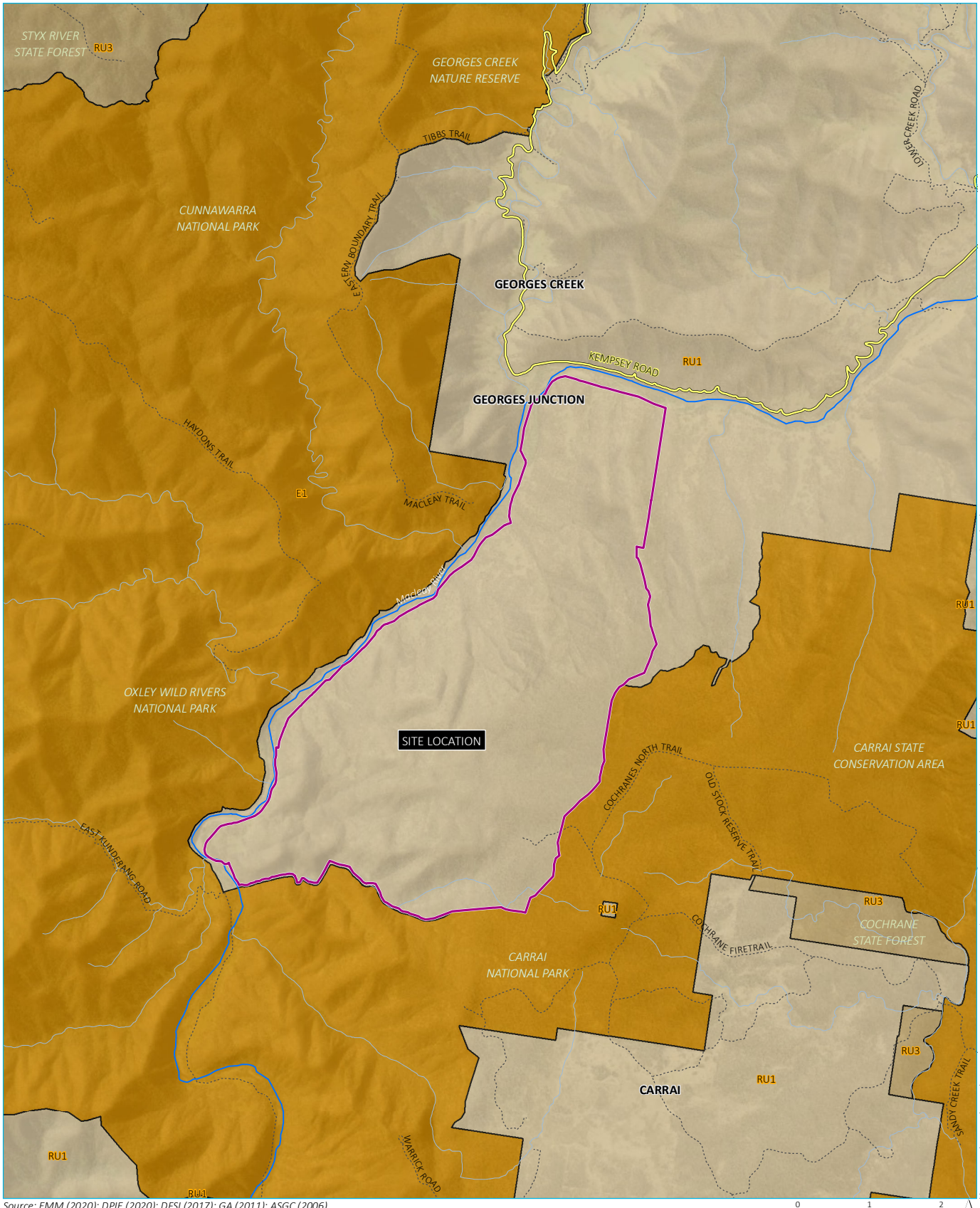
Aspect	
Project area (ha)	2391.6 ha
Land zoning	RU1 Primary Production
Identification of Biophysical Strategic Agricultural Land (BSAL)	There is no BSAL identified within the Project area, however there is some BSAL identified north of the Project area, along Kempsey Road.
Access to ports	Broader transport logistics options are still under consideration and may include the use of local ports, including the Port of Newcastle.

2.3.3 Other major projects in the region

Figure 2.6 shows other major projects in the region. There are no major project's within close proximity to the project (within 25km of the Project area), however all major projects within the region will be considered for potential cumulative impacts during the EIS phase.

2.3.4 Potential local receivers

Figure 2.7 provides an overview of potential local receivers in the area in relation to the Project area. The identification of these receivers is based on preliminary desktop assessments and stakeholder engagement and their status and actual locations will be confirmed during the EIS assessment phase.



Source: EMM (2020); DPIE (2020); DFSI (2017); GA (2011); ASGC (2006)

0 1 2 km

GDA 1994 MGA Zone 56

N

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KEY

Project boundary (Lots 18, 19 & 37 of DP756471)

Armidale Regional Council LEP zoning

- E1 National Parks and Nature Reserves
- RU1 Primary Production
- RU3 Forestry

Existing environment

- Macleay River
- Watercourse/drainage line
- Road
- Track

Land zoning

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Figure 2.4

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Source: EMM (2020); DPIE (2020); DFSI (2017); GA (2011); ASGC (2006)

0 0.5 1 km

GDA 1994 MGA Zone 56

N

KEY

- Cadastre
- Project boundary

Existing environment

- Macleay River
- Watercourse/drainage line
- Major road
- Vehicular track
- NPWS reserve

NSW landuse (DPIE, 2017)

- 1.1.0 Nature conservation
- 1.3.0 Other minimal use
- 2.1.0 Grazing native vegetation
- 3.2.0 Grazing modified pastures
- 5.7.0 Transport and communication
- 6.3.0 River

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Land use

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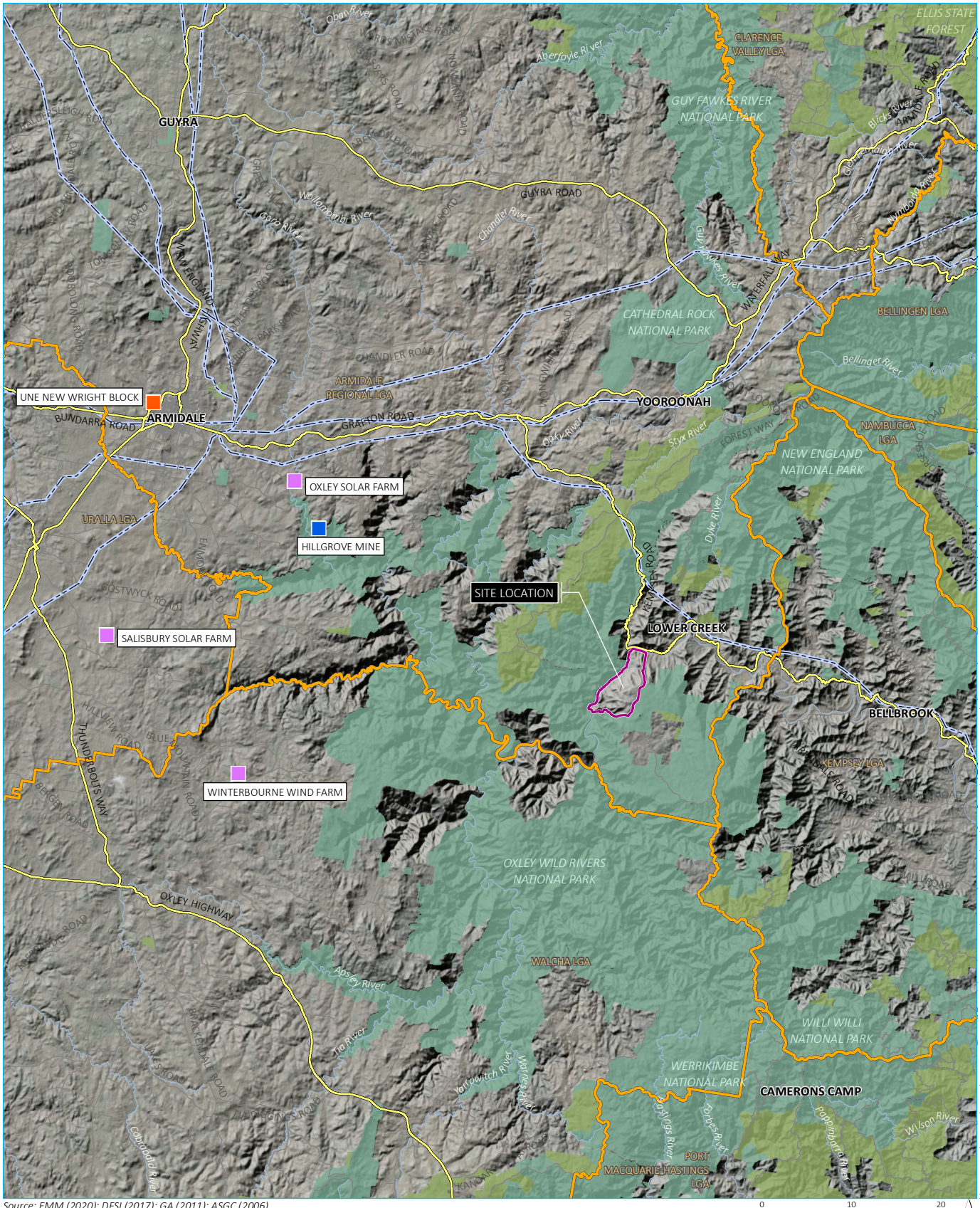
Figure 2.5

EMM
creating opportunities



KEY

- Project boundary

Current SSD projects

- Existing project
- SSD (Prepare EIS phase - not approved)
- SSD (Project approved)

Existing environment

- Transmission line
- Watercourse/drainage line
- Major road
- Local road
- NPWS reserve
- State forest
- Local government area

Other major projects in the region

Oven Mountain Pumped Hydro Energy Storage Project
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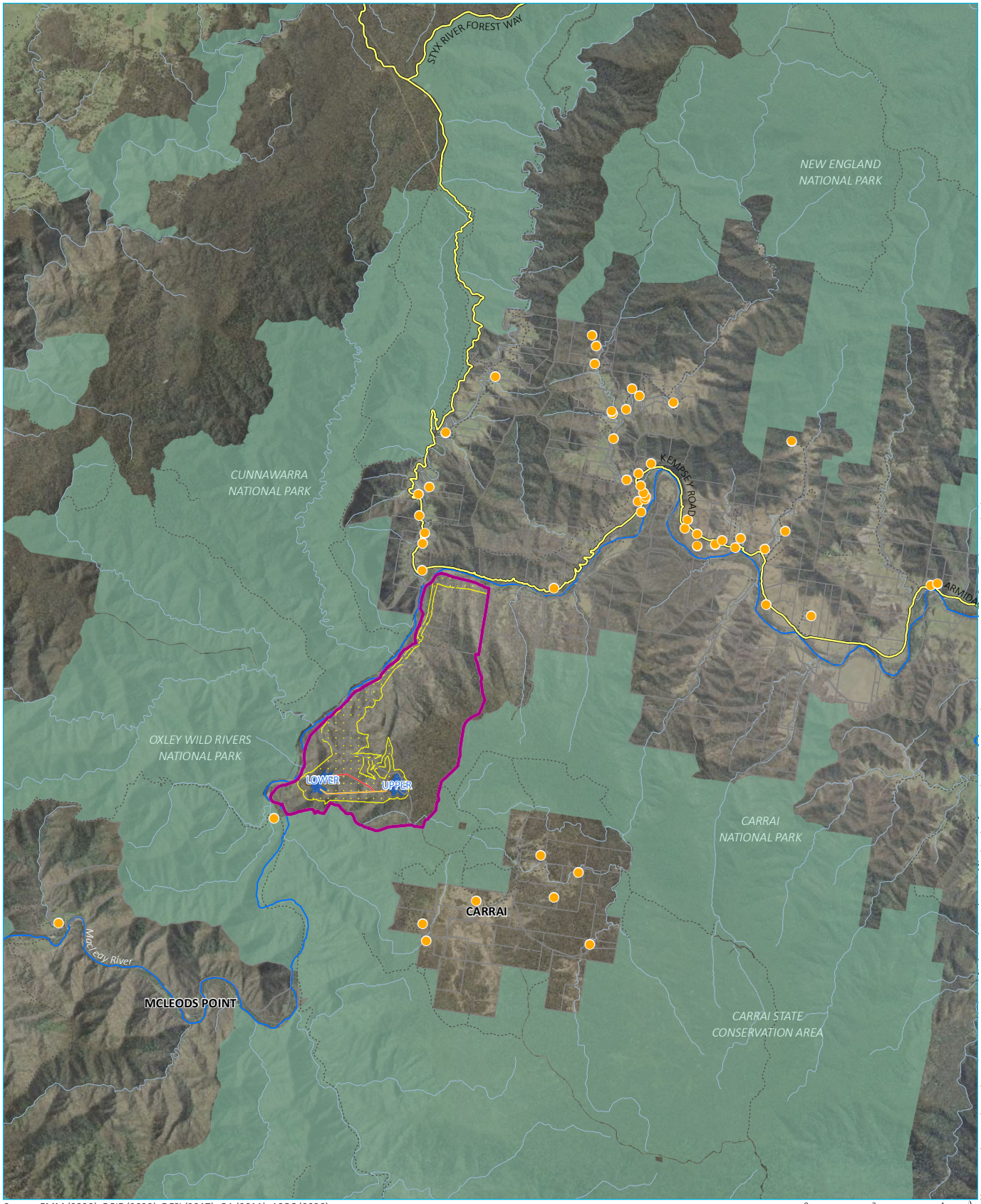
Figure 2.6

EMM
creating opportunities



Source: EMM (2020); DPIE (2020); DFSI (2017); GA (2011); ASGC (2006)

0 2 4 km

GDA 1994 MGA Zone 56

N

KEY

- Potential receivers
- Cadastre
- Project boundary

Existing environment

- Macleay River
- Watercourse/drainage line
- Major road
- Vehicular track
- NPWS reserve
- Investigation area for construction footprint

Indicative tunnel alignments

- Main access tunnel
- Power waterway

Indicative water storage locations

- Dam
- Reservoir

Potential local receivers

Oven Mountain Pumped Hydro Energy Storage Project
Scoping report
OMPS Pty Ltd
Figure 2.7

EMM creating opportunities

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2.4 Design development

SMEC Australia Pty Ltd (SMEC) was engaged by OMPS to undertake and develop the Project's design.

During 1996 SMEC carried out intrusive field investigations at the Project area to depths of 50 m, focussing on the upper and lower reservoirs. The investigations concluded that the geology was suitable for tunnel and dam construction.

SMEC's investigations and respective reports in 1997 report detailed the main components of a scheme and identified issues and items that would be required in future studies. Another third-party investigation was undertaken in 2009. This report generally agreed with the SMEC 1997 arrangement of the major components of the Project and concluded that there were no technical factors preventing it from progressing to further stages of development. The shared outcome of these earlier studies, coupled with the work undertaken during this investigation, clearly conclude that the Project site has attributes that are supportive of a pumped hydro storage project.

In 2019/2020 SMEC completed a concept design study to identify potential options and select and screen preferred option(s) in order to develop a technically sound, economically viable pumped storage hydropower scheme to a concept design level. To achieve this, the following tasks were carried out:

1. a review of previous studies;
2. a site visit;
3. concept screening; and
4. concept design development.

The next engineering phase is to undertake detailed design, building upon the results of the concept design study, and incorporating optimisation of the preferred arrangement (eg waterways and dams), detailed dam selection studies, detailed hydraulic studies, development of preliminary geotechnical models and seismicity studies, additional information, feasibility level design of the main elements (ie reservoirs, power waterway, power station complex, access, grid connections) and quantity off-takes. A geotechnical investigation campaign will be undertaken in parallel to inform the detailed design.

OMPS will utilise a design integration and assessment approach (DIAA), which will work in an iterative way with other work streams such as environmental impacts, geotechnical, hydrological and engineering studies.

2.5 Alternatives considered

2.5.1 Alternative locations

The Project was designed and studied extensively during the 1990s, significantly de-risking many key project elements. A review was undertaken of the Australian National University's 2017 dataset of 8,578 identified reservoir opportunity sites across NSW. OMPS applied additional development filters and reduced this down to 736 reservoir combinations, as shown in Figure 2.8.

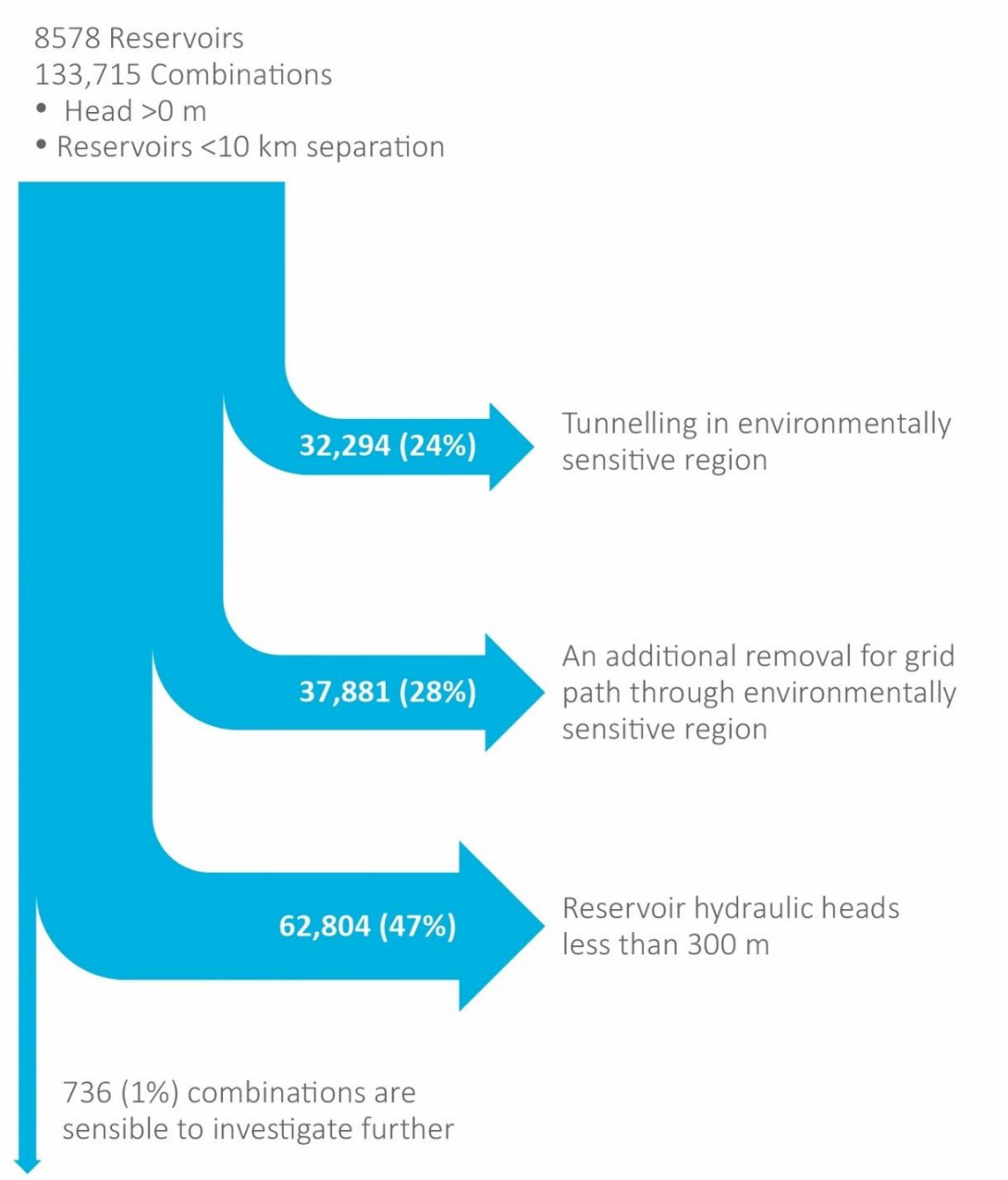

Figure 2.8 Overview of reservoir site opportunity review

This allowed for the comparison of key pumped hydro storage metrics of hydraulic head and distances between reservoirs which are early-stage proxies for project and cost efficiencies. This comparison confirmed the high quality nature of the Project within the portfolio of other potential greenfield locations (refer to Figure 2.9).

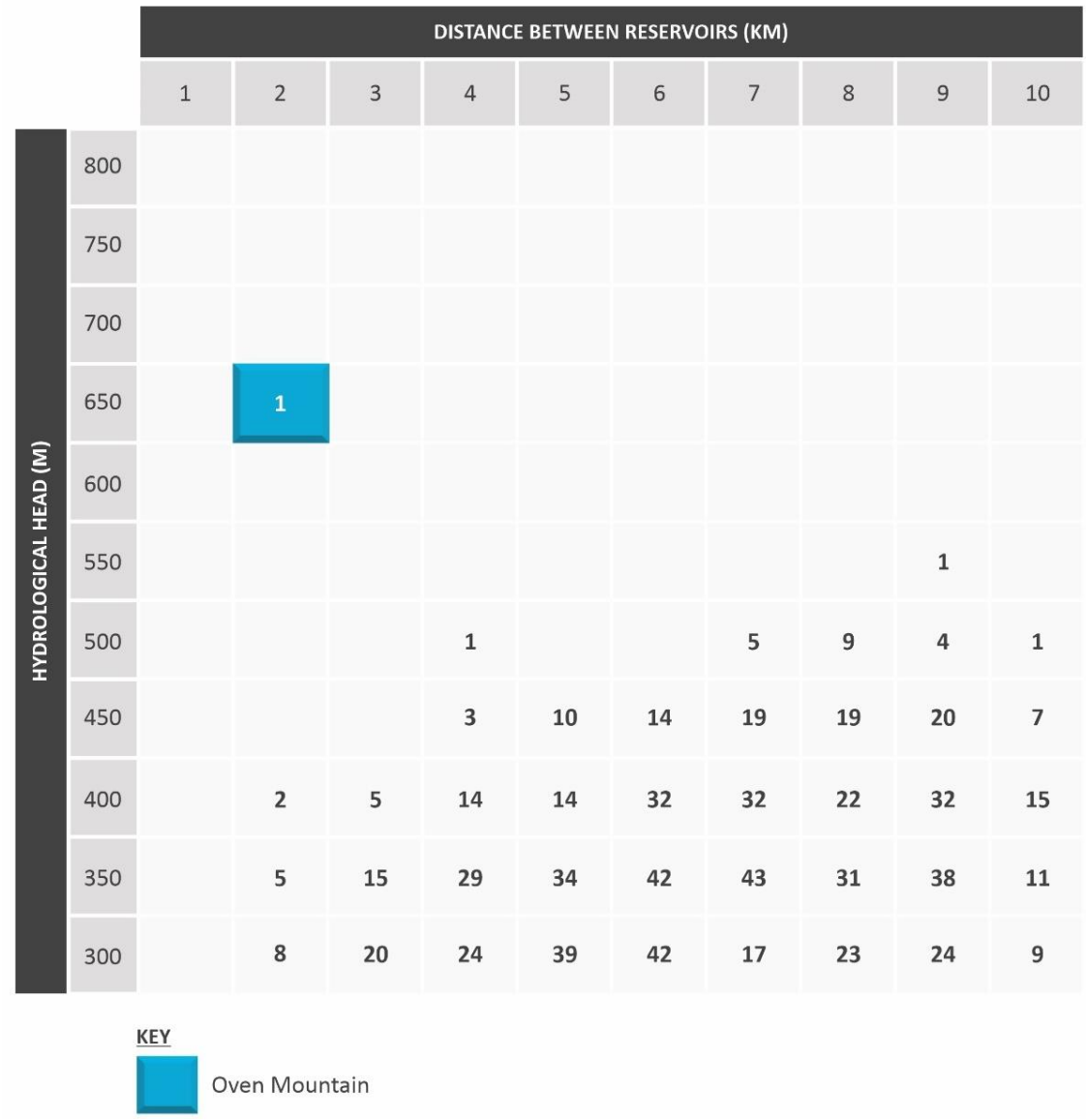

Figure 2.9 Hydraulic head and distance between reservoirs comparison

2.5.2 Reservoir location and storage capacity

Initial phases of screening options drew upon the desktop assessment of the 1997 SMEC work, recent LiDAR topographic data, geology interpretation and hydrology analysis. Four arrangement options were considered at this phase, each sharing the same lower reservoir location:

1. the original 1997 configuration;

2. the original 1997 configuration expanded to allow for 12 hours storage;

3. an alternate upper reservoir location at 'Option 1' which provided higher head compared to the 1997 design; and

4. an alternate upper reservoir location at 'Option 2' which provided yet higher head compared to both the 1997 design and 'Option 1'.

OMPS provided guidance to SMEC to progress the 1997 design with two storage scenarios being: a) nine hours storage; and b) 12-hour storage. This allowed SMEC to refine the arrangement for the two designs.

Technical and environmental constraints were taken into account when selecting the upper reservoir location; for example, one location was avoided due to the potential location of montane peatland.

2.5.3 Ongoing design refinements

Development of hydropower projects is iterative as changes to parameters or elements subsequently require changes to other elements. This iterative approach is typical for hydropower and pumped storage projects, where the design is progressively refined as information improves. This process will continue across the entire engineering design process of any project. Significant refinements include the following:

- turbine submergence;
- waterway alignment and sizing;
- arrangement of the surface options; and
- sizing and design of intakes.

3 Project description

3.1 Overview

The Project will include upper and lower water reservoirs constructed on an ephemeral tributary of the Macleay River, near Georges Junction, and will operate as a closed-loop circuit. An underground power station will be connected to the reservoirs by power waterways or tunnels.

Water access from the Macleay River will be required for an initial, one-off fill of the reservoirs and minimal top-up will be required thereafter. The initial fill will occur during high flow periods only and in a manner which does not compete against downstream water uses.

Once constructed, operation of the Project will involve the generation of hydroelectricity when water is transferred through underground tunnels from the upper reservoir, through turbines in the proposed underground power station, and on to the lower reservoir. The Project will allow water to be pumped back to the upper reservoir so it can be used again. Being 'off river' or a 'closed loop' scheme means that once filled, the Project will have little annual water needs over an operational life in excess of 50 years.

The Project intends to connect at or near the Armidale substation on TransGrid's high voltage transmission backbone which extends from the Queensland-NSW Interconnector (QNI) down to the Hunter Valley. New 330 kilovolt (kV) transmission infrastructure is required with the objective to augment existing 132 kV TransGrid transmission assets back to Armidale. As outlined in Section 2.1, a separate application will be prepared for these transmission works.

3.1.1 Key project elements

The following Project key elements outlined in Table 3.1 are required for the operation of the Project and form the basis of this Scoping Report and subsequent EIS.

Table 3.1 Project key elements

Project component	Description
Key project elements – operational infrastructure	• an underground pumped hydro-electric power station complex;
	• lower reservoir and intake;
	• upper reservoir and intake;
	• spillways;
	• power waterway tunnels, chambers and shafts;
	• access tunnels;
	• new and upgraded roads to allow ongoing access and maintenance; and
	• power and communication infrastructure.
To support the construction of operational infrastructure, the following elements and activities are needed and are referred to as construction elements, and include:	• construction water infrastructure and supply including: – a temporary water store such as a turkey's nest or similar for construction activities; – the ability to fill and maintain temporary water stores such as via surface water, bores, and/or extraction from the Macleay River; – associated infrastructure such as pumps and pipes;

Table 3.1 Project key elements

Project component	Description
	• an on-site borrow pit or quarry;
	• an on-site concrete batching plant;
	• establishment and removal of temporary structures including coffer dams;
	• management of cleared vegetation, soils and overburden;
	• construction compounds including laydown and logistics yards within the Project area boundaries;
	• supporting services infrastructure including: – construction power supply; – potable water supplies; – waste and wastewater management; – communications infrastructure; – site control infrastructure; – accommodation camps;
	• emergency infrastructure including: – water tanks for fire control; and – helicopter access.

Consideration will also be given to the decommissioning and rehabilitation of the Project.

Infrastructure elements required for the transmission works will be assessed as part of that application.

3.1.2 Capital project investment

The current cost estimate of the Project is estimated to be between $1.0 and $1.5 billion. The current estimate will be refined during the design phase.

Source: EMM (2020); DFSI (2017); GA (2011); ASGC (2006)

0 0.5 1 km

GDA 1994 MGA Zone 56

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KEY

- Project boundary
- Investigation area for construction footprint

Indicative tunnel alignments

- Main access tunnel
- Power waterway

Indicative water storage locations

- Dam
- Reservoir

Existing environment

- Macleay River
- Watercourse/drainage line
- 50 m contour (derived from LiDAR)
- Road
- Vehicular trail
- NPWS reserve

Overview of the project elements

Oven Mountain Pumped Hydro Energy Storage Project
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Figure 3.1

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3.2 Operational infrastructure

This section provides an overview of the operational infrastructure required for the Project, which will include upper and lower water reservoirs constructed on an ephemeral tributary of the Macleay River. The operational infrastructure for the Project has been chosen in highly favourable and studied natural terrain and includes an excellent head height and only a short distance between the two reservoirs. An artistic interpretation of the upper and lower reservoirs at the Project site is shown in Figure 3.2.

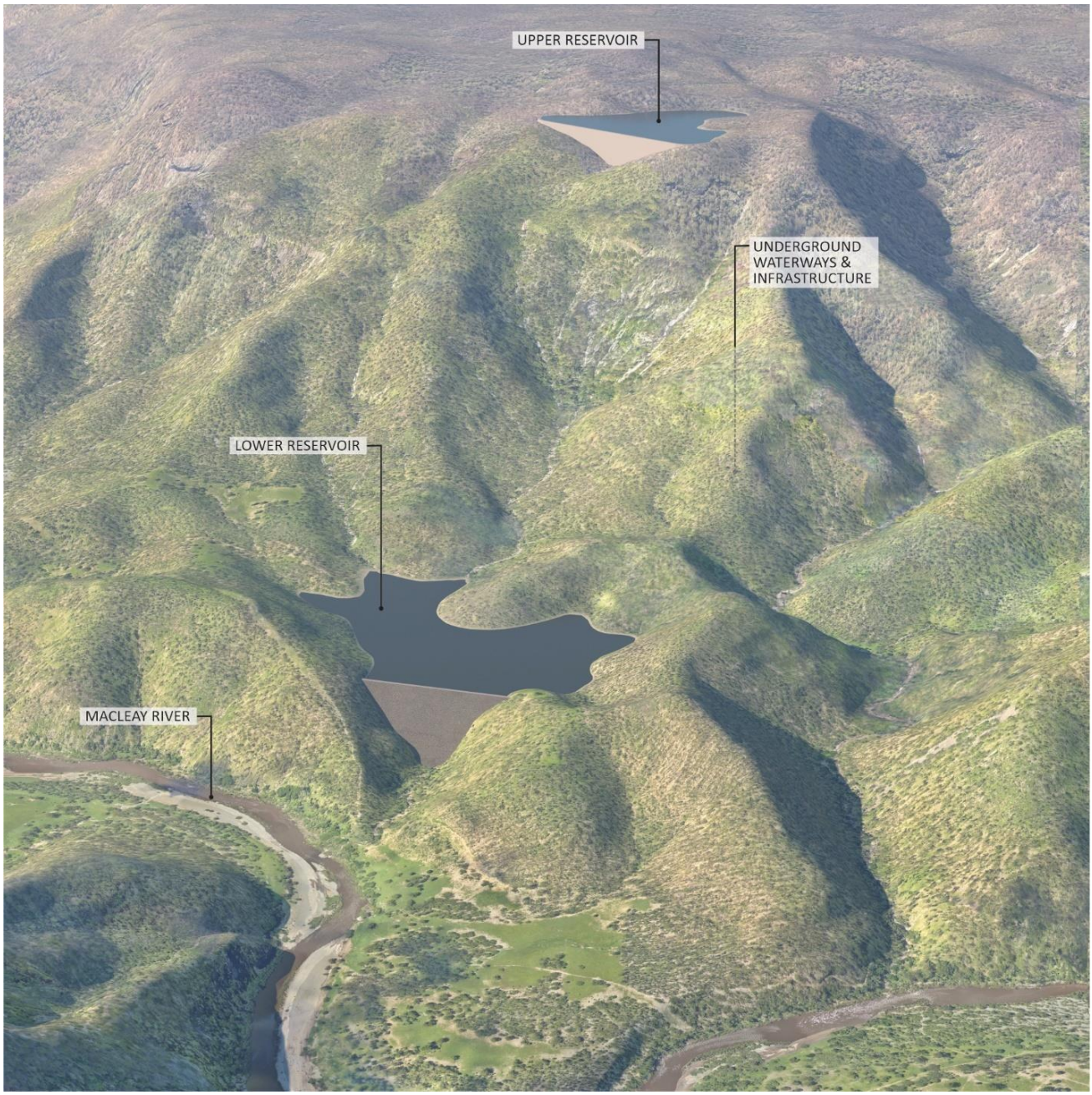


Figure 3.2 Artistic interpretation of the upper and lower reservoirs at the Project site

3.2.1 Underground power station

Geotechnical investigations and concept designs undertaken to date centre around an underground design in terms of waterways, power station and associated infrastructure. The final location and orientation of these elements will be informed by further geotechnical investigations.

Key elements of the underground power station include a machine hall, a transformer hall, and a tailrace surge shaft. The machine hall will house pump-generators to provide a combined nominal export capacity of 600 MW along with the associated infrastructure.

The transformer hall will contain transformers to step voltages to the machine requirements along with associated infrastructure for their safe operation, maintenance, and replacement. The transformer and machine will be connected via Isolated Phase Busbars (IPBs) while the emergency cable and ventilation tunnel (ECVT) will provide access for the connection of the transformers to the above ground electrical infrastructure.

The main access tunnel (MAT) will provide access from above ground to the key elements of the underground power station. Figure 3.1 shows the concept arrangement of these elements.

3.2.2 Lower reservoir, intake and Macleay River access

The lower reservoir is in the lower reaches of the ephemeral Fingerboard Crossing Creek, taking advantage of natural geographic attributes to minimise dam size requirements to achieve sufficient water storage. Concept designs have identified that a number of candidate dam types may be suitable for the lower reservoir including a concrete faced rockfill dam (CFRD) and gravity dam.

OMPS will utilise a DIAA process which will develop the dam design in concert with other work streams such as environmental impacts, geotechnical, hydrological and engineering studies.

The estimated inundation area of the lower reservoir at full supply level (FSL) is up to 23 ha.

Permanently submerged intake structures are required to allow water flow to and from each reservoir via the machine hall and water ways. These structures will also require intake gates or tower structures for safe operation of the facility and a likely access bridge to the tower or gate.

Infrastructure to allow water take from and/or release to the Macleay River is required and will comprise pipes, pumps, structures at or near Fingerboard Crossing Creek, and associated infrastructure to allow for the safe operation of the pumps.

3.2.3 Upper reservoir and intake

The upper reservoir is located in the upper reaches of the Fingerboard Crossing Creek. The upper reservoir is set in a steep walled valley. The candidate dam types for the upper reservoir include a roller compressed concrete (RCC) or CFRD dam to be refined further by the DIAA process. The dam designs between the upper and lower dams may differ.

The estimated inundation area of the lower reservoir at FSL is up to 24 ha.

As with the lower reservoir, permanent intake structures and associated intake gates or towers will be required and access bridge to these associated elements is also likely with detailed design required for confirmation.

3.2.4 Spillways

Both the upper and lower reservoirs will require spillways to safely discharge overflow generated by excess water within the system due to localised inflows including seepage, groundwater etc, and/or rainfall and flood events.

The lower reservoir will experience larger floods than upper reservoirs, due to larger natural catchment size. Therefore, the spillway at the lower reservoir will need to be designed for significantly higher design discharge capacity.

The spillways would terminate with structures to dissipate the flow energy prior to release into the existing creek bed. Modifications to a short section of Fingerboard Crossing Creek may be required depending on the scour suitability of the underlying rock for the design spill flow rates.

3.2.5 Power waterway tunnels and chambers and shafts

The power waterway is the component connecting the upper and lower reservoirs and concept designs are for an average of approximately 5 m in diameter. This diameter will change upstream and downstream of the power station complex as the waterway bifurcates to the machines. The low-pressure headrace is connected to the upper intake and is approximately 250 m long. The headrace would be followed by an approximate 640 m deep vertical pressure shaft.

Penstocks, potentially steel-lined, which are approximately 300 m long would interface with the bottom of the pressure shaft to the power station complex. A tailrace surge shaft indicatively of a nominal 5 m diameter and 130 m height may be required to help regulate the hydraulic transients ('water hammer'). The relatively flat tailrace is approximately 1,450 m long and, to ensure the tailrace is pressured, the last section is more steeply inclined to the lower intake. Overall, the waterway length is approximately 2,700 m. A longitudinal section showing these elements is provided in Figure 3.3**.**

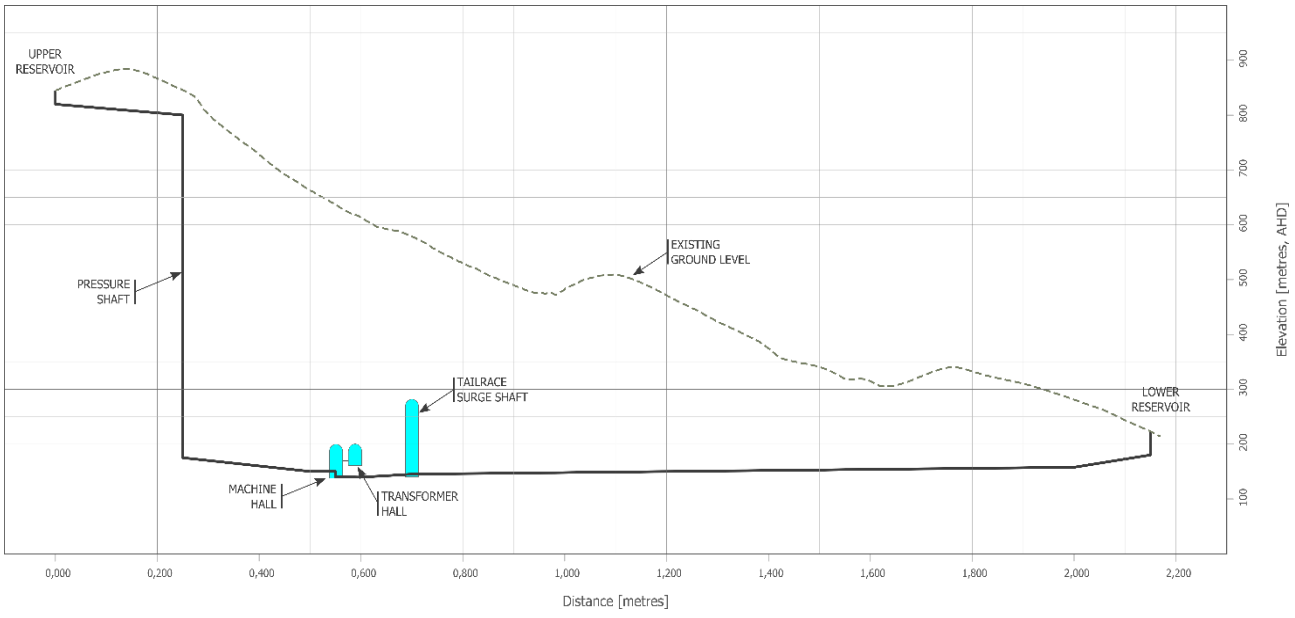


Figure 3.3 Longitudinal section of concept layout

3.2.6 Permanent access tunnels

Access tunnels are needed to provide efficient and safe access to permanent infrastructure during both construction and operation. They serve multiple purposes including provision of access for personnel, electrical connection to the electricity grid, emergency egress, and ventilation. The expected tunnels for the Project are as follows.

Table 3.2 Permanent access tunnels

Access tunnel	Description
MAT	This is the primary access tunnel and will be designed to a slope limit of approximately 10 per cent and allow for movement of vehicles and the transport of the largest replacement items. Concept designs indicate a length of 1,400 m from the power station complex to above ground.
ECVT	To meet normal fire and life safety criteria, a secondary tunnel is provided for emergency egress, High voltage power evacuation and ventilation called the ECVT. This tunnel can be steeper as it is not the primary access path to the station and has been assumed to be at a grade of 20%. Concept designs indicate a length of approximately 700 m from the power station complex to above ground.
Other tunnels	Access tunnels between the machine hall and transformer hall and waterways will be designed to consider access to elements such as IPBs, and draft tubes.

3.2.7 Access roads

Site access to and from the Project area will be via the Kempsey-Armidale Road either via Armidale or Kempsey. The current road build is insufficient for the level and nature of Project transport requirements and upgrades will be required. There are currently two site access locations under investigation from the Kempsey-Armidale Road to the Project area, these locations are based on preliminary discussions with local landowners and design considerations. The first location is near the George's Junction campground, in the north-west corner of the Project area. Additional consultation with the community has identified a second location on the eastern side of the Project area (on the Kempsey side of Lower Creek). Site access is likely to include at least one new crossing of the Macleay River. Detailed design, construction programming, further consultation with landowners and preliminary traffic assessments will be required to confirm location of site access to the Project area (and subsequent road upgrades and river crossings) and will be assessed further during the EIS phase.

Within the Project area, approximately 15 km of surface access roads will be required to be constructed so as to allow access to the upper and lower reservoirs, MAT and ECVT and associated infrastructure.

The road will need to consider the risk of inundation in high flood waters. For access to the upper reservoir and pressure shaft area, the road alignment will be located in the investigation area for the construction footprint (shown in Figure 3.1).

3.2.8 Power and communication infrastructure

Whilst a separate application will be prepared for the transmission works, the scope of works for the generation component includes some power and communication infrastructure. A switching yard will be required to provide connection to the transmission network. The switching yard may include transformation of voltages between the transmission voltage, transformer hall high side voltage, and site services voltage. An auxiliary supply either via the local distribution network or on-site generator for plant reliability will also be included. Also housed within the switching yard will be protection and control equipment, communications equipment and interfaces, buildings and facilities to house and operate the equipment.

Redundant communication paths will be established for secure and reliable operation of the facility. These may be achieved via optical ground wire (OPGW) associated with the transmission interconnection back to or near TransGrid's Armidale substation, existing third-party fibre optic assets in the region, and/or microwave links via new communications towers on site and via repeaters to TransGrid's Armidale Substation. It is expected that these new links will suffice for business communications purposes.

3.3 Construction elements

This section provides details on the construction elements and activities needed to support the construction of operational infrastructure.

3.3.1 Overview of construction methods

The proposed construction methods for key project elements are outlined in Table 3.3.

Table 3.3 Construction methods for key project elements

Project element	Construction method
Access tunnels	Likely construction method will be drill and blast, however this method will be confirmed during detailed design for the MAT, ECVT, and adits (where required).
Underground power station	Likely construction method will be drill and blast, however this method will be confirmed during detailed design for the underground power station.
Lower reservoir and intake	Likely construction method will include the lower reservoir floor to be stripped to a suitable depth using conventional civil engineering methods with intake excavation occurring in conjunction with the power waterway tunnel. This method will be confirmed during detailed design.
Upper reservoir and intake	Likely construction method will include the upper reservoir floor to be stripped to a suitable depth using conventional civil engineering methods with intake excavation occurring in conjunction with the power waterway tunnel. This method will be confirmed during detailed design.
Power waterway tunnel, chambers and shafts	Likely construction method will be drill and blast with associated road headers as a suitable method for the near horizontal components and raise bore associated with down reaming for the vertical components. This method will be confirmed during detailed design for power waterway tunnels.
Power and communication infrastructure	Civils and building works will be used for the switching yard. Civils for the foundations of the transmission and microwave tower structures.
Construction compounds	Civil and building work for the construction compounds, lay down yards, concrete batching plant, and site offices.

3.3.2 Access roads

Due to the nature of the site, the establishment of access roads from the Armidale-Kempsey Road requires at least one new access over the Macleay River followed by internal roads for both construction and operation. Detailed design will determine the most efficient method for construction of the new access. All weather site access roads will be constructed via civil earthworks suitable to the terrain.

3.3.3 Accommodation camps

Due to the remoteness of the site, temporary accommodation will be required for the construction workforce. Potential locations for one or more accommodation camps will be identified during detailed design and EIS preparation and may be outside the Project area boundary. The camp(s) will contain individual rooms, mess and recreational facilities.

As a DIAA method to iterate and refine project requirements, the following key criteria will be included in the consideration of the accommodation camp locations:

- land ownership arrangements;
- suitable zoning for the establishment of an accommodation camp;
- site topography, drainage and soil conditions, and low susceptibility to flooding;
- avoidance, where possible, and minimisation of disturbance to neighbours, threatened vegetation, Aboriginal areas of significance;
- sufficient land size to support required accommodation levels;
- access to or the ability to supply necessary food, water, communications, and electricity;
- proximity to the Project area;
- accessibility by emergency services; and
- security and safety of accommodation camp residents and nearby neighbours.

3.3.4 Supporting services infrastructure and utilities

The following supporting key services outlined in Table 3.4 will also be required to support the construction of the Project.

Table 3.4 Construction and sourcing methods for key services

Project element	Construction method
Site offices and services	Cut and fill civils methods will be employed to ensure a level yard for site offices, workshops, facilities buildings and parking. Suitable drainage and surface dressing to allow all weather access. The compound to be serviced for electricity, communications, water and wastewater/sewerage.
Potable water	Investigations will be undertaken for servicing site potable water needs and may include interception, storage and treatment of surface water, establishment of ground water bores, or importation from third party sources.
Wastewater and sewerage	Waste water from intercepted ground water will be assessed for suitability to utilise on site (construction water). Suitable sewerage management is required including removal from site.
Electricity supplies	Investigations will be undertaken to utilise nearby TransGrid 132 kV supply, which may suit as longer term auxiliary supply. Essential Energy supplies in the region and may be an alternate supply with arrangements to support reliability required. Alternate mobile generator units may be required to bridge timing gaps and/or supplement reliability.
Communication Infrastructure	The region has marginal telecommunications coverage and a site communications network will need to be established. Typically these comprise a private ultra-high frequency network for communication in and around the Project area. The nature of the construction undertakings requires a more robust communication solution and investigations will be undertaken including whether existing fibre optic assets in the Georges Junction region can be utilised or the establishment of microwave repeater network coupled with private radio communication.

Table 3.4 Construction and sourcing methods for key services

Project element	Construction method
Site safety	• A first aid facility will be established within the site offices compound. • An early establishment of helicopter landing area(s) for rapid evacuation of personnel will be required. • A network of fire fighting water tanks will also be required as the region is prone to bushfires. • The remoteness and complexity of the site and terrain lends itself to controlling access to the site, nonetheless given the anticipated volume of workers on site, a suitable site access control management framework will be implemented.

3.4 Construction details

3.4.1 Site access and movement

Access to and from the Project area is primarily via the Kempsey-Armidale Road. It is anticipated that the Kempsey-Armidale Road traffic volumes will be significantly increased and a detailed traffic study is required to ensure a suitable management strategy is developed to coordinate anticipated construction traffic and existing road requirements. There will be a need to close portions of the road to allow over dimensional/over mass transport safely. The timing, durations of any closures will be the subject of study and consultation.

The Kempsey-Armidale Road will require upgrades to accommodate the anticipated traffic volumes and nature of transported materials. Further investigations are required as part of the DIAA to detail the level, nature and location of upgrades required.

3.4.2 Transport of materials

On-site geotechnical investigations indicate that local materials may be suitable for use as concrete aggregate and dam fill, but additional materials such as fly-ash and cement dust may need to be transported to site. Investigations into suitable quarries within the region for other required materials will be made and will inform transport volumes and direction.

3.4.3 Excavated rock management

Material quantities of excavated materials will be generated during the construction of the Project, particularly from the construction of the power waterway tunnels, underground power station, MAT and ECVT. There is the potential opportunity to utilise some of these materials within the overall site constructions including access roads and dam walls. There will potentially be material that either cannot be utilised or is excess to requirements that will need to be managed on site.

Detailed site investigations into rock suitability will inform excavated rock management approaches which may include utilisation or disposal on or off site. At this stage of the Project it is not yet known where the excavated rock will be managed and stored. This would form part of the next phase of engineering design which is being undertaken to inform the EIS and DIAA process.

Notwithstanding the above, the long term options under consideration for rock excavated include:

- construction of the dam walls;
- use as a construction material for the Project (ie aggregate for the production of concrete);

- road base material for the construction or upgrade of roads;
- base material for construction pads; and
- land-based disposal off-site outside of the Project area.

3.4.4 Reservoir filling

Hydrological analysis shows that initial filling can be achieved via the Macleay River during high flow periods with minimal impact on the overall river flow. Infrastructure connecting the lower reservoir to the Macleay River coupled with pumping infrastructure at or near to Fingerboard Crossing Creek will be required. Up to an estimated 6,000 megalitres (ML) will be required for the initial fill and filling times may vary depending on environmental conditions.

3.4.5 Workforce

Initial estimates of a peak construction workforce of 600 people will be refined during detailed design and through the development of the EIS. The majority of the works are civils based and it is expected a significant portion of the work force can be sourced from the nearby LGAs. In addition, there are airports at Armidale, Port Macquarie and Coffs Harbour that allow fly-in/fly-out resources to be sourced for the Project.One or more accommodation camps will accommodate these workers with the location of these camps to be determined per Section3.3.3.

Initial estimates are of approximately 30 full-time equivalent operational workforce.

3.4.6 Schedule and hours of construction

The project construction is currently anticipated to span 36 to 48 months targeting commencement in 2023. To achieve this compressed timeframe, some construction activities may be required to be undertaken in shifts of up to 24 hours per day 7 days per week. Further detail will be developed during detailed investigations and EIS development.

3.5 Rehabilitation and decommissioning requirements

Rehabilitation will, as far as practicable, be undertaken progressively during all phases of the Project and consideration of rehabilitation risks and planning will apply from construction, operations and decommissioning through to final landform design, reinstatement, and revegetation. Indicative rehabilitation activities are given in Table 3.5.

Table 3.5 Indicative rehabilitation activities

Development feature	Rehabilitation
Road access works	All areas disturbed by road works will be stabilised using erosion and sediment control techniques and revegetation.
Construction portals	Portal area to be sealed from entry using suitable fill material, shaped, stabilised and rehabilitated.
Construction compounds and supporting infrastructure	Infrastructure removed (as agreed with relevant landowners or land managers) and rehabilitated to an agreed state consistent with the nominated final land use.
Tunnel entries	Construction or works area is to be limited and revegetated. The tunnel entry batters will be stabilised and rehabilitated.

Table 3.5 Indicative rehabilitation activities

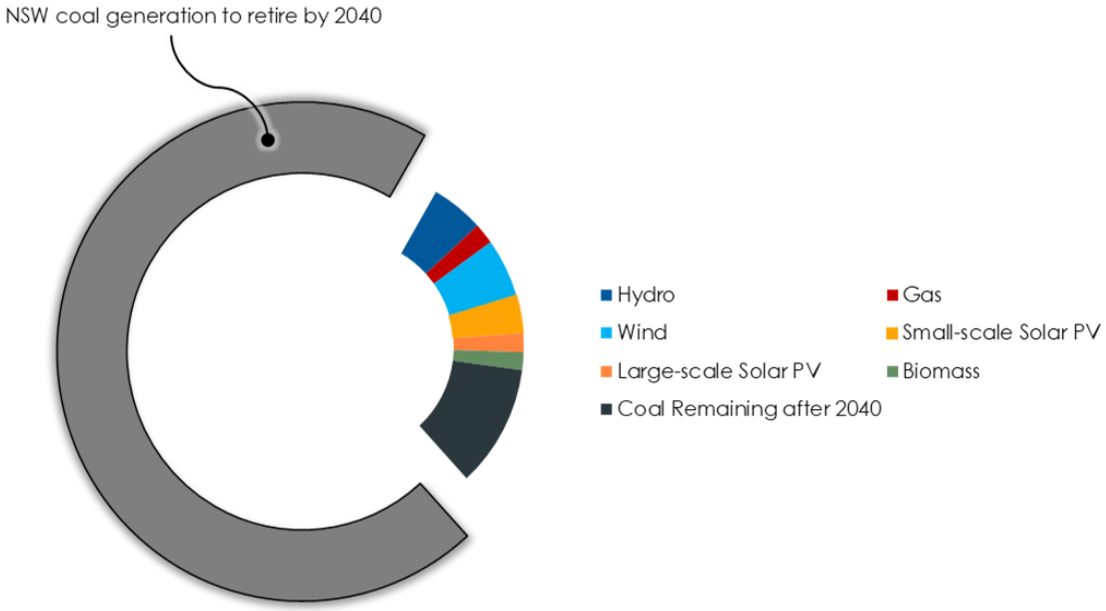
Development feature	Rehabilitation
Temporary stockpiles	Stockpile material re-used in rehabilitation (if suitable), and surfaces repaired and rehabilitated.
Intake structures	The intake structures at the upper and lower reservoirs will have a façade treatment above the minimum operating level (MOL) that appropriately stabilises the batters and is of a finish and appearance that mitigates any visual impacts.

4 Strategic and statutory context

4.1 NSW energy transition

To date, most electricity in the National Electricity Market (NEM) comes in the form of coal-fired generation and NSW has the highest dependence on coal of all regions. Most of coal generators in NSW are set to retire, as they near the end of their technical and economic life, in the short to medium term starting with Liddell in 2022-2023 and followed by Vales Point (2029), Eraring (2031) and Bayswater (2035). All five NSW coal fired power stations are expected to retire by 2043, while four of these are expected to withdraw by 2035.

Figure 4.1 breaks down NSW electricity generation over the last financial year by technology and illustrates the expected loss of the state's dispatchable capacity due to these retirements.



Data Source: AEMO 2020 ISP

Figure 4.1 NSW Generation 2018-19 and Pending Coal Retirements out to 2040

NSW faces the largest challenge but also has the greatest opportunity of all NEM regions in the transition away from coal. The *NSW Electricity Infrastructure Roadmap*, issued in November 2020, provides a blueprint for *"an integrated policy framework to secure an affordable, reliable and clean energy future for New South Wales"*. In doing so, the Roadmap paves the way for significant investment and jobs within NSW for the next decade and beyond while also lowering electricity costs to consumers. This is achieved by replacing retiring coal with low cost renewable bulk energy generation plant (primarily wind and solar) and storage. The resulting NSW *Electricity Infrastructure Investment Act 2020* (EII Act) aims to encourage investment in:

- renewable energy generation;
- long duration storage like pumped hydro energy storage and firming which can also be contributed by batteries and gas; and
- new transmission to support the transition.

To achieve the needed energy reliability, the Roadmap draws on AEMO's projection of approximately 2.3 GW of long duration storage required in NSW over and above the 2 GW from Snowy 2.0. Pumped hydro energy storage is the primary source of long duration energy storage globally and able to provide the bulk energy time shifting to when needed. The EII Act defines "*long-duration*" as storage for at least eight hours.

Pumped hydro energy storage, by utilising natural terrain features, can provide efficient, responsive and reliable long duration storage over a useful life of 50+ years. A high proportion of civils works means the technology is local jobs-intensive.

The Roadmap details plans to efficiently deploy generation, transmission, storage and system services within coordinated REZs including the prioritised 8 GW New England REZ now legislated in the EII Act. Pumped hydro energy storage strongly supports this approach to assembling dispatchable regions by providing not only energy storage but, by virtue of being a synchronous plant, also providing critical services including system strength, inertia and voltage support. Further, the dispatchable nature of pumped hydro allows for existing and future transmission assets to be operated much closer to their design capability than is currently the case.

4.2 Need and benefits of the Project

More pumped hydro energy storage is required to meet NSW's essential energy needs. The Project is uniquely positioned to do this and will connect to the New England REZ which is anticipated to be the State's largest REZ at 8 GW of new renewable energy generation.

4.2.1 Project timing to address pending retirement of NSW coal generators

The Project is strategically planned to address the pending retirement of NSW coal generators and will act to reduce the risk of emerging energy reliability gaps as highlighted in the *NSW Electricity Strategy*. The anticipated timeline (refer to Figure 4.2) allows for it to be available in time to provide energy security resilience and insurance against not only Vales Point and Bayswater retirement, but also any early retirements (for example, due to economic pressures).

Figure 4.2 Proposed timeline for OMPS, against planned coal exits in NSW

4.2.2 Meeting the NSW Energy Security Target

The objective of the *NSW Energy Security Target* is to have sufficient dispatchable generation to cover the loss of NSW's largest generating unit (Eraring – 680 MW). At 600 MW and up to 12 hours storage, the Project provides long-duration storage which cannot be matched by gas generation or economically provided by batteries.

As such the Project is of a sufficient scale to significantly and positively influence the State's ongoing energy reliability and security.

4.2.3 Project location

Located in the renewables-rich but transmission-congested New England REZ, the Project is able to unlock significant additional renewables generation, thereby assisting the NSW Government to achieve Stage 1 of its *Net Zero Plan*. The Roadmap and EII Act prioritise the delivery of three REZs including 8 GW of new renewable energy generation in the New England.

4.2.4 Unlocking network benefits and energy investment

The Project's high voltage connection at or near Armidale enables it to provide network benefits (system security services) and congestion relief within the New England REZ, south towards Liddell, and north towards the Queensland-NSW Interconnector, improving supply reliability within and into NSW.

Through its ability to shift peak generation and thereby reduce transmission losses to the region, the Project will deliver improvements to marginal loss factors (MLF) and congestion relief to the local network. As a synchronous plant either in generation, load or in synchronous condenser mode, the Project will underpin the connection of high-quality renewable generation in the New England REZ, decreasing fuel consumption as well as reducing the cost of generation. These two points provides much-needed certainty to renewable energy investors. The ability of this project to enable the NEM's transition is strongly aligned with the Roadmap, EII Act, *NSW Electricity Strategy* and NSW emissions reductions targets.

4.3 NSW planning framework

The EP&A Act and NSW *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) form the statutory framework for planning approval and environmental assessment in NSW. This legislation is supported by environmental planning instruments (EPIs) including State environmental planning policies (SEPPs) and local environmental plans (LEPs).

4.3.1 Critical State Significant Infrastructure

Section 5.12 of the EP&A Act provides for the declaration of State significant infrastructure (SSI), and Section 5.13 enables the NSW Minister for Planning and Public Spaces to declare SSI to be CSSI if 'it is of a category that, in the opinion of the Minister, is essential for the State for economic, environmental or social reasons'.

The declaration came into effect on 4 September 2020 and is reflected in clause 20 of Schedule 5 of the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP).

In public statements, the NSW Minister for Energy and Environment stated that:

> … pumped hydro was essential for the State's energy future and works by pumping water up the hill when energy is cheap and letting it run down the hill when the sun isn't shining and the wind isn't blowing.
>
> The Australian Energy Market Operator says that NSW needs more than twice the energy storage of Snowy 2.0 again by the mid-2030s and projects like Oven Mountain can help us reach that goal.

The NSW Minister for Water, Property and Housing and Member for Oxley stated that:

> … the project would be an essential part of the local future water infrastructure.
>
> The project will include the construction of two reservoirs, tunnels and a new underground power station, creating jobs and critical water infrastructure with the potential to operate as a water source for firefighting and water security for Kempsey.
>
> The infrastructure will enable water from the lower reservoir to be pumped into the upper reservoir using excess power from other renewable energy projects. It is then released to generate up to 600 MW of hydro power during periods of peak demand.

The Member for Northern Tablelands stated that:

> … regional NSW has some of the best pumped hydro resources in the world and coming out of the COVID-19 recession we should be using those resources to create jobs.
>
> Oven Mountain could inject more than $1 billion of investment into our region and create up to 600 new local jobs during construction alone.
>
> This project is the jewel in our region's renewable energy crown and cements the New England as the renewable energy powerhouse of Australia.
>
> We're already home to the two largest windfarms in NSW and the largest solar farm in Australia is about to start construction, so this project is the cherry on top.

Clause 20 of Schedule 5 of the SRD SEPP identifies the Project as follows:

> **20 Oven Mountain Pumped Hydro Energy Storage Project**
>
> (1) Development for the purposes of the Oven Mountain Pumped Hydro Energy Storage Project.
>
> (2) The Oven Mountain Pumped Hydro Energy Storage Project includes the following—
>
> (a) pumped hydroelectric and generation works, including—
>
> (i) subsurface works to facilitate exploratory geotechnical investigations, and
>
> (ii) new upper and lower water storage dams and reservoirs, and
>
> (iii) a new underground pumped hydroelectric power station, and
>
> (iv) water and access tunnels, surge tank, intake and outlet structures, and
>
> (v) water offtake works to connect the water storage dams and reservoirs to the Macleay River, and
>
> (vi) decommissioning works and rehabilitation of the site,
>
> (b) transmission works, including—
>
> (i) new electricity transmission lines to connect the pumped hydroelectric and generation works to the existing electricity transmission network, and
>
> (ii) new electricity transmission infrastructure and upgrades on the existing transmission network back to, or in the vicinity of, the existing substation at Armidale, and

(iii) augmentation of the existing substation, or the construction and operation of a new substation near Armidale,

(c) ancillary development, including (but not limited to) access roads, on-site quarry and related infrastructure, utilities and communications infrastructure, construction accommodation, construction compounds and construction power supply.

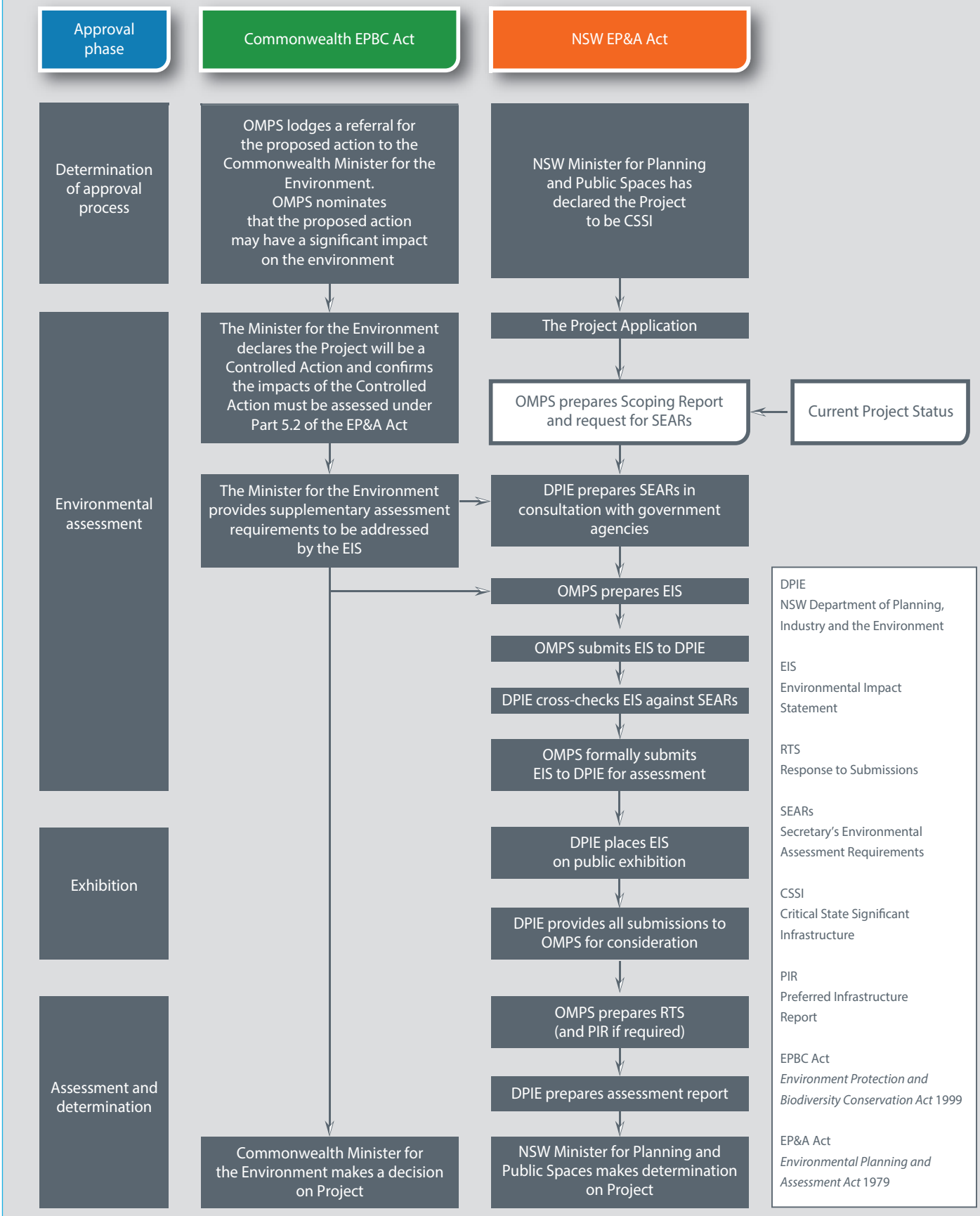
(3) The development is to be carried out on land in the local government areas of Armidale Regional Council and Kempsey Shire Council.

(4) The development does not include the carrying out of surveys, sampling, environmental investigations, geotechnical borehole drilling, test drilling, test excavations or other tests or investigations for the purposes of the preliminary design and assessment of the Project.

The Project is development of the kind specified in Schedule 5, clause 20, subclause (2)(a) and(c) of the SRD SEPP and, therefore, may be carried out without obtaining development consent under Part 4 of the Act and is declared to be SSI and CSSI. As such, the project requires assessment and approval under Division 5.2 of the EP&A Act.

4.3.2 Approval pathway

Division 5.2 of the EP&A Act sets out the assessment and approval framework for SSI and CSSI and is shown in Figure 4.3. The NSW Minister for Planning and Public Spaces is the determining authority for CSSI.



Approval pathway
Figure 4.3

4.3.3 Other State approvals and licences

Under sections 5.23 and 5.24 of the EP&A Act, certain separate environmental approvals would not be required for the Project or would be required to be issued consistent with the planning approval granted to the Project. Each of these separate environmental approvals is considered in Table 4.1.

Further environmental and other approvals may be required in addition to those referred to under section 5.23 and 5.24 of the EP&A Act, and these would be considered and outlined where relevant to the assessment of the Project as part of the EIS.

Table 4.1 Other State approvals and licenses

Approval	Relevance to the Project	Comment
Approvals not required under section 5.23		
A permit under section 201, 205 or 219 of the NSW *Fisheries Management Act 1994* (FM Act)	Relevant but not required	Consistent with clause 5.23 of the EP&A Act, these approvals are not required for SSI or any investigative or other activities that are required to be carried out for the purpose of complying with any environmental assessment requirements in connection with an application for approval.
An approval under Part 4 or an excavation permit under section 139 of the NSW *Heritage Act 1977*	Relevant but not required	
An Aboriginal heritage impact permit under section 90 of the NSW *National Parks and Wildlife Act 1974*	Relevant but not required	
A bushfire safety authority under section 100B of the NSW *Rural Fires Act 1997*	Relevant but not required	
A water use approval under section 89, a water management work approval under section 90 or an activity approval (other than a groundwater interference approval) under section 91 of the NSW *Water Management Act 2000*	Relevant but not required	
Approvals required to be issued consistently under section 5.24		
An aquaculture permit under section 114 of the FM Act	No	The project does not involve aquaculture.
Approval under section 15 of the NSW *Mine Subsidence Compensation Act 1961*	No	The project is not within a mine subsidence district.
A mining lease under the NSW *Mining Act 1992*	No	The project does not involve mining.
A production lease under the NSW *Petroleum (Onshore) Act 1991*	No	The project does not involve petroleum production.
An environment protection licence (EPL) under Chapter 3 of the NSW *Protection of the Environment Operations Act 1997*	Yes	An EPL will be required for the applicable scheduled activities. Under section 5.24(1) of the EP&A Act, an EPL cannot be refused if it is necessary for carrying out approved SSI and is to be substantially consistent with the EP&A Act approval.
A consent under section 138 of the NSW *Roads Act 1993*	Yes	The project involves interaction and works within public road reserves.
A licence under the NSW *Pipelines Act 1967*	Relevant	The Project involves the construction and operation of water pipelines and therefore licensing under this Act will be further investigated during the EIS phase.

A number of State and regional policies are relevant to the Project. It is noted that EPIs, including SEPPs, do not apply to SSI by virtue of section 5.22(2) of the EP&A Act. Nevertheless, the SEPPs that would have otherwise applied to the Project in the absence of section 5.22(2) of the EP&A Act and consideration of their consistency are set out in Table 4.2.

Table 4.2 Consistency of relevant State policies and plans

Policy/Plan	Relevance to the Project
State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007	Extractive industry activities included excavation of rock and placement of excavated material. Consideration of these matters will be given in the EIS for the Project.
State Environmental Planning Policy No. 33 – Hazardous and Offensive Development	Storage and transport of dangerous goods. Consideration of DPIE's guideline *Applying SEPP 33* (2011) and, if required, preparation of a Preliminary Hazard Assessment will be undertaken.
State Environmental Planning Policy (Koala Habitat Protection) 2020	Clearance of potential koala habitat. A biodiversity assessment will be undertaken which will include surveys for koalas to determine whether koala habitat would be impacted

4.4 Commonwealth approvals

The EPBC Act is the primary Commonwealth legislation that governs the protection of the environment. An approval under the EPBC Act is required for the Project if:

- it will have or is likely to have a significant impact on MNES; or
- it will have or is likely to have a significant impact on the environment inside or outside the Australian jurisdiction.

A search of the Commonwealth's protected matters search tool was used to generate a list of MNES or other matters protected by the EPBC Act likely to occur within the Project area. The results of the search are summarised in Table 4.3 and provided in full in Appendix B.

In addition to the above, on Tuesday 11 February 2020, the Commonwealth Department of Agriculture, Water and the Environment (DAWE) released a provisional list of animal species identified as requiring urgent management intervention following the 2019/2020 bushfire season in southern and eastern Australia. Most of the species have potentially had at least 30 per cent of their range burnt. The list includes 13 bird, 19 mammal, 20 reptile, 17 frog, five invertebrate, 22 crayfish and 17 fish species. These species were considered during the referral process. The priority animals were identified based on the extent to which their range has potentially been burnt, their conservation status prior to the fires, and the physical, behavioural and ecological traits which influence their vulnerability to fire. This list also includes species which are not currently listed as threatened under the FM Act or EPBC Act but have more than 30 per cent of their range within burnt areas.

Table 4.3 MNES matters under the EPBC Act relevant to the Project

MNES	Matters relevant to the Project
World heritage properties	There is one world heritage property within 10 km of the Project area: • Gondwana Rainforests of Australia

Table 4.3 MNES matters under the EPBC Act relevant to the Project

MNES	Matters relevant to the Project
National heritage places	There is one National heritage place within 10 km of the Project area: • Gondwana Rainforests of Australia
Wetlands of international importance	There are no wetlands of international importance in proximity to the Project area.
Commonwealth listed ecological communities	There are three listed threatened ecological communities that may occur or is likely to occur within 10 km of the Project area: • Lowland Rainforest of Subtropical Australia (Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions); • Coastal Floodplain Eucalypt Forest of Eastern Australia, currently under draft conservation advice; and • Alpine Sphagnum Bogs and Associated Fens (FA).
Commonwealth listed threatened species	A number of threatened species are known to occur within the Project area, including: Eight flora species with a moderate or high likelihood of occurring within the proposal area: • Cynanchum elegans – high likelihood; • Callistemon pungens – high likelihood; • Diuris eborensis – moderate likelihood; • Diuris pedunculata – moderate likelihood; • Grevillea guthrieana – high likelihood; • Haloragis exalata subsp. Velutina – high likelihood; • Marsdenia longiloba – moderate likelihood; and • Sarcochilus fitzgeraldii – moderate likelihood. One frog species with a high likelihood of occurring within the proposal area: Stuttering Frog (Mixophyes balbus). One reptile species with a moderate likelihood of occurring within the proposal area: Three-toed snake-tooth skink (Coeranoscincus reticulatus). Four bird species with a moderate or high likelihood of occurring within the proposal area: • Rufous Scrub-bird (Atrichornis rufescens) – moderate likehood; • Eastern Bristlebird (Dasyornis brachypterus) – high likelihood; • White-throated Needletail (Hirundapus caudacutus) – high likelihood; and • Swift Parrot (Lathamus discolor) – high likelihood Eight mammals with a moderate or high likelihood of occurring within the proposal area: • Large-eared Pied Bat (Chalinolobus dwyeri) – high likelihood; • Spotted-tailed Quoll (Dasyurus maculatus) – high likelihood; • Greater Glider (Petauroides Volans) – high likelihood; • Brush-tailed Rock-wallaby (Petrogale penicillate) – high likelihood • Koala (Phascolarctos cinereus) – high likelihood; • Long-nosed Potoroo (Potorous tridactylus tridactylus) – high likelihood; • New Holland Mouse (Pseudomys novae-hollandiae) – moderate likelihood; and • Hastings River Mouse (Pseudomys oralis) – moderate likelihood;

Table 4.3 MNES matters under the EPBC Act relevant to the Project

MNES	Matters relevant to the Project
Migratory species	There are nine migratory species with a moderate or high likelihood of occurring within the Project area: • Fork-tailed Swift (Apus pacificus) – high likelihood; • Oriental Cuckoo, Horsfield's Cuckoo (Cuculus optatus) – moderate likelihood; • White-throated Needletail (Hirundapus caudacutus) – high likelihood; • Black-faced Monarch (Monarcha melanopsis) – moderate likelihood; • Spectacled Monarch (Monarcha trivirgatus) – moderate likelihood; • Yellow Wagtail (Motacilla flava) – moderate likelihood; • Satin Flycatcher (Myiagra cyanoleuca) – high likelihood; • Osprey (Pandion haliaetus) – moderate likelihood; and • Rufous Fantail (Rhipidura rufifrons) – moderate likelihood
Commonwealth marine areas	Not applicable – the Project is not within a marine area.
The Great Barrier Reef Marine Park	Not applicable – the Project is not within the Great Barrier Reef marine park
Nuclear actions (including uranium mines)	Not applicable – the Project does not involve a nuclear action.
A water resource, in relation to coal seam gas development and large coal mining development	Not applicable – the Project is not a coal seam gas development or a large coal mining development.

While some survey work has been carried out to date, additional detailed surveys are needed to determine potential impacts of the Project on MNES. Accordingly, OMPS, on a precautionary basis, referred the Project to the Commonwealth Minister for the Environment and nominated that it has the potential to have a significant impact on MNES.

Additionally, OMPS has sought to have potential impacts of the Project assessed under an accredited process under section 87(4) of the EPBC Act, where the Commonwealth accredits the assessment process under Division 5.2 of the EP&A Act. This will enable DPIE to manage the assessment of the Project, including the issuing of the assessment requirements for the EIS. The use of an accredited assessment process does not alleviate the approval requirements of the Commonwealth Minister for the Environment under the EPBC Act. While the NSW Minister for Planning and Public Spaces is the determining authority for the Project under the EP&A Act, the Commonwealth Minister for the Environment remains the person who must decide whether or not to approve the controlled action under the EPBC Act.

5 Scoping of key issues

5.1 Issues identification

Preliminary environmental investigations have been carried out to identify the relevant matters to be addressed in the EIS for the Project, and the required level of assessment. This process was guided by the draft guidelines for scoping an EIS as prepared by the then NSW Department of Planning and the Environment (2017) and informed by identifying and characterising relevant matters, taking into account an initial scientific and technical assessment review of the Project area and project description.

A checklist of matters was provided and a preliminary impact and mitigation assessment was carried out based on available information. The full list of matters considered in the scoping assessment is provided in Appendix A. Those matters relevant to the construction and operation of the Project have been identified and allocated to one of the following categories:

- key matters or issues – these have been defined as requiring detailed assessment, ie will require detailed field surveys and/or quantified modelling techniques to fully understand the impacts and identify project-specific mitigation and/or alternatives. It is assumed at this stage of assessment that each of the listed key issues will require separate technical responses and will be separately attached to the EIS;

- other matters or issues – characterised as matters where the assessment approach and measures to manage impacts are well understood and routinely used on similar projects. Each of these issues will need to be addressed through the EIS process and require investigation, but which may or may not require a technical study; and

- scoping only issues – matters in this group have been considered in this initial scoping assessment and justification is provided as to why it is proposed that they are not investigated further.

The outcomes of the scoping investigations are provided in this report and the completed Scoping Worksheet at Appendix A.

Table 5.1 Checklist of matters identified in the Scoping Worksheet

Potential matters listed in the Scoping Worksheet that could be affected by the Project		Proposed approach to assessment in EIS as identified in the Scoping Worksheet	Reference in this scoping report
AIR	particulate matter	Standard assessment + cumulative impact assessment (CIA)	Section 5.7.2
	gases	Standard assessment + CIA	Section 5.7.2
	atmospheric emissions	Standard assessment + CIA	Section 5.7.2
AMENITY	noise	Detailed assessment + CIA	Section 5.7.1
	vibration	Detailed assessment + CIA	Section 5.7.1
	visual	Standard assessment	Section 5.7.3
	odour	Standard assessment	Section 5.7.2
BIODIVERSITY	conservation areas	Detailed assessment + CIA	Section 5.2.1
	native vegetation	Detailed assessment + CIA	Section 5.2.1
	native fauna	Detailed assessment + CIA	Section 5.2.1

Table 5.1 Checklist of matters identified in the Scoping Worksheet

Potential matters listed in the Scoping Worksheet that could be affected by the Project		Proposed approach to assessment in EIS as identified in the Scoping Worksheet	Reference in this scoping report
	aquatic ecology	Detailed assessment + CIA	Section 5.2.2
BUILT ENVIRONMENT	public domain	Scoping report	Section 5.10
	public infrastructure	Scoping report	Section 5.10
	private property	Standard assessment + CIA	Section 5.10
CLIMATE	macroclimate	Scoping report	Section 5.7.2
	microclimate	Scoping report	Section 5.7.2
ECONOMIC	natural resource use	Standard assessment + CIA	Section 5.9
	livelihood	Standard assessment + CIA	Section 5.9
	opportunity cost	Standard assessment + CIA	Section 5.9
	regional economic benefits	Standard assessment + CIA	Section 5.9
HERITAGE	natural	Standard assessment + CIA	Section 5.3
	historic	Detailed assessment + CIA	Section 5.3.2
	Aboriginal cultural	Detailed assessment + CIA	Section 5.3.1
LAND	stability / structure	Standard assessment	Section 5.5
	soil chemistry	Standard assessment	Section 5.5
	land capability	Standard assessment	Section 5.5
	topography	Standard assessment	Section 5.5
RISKS	effects of climate change	Standard assessment + CIA	Section 5.10.1
	coastal hazards	None (include short explanation in scoping report)	Section 5.10
	effects of flood waters	Detailed assessment + CIA	Section 5.4.1
	bushfire	Standard assessment + CIA	Section 5.10.1i
	effects of subsidence	Standard assessment	Section 5.10.1iii
	steep slopes	Standard assessment	Section 5.5
SOCIAL	health	Standard assessment + CIA	Section5.7.3
	safety	Standard assessment	Section 5.7.3
	community services / facilities	Standard assessment + CIA	Section 5.7.3
	housing availability	Standard assessment + CIA	Section 5.7.3
	social cohesion	Standard assessment + CIA	Section 5.7.3
TRANSPORT AND ACCESS	access to property	Detailed assessment + CIA + focussed engagement	Section 5.6
	port/airport facilities	Standard assessment	Section 5.6
	road and rail network	Detailed assessment + CIA + focussed engagement	Section 5.6
	offsite parking	None (include short explanation in scoping report)	Section 5.6

Table 5.1 Checklist of matters identified in the Scoping Worksheet

Potential matters listed in the Scoping Worksheet that could be affected by the Project		Proposed approach to assessment in EIS as identified in the Scoping Worksheet	Reference in this scoping report
WATER	hydrological flows (incl. Flooding and geomorphology)	Detailed assessment + CIA	Section 5.4.1
	surface water quality	Detailed assessment + CIA	Section 5.4.1
	ground water quality	Detailed assessment + CIA + focussed engagement	Section 5.4.6
	water availability	Detailed assessment + CIA	Section 5.4.1

Based on the findings of the scoping assessment (Appendix A), the following are considered key issues or matters for the EIS, and are detailed further in the following sections:

Table 5.2 Key matters for the EIS

Category	Matters
Key issues	• Biodiversity, including: – terrestrial ecology, and – aquatic ecology.
	• Heritage, including: – Aboriginal cultural heritage; and – historic heritage.
	• Water, including: – ground water; and – surface water, including flooding;
	• Land, including: – geology and soils; and – contamination.
	• Amenity, including: – noise and vibration; – air quality; and – landscape and visual amenity.
	• Transport and access;
	• Social; and
	• Economic.
Other issues (unlikely to require a standalone or detailed technical assessment in the EIS):	• Built environment • Climate change and other risks

5.2 Biodiversity

5.2.1 Terrestrial biodiversity

i Existing environment

The Project area crosses three Interim Biogeographic Regionalisation for Australia (IBRA) subregions: Macleay Gorges, Carrai Plateau and Macleay Hastings. However, the majority of the site falls within the Macleay Gorges IBRA subregion. Much of the Project area contains undulating and steep terrain ranging from approximately 150 m to 1,000 m above sea level that is heavily vegetated. However small areas, predominately restricted to fringing floodplain areas adjacent to the Macleay River, appear to have been previously cleared for low intensity grazing. Selective logging has also occurred within the Project area.

The primary vegetation communities present within the Project area are the North Coast Wet Sclerophyll Forests, the Northern Tableland Wet Sclerophyll Forests, and the Northern Gorge Dry Sclerophyll Forests:

- The open canopy of North Coast Dry Sclerophyll Forests is dominated by eucalypts reaching 30-60 m high, underneath which occurs an open layer of small mesophyllous trees or tall shrubs up to 15 m. The understorey comprises a second layer of mesophyllous shrubs which sits above a continuous layer of ferns and herbs. Selective harvesting, regular burning and livestock grazing have all contributed to a change in species composition.

- The canopy of the Northern Tableland Wet Sclerophyll Forests is dominated by a combination of Eucalyptus species. In these areas, shrubs are conspicuously sparse however the ground flora includes a diverse range of grasses and herbs.

- The Northern Gorge Dry Sclerophyll Forests are also characterised by an open canopy and a mesophyllous understorey.

A preliminary survey of the Project area indicates that some cleared areas have an incursion of exotic flora such as Lantana (*Lantana camara*), Thorn Apple (*Datura stramonium*) and Prickly Pear (*Opuntia stricta*). Recent bushfire activity at the end of 2019 has burnt a large amount of vegetation across the Project area, particularly higher up on ridgelines and near the site of the proposed upper reservoir where fire of medium to high intensity has occurred, resulting in scorched canopy in some places but intact in other areas. Mid-storey vegetation was noted to have been almost completely removed. Vegetation within gullies and lower slopes appeared to have burnt at a lower intensity with canopy largely intact and mid-storey and groundcover recovering adequately and may provide existing refuge habitat.

Based on existing mapping adjacent to the Project area and rapid assessment points collected during the preliminary survey, seven plant community types (PCTs) have been identified as occurring. Landscape characteristics (soils, aspect and topography) also informed the PCT determination. The seven PCTs, and potentially-related endangered ecological communities (EECs), are summarised below and shown in Figure 5.1:

- PCT 761: Cabbage Gum – Broad-leaved Apple open forest of the eastern escarpment, NSW North Coast Bioregion and South Eastern Queensland Bioregion;

- PCT 868: Grey gum – stringybark open forest of the gorges of the NSW North Coast Bioregion and New England Tableland Bioregion;

- PCT 983: New England Blackbutt – stringybark grassy forest the eastern New England Tableland Bioregion and NSW North Coast Bioregion;

- PCT 988: New England Blackbutt – Tallowwood moist shrubby forest of the escarpment ranges of the NSW North Coast Bioregion and New England Tableland Bioregion;

- PCT 993: New England Blackbutt grassy open forest of the eastern New England Tableland Bioregion;

- PCT 1106: River Oak riparian woodland of the NSW North Coast Bioregion and northern Sydney Basin Bioregion; and

- PCT 1287: Upland heath swamps of the New England Tableland Bioregion.

Generally, vegetation throughout the lower portions of the Project area is dominated by PCT 761 containing Cabbage Gum (*Eucalyptus amplifolia*), Pink Bloodwood (*Corymbia intermedia*), Rough-barked Apple (*Angophora floribunda*) and occasional Broad-leaved Apple (*Angophora subvelutina*). PCT 761 transitions into PCT 1106 within riparian areas at low elevations and is dominated by River Oak (*Casuarina cunninghamiana*) which contains a distinct rainforest element on occasion. PCT 868 is a highly diverse community and is dominated by Grey Gum (*Eucalyptus biturbinata*), Pink Bloodwood, Forest Red Gum (*Eucalyptus tereticornis*), Thin-leaved Stringybark (*Eucalyptus eugenioides*) and New England Blackbutt (*Eucalyptus campanulata*). At higher altitudes, montane moist open forest, PCT 983, PCT 988 and PCT 993 occurs, dominated by New England Blackbutt, Diehard Stringybark (*Eucalyptus cameronii*) and Sydney Blue Gum (*Eucalyptus saligna*), although the latter does not appear to be consistent with current PCT descriptions. Additionally, areas of montane peatlands occur in poorly draining depositional flats on the Carrai plateau and contain representatives of the genus *Sphagnum*. Although this area had been recently burnt, it was regenerating aggressively with a high abundance of groundcover and shrub layers.

Two EECs were observed to occur within the Project area, but are unlikely to be directly impacted by the Project, comprising;

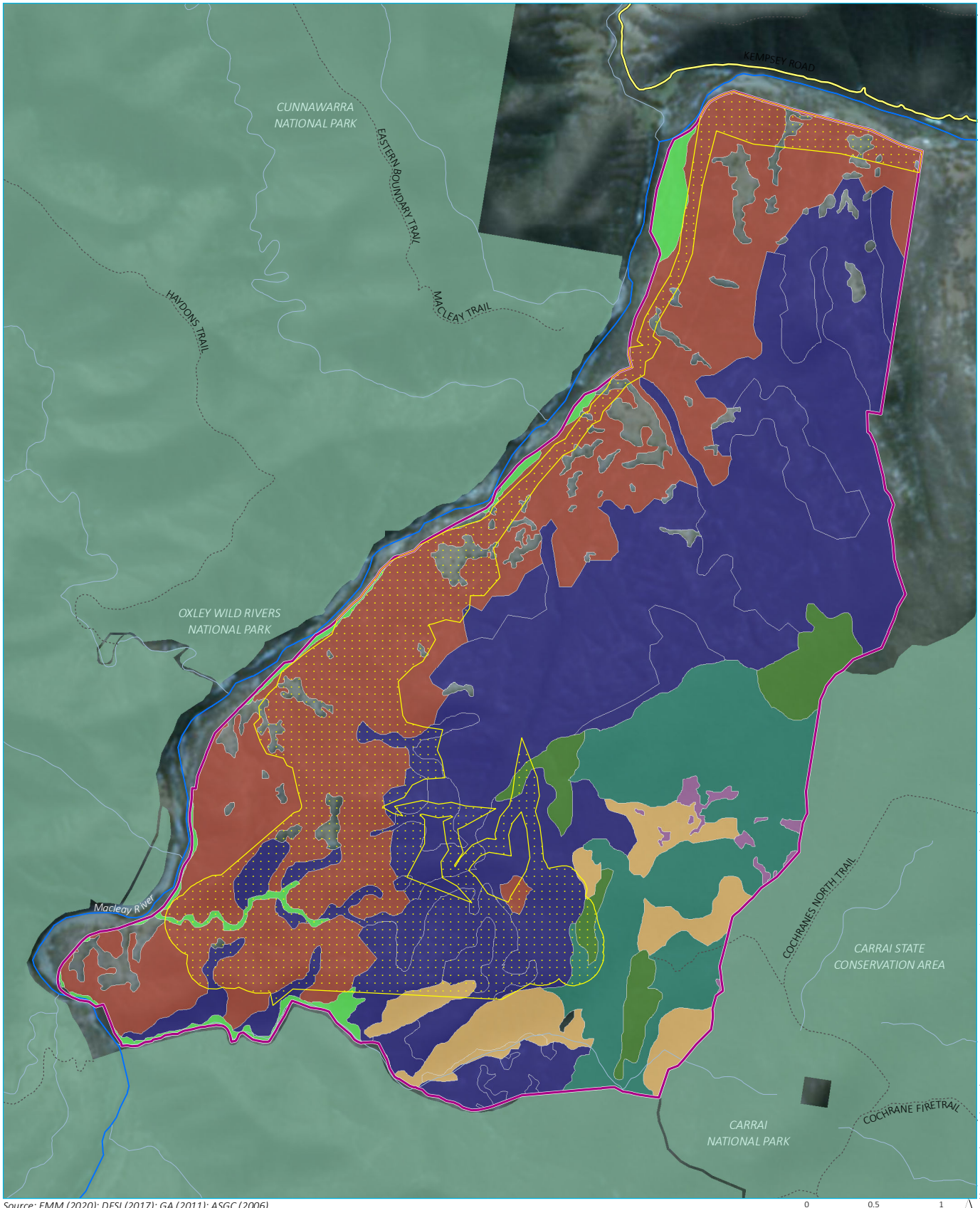
- Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion: This EEC occurs in coastal valley and floodplains up to 250 m ASL. While the majority of this EEC is currently located closer to the coast, historically, the Macleay River is likely to have supported this EEC as well and remnant areas may occur within floodplains across the lower slopes, particularly the areas around the lower reservoir and lower access tracks (DPIE, 2020). Literature suggests that this EEC is unlikely to occur higher up in the catchment adjacent to the Project. This EEC is associated with PCT 761.

- Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions EEC. Located across the Project area, this EEC occurs at high altitudes on the Carrai plateau in accumulated peaty or organic-mineral sediments on poorly drained areas at the headwaters of streams. This EEC comprises shrubs, soft-leaved sedges, grasses and forbs, and may contain *Sphagnum* spp., the peat-forming hummock moss genus. Small trees may be absent, or present as scattered emergent (DPIE, 2020). This EEC is associated with PCT 1287. Some of the swamps listed under this EEC may also be listed under the EPBC Act as Temperate Highland Peat Swamps on Sandstone EEC.

To date, as only rapid assessment surveys have been undertaken across discrete portions of the Project area, no threatened flora or fauna species were observed. It was noted that although the canopy in some areas remains unaffected by bushfire impacts, mid-storey and groundcover have been substantially burnt, with exception of areas of refuge within drainage lines and gullies. Consequently, there were limited observations of fauna presence. However, this is not considered to be representative of the broader Project area and it is expected that the vegetation and habitat within the Project area will recover adequately and fauna species will recolonise the area. The EECs, threatened flora and threatened fauna species known from, or predicted to occur within, the Project area are summarised in Appendix C.

Some vegetation within the Project area forms part of a contiguous area of forest and woodland vegetation that links Carrai National Park and Oxley Wild Rivers National Park. Although bushfire-affected, heavily wooded forest and woodland habitats as well as pockets of dry rainforest and montane bogs support a wide range of fauna species and support hollow-bearing trees and abundant fallen timber. Numerous rocky outcrops were also observed that would support a range of threatened flora and fauna, including species such as *Grevilia guthrieana*. Conversely, within the majority of cleared areas at lower elevations, there is a reduced or limited value in terms of flora and fauna habitat, other than foraging opportunities for species such granivorous avifauna, raptors and macropod grazing. The high levels of disturbance and introduction or invasion of exotic species in some areas have substantially diminished the habitat values in these areas. Waterways and riparian corridors provide aquatic habitat for species and fauna movement corridors and have high potential to transport sediments and other pollutants. Ephemeral tributaries flow through the Project area towards the Macleay River and may provide habitat for a number of amphibians and turtle species.

As shown in Figure 2.3, the GRA is nearby to the western border of the Project area where the Macleay River is situated between the Project area and the GRA (close to its western bank). The GRA comprises the major remaining areas of rainforest in southeast Queensland and northeast NSW. It represents outstanding examples of major stages of the Earth's evolutionary history, ongoing geological and biological processes, and exceptional biological diversity. The Project would not directly impact World Heritage values of the GRA, however indirect impacts may occur and these will be investigated and assessed in the EIS. The EIS will consider the EPBC Act significant impact criteria for world heritage areas, with particular consideration of whether the proposal could fragment, isolate or substantially damage habitat for rare, endemic or unique species, or more broadly, for biological diversity, in a World Heritage property. The potential for species movement and ecological process interactions between the Project area and the World Heritage property will be addressed in the EIS.



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Source: EMM (2020); DFSI (2017); GA (2011); ASGC (2006)

0 0.5 1 km

GDA 1994 MGA Zone 56

N

KEY

- Project boundary
- Investigation area for construction footprint

Existing environment

- Macleay River
- Watercourse/drainage line
- Road
- Vehicular trail
- NPWS reserve

Plant community type

- 1106 - River Oak Riparian Woodland
- 1287 - Upland Heath Swamps of New England Tableland
- 761 - Cabbage Gum – Broad-leaved Apple open forest of the eastern escarpment, NSW North Coast Bioregion and South Eastern Queensland Bioregion
- 868 - Grey Gum - Stringybark open forest of the gorges
- 983 - New England Blackbutt _Stringybark grassy forest
- 988 - New England Blackbutt – Tallowwood moist shrubby forest of the escarpment ranges of the NSW North Coast Bioregion and New England Tableland Bioregion
- 993 - New England Blackbutt grassy open forest

Plant community types

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ii Summary of potential issues

a Construction phase

Impacts to terrestrial biodiversity during the construction phase would include direct, indirect and prescribed impacts. The construction of new access roads, the reservoirs and associated facilities for the operation of the Project would require clearing of vegetation and reshaping of the topography and landscape. These activities may result in a direct and long-term impact on the extent and coverage of native vegetation and EECs. Direct impacts to threatened flora species could also occur from clearing and changes in landscape. The indirect impact would relate to loss of feeding, refuge and breeding habitat for native fauna and particularly threatened fauna. Loss of habitat connectivity and potentially habitat fragmentation may also occur.

Short-term direct impacts would also occur where areas of land are cleared for establishing the compound sites, cement batching plant, material storage and other construction staging facilities. Post construction these areas would be rehabilitated and revegetated. However, the successful recovery and re-establishment of plant communities would be limited by the extent of suitable soils and topography. Overland changes in hydrology would directly impact on overland flows, drainage lines and waterways. Indirect impacts to associated vegetation could result in changes to vegetation communities and diversity.

The potential impact of the construction of the reservoirs and tunnels on groundwater systems and perched aquifers will be studied. Noise, traffic, lights and dust from construction related activities would also contribute to a temporary decrease in fauna diversity and adversely impact on local fauna populations.

b Operation phase

Impacts to terrestrial biodiversity during operation would be limited to the operational footprint. However, traffic and maintenance activities – substantially less once the Project is operational – and possibly visitation by tourists may present a risk to fauna assemblages.

iii Possible cumulative impacts

It is acknowledged that the transmission component, which will form part of a separate and concurrent project, will be providing transmission connection to the Project and may also result in cumulative biodiversity impacts in context to the Project area.

iv Approach to assessment in the EIS

Upon issuance of SEARs, a detailed biodiversity impact assessment in the form of a biodiversity development assessment report (BDAR) will be undertaken in consideration of the NSW *Biodiversity Conservation Act 2016* (BC Act) and EPBC Act with site-specific assessment of flora, ground-based fauna, and aerial fauna (including bats and birds) to determine Project-related impacts.

The scope of the BDAR will generally include:

- detailed background from existing literature sources;
- a desktop review of relevant databases and extensive available literature to identify declared wilderness areas, flora, fauna species, groundwater dependent ecosystems (GDEs) and vegetation communities with a potential to occur within the Project area;

- seasonal field surveys of vegetation communities, terrestrial flora and fauna and habitat condition across the Project area to comply, where possible, with the NSW Biodiversity and Conservation Division's (BCD)s and DAWEs recommendations for survey;
- mapping the distribution of vegetation communities within the Project area and transport route upgrades;
- targeted searches for threatened species, populations and communities (as listed under the schedules of the BC Act and EPBC Act) that may potentially occur in the Project area;
- habitat assessments within the Project area;
- assessment of impacts on listed vegetation communities and threatened flora and fauna species;
- identification of any impact avoidance, mitigation and offset measures necessary for the Project area and transport route upgrades; and
- development of any required offset strategy in accordance with the BC Act and EPBC Act.

In addition, a review of land categorisation under the NSW *Local Land Services Act 2013* to clarify the native vegetation management regime will be undertaken. Where applicable (i.e. rural land), the potential for land to be mapped as Category 1 exempt land will be evaluated. The results will be incorporated into the BDAR where relevant and following consultation with DPIE.

The BDAR will be conducted in accordance with relevant guidelines including:

- *Biodiversity Assessment Method* (OEH, 2017);
- *Guideline for applying Biodiversity Assessment Method at severely burnt sites* (DPIE, 2020); and
- *Threatened Species Assessment Guidelines: The assessment of significance* (DPI, 2006).

5.2.2 Aquatic biodiversity

i Existing environment

Information regarding biogeographical context, topography, catchment and general ecology can be found in Section **Error! Reference source not found.** (Project area description), Section 5.2.1 (terrestrial biodiversity) and Section 5.4 (water).

As part of the aquatic ecology and GDEs (aquatic biodiversity) scoping assessment a number of databases were interrogated to determine the likelihood of occurrence of threatened aquatic habitats, communities and species, as well as GDEs, in the vicinity of the Project area. The following databases were accessed, comprising State and Commonwealth resources:

- key fish habitat maps (NSW Department of Primary Industries (DPI) Fisheries);
- threatened species lists (DPI Fisheries);
- freshwater threatened species distribution maps (DPI Fisheries);
- fish stocking (DPI Fisheries);
- freshwater pest fish (DPI Fisheries);

- *Directory of Important Wetlands: Nationally Important Wetlands* (DAWE);
- *Australian Ramsar Wetlands: Internationally Important Wetlands* (DAWE);
- *Groundwater Dependant Ecosystems Atlas* (Bureau of Meteorology (BoM));
- Protected Matters Search Tool (with a 50 km buffer) (DAWE);
- threatened biodiversity profile search (DPIE);
- *BioNet Atlas* (DPIE); and
- *NSW WeedWise: Water weeds* (DPI).

This information is summarised in the following sections, where applicable.

a Habitats

According to the database searches, three water-dependent communities of ecological significance occur within the vicinity of the Project area:

- Round Mountain Swamps (nationally important wetland NSW024): Located more than 30 km north north west and not directly connected to the Macleay River; however, may be connected via groundwater. The Round Mountain swamps are dominated by upland swamp fen comprising sedges, fen heath and bog (Oakes, 1982).
- Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions EEC. Located across the Project area, this EEC occurs at high altitudes on the Carrai plateau in accumulated peaty or organic-mineral sediments on poorly drained areas at the headwaters of streams. This EEC comprises shrubs, soft-leaved sedges, grasses and forbs, and may contain *Sphagnum* spp., the peat-forming hummock moss genus. Small trees may be absent, or present as scattered emergent (DPIE, 2020). This EEC is associated with PCT 1287. Some of the swamps listed under this EEC may also be listed under the EPBC Act as Temperate Highland Peat Swamps on Sandstone EEC.
- Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion: This EEC occurs in coastal valleys and floodplains up to 250 m above sea level (ASL). While the majority of this EEC is currently located closer to the coast, historically, the Macleay River is likely to have supported this EEC as well and remnant areas may occur within floodplains across the lower slopes, particularly the areas around the lower reservoir and lower access tracks (DPIE, 2020). DAWE literature suggests that this EEC is unlikely to occur higher up in the catchment adjacent to the Project. This EEC is associated with PCT 761.

All three communities will be assessed as a part of the terrestrial ecology scope of the EIS. However, inundated aquatic habitat may be present in the form of incised channels running through these areas, and may require assessment as part of the EIS phase.

With regard to key fish habitat, and in alignment with the FM Act objective to 'conserve key fish habitats', permanent and semi-permanent freshwater habitats must be assessed if they intersect areas of impact related to the Project. These habitats include rivers, creeks, lakes, lagoons, billabongs, weir pools and impoundments up to the top of the bank, but do not include small ephemeral headwater creeks and gullies (ie 1st and 2nd order streams) (Strahler, 1952) or farm dams constructed on these systems. The Macleay River and its tributaries are considered to potentially contain key fish habitat, in alignment with its location within the Armidale Regional LGA (Armidale/Dumaresq Key Fish Habitat Map) (DPI, 2019). Strahler (1952) and will be investigated further during the EIS phase.

b Aquatic flora

No aquatic flora listed under the FM Act or the EBPC Act were identified during database searches. A number of exotic species were identified from the Protect Matters Search Tool (PMST) results including Alligator Weed (*Alternanthera philoxeroides*; Weed of National Significance (WoNS)) and Salvinia (*Salvinia molesta*; WoNS) (WeedWise, 2020).

c Aquatic fauna

Two threatened species listed under the FM Act with the potential to occur adjacent to the Project area were identified as a result of the database searches; Southern Purple-spotted Gudgeon (*Mogurnda adspersa*) and Eastern Freshwater Cod (*Maccullochella ikei*) (refer to Table 5.3). However, the DPI Fisheries (2020) considered it to be unlikely that the Eastern Freshwater Cod will occur. Three threatened species listed under the BC Act with the potential to occur adjacent to the Project area were also identified; Bellinger River Snapping Turtle (*Myuchelys georgesi*), Manning River Helmeted Turtle (*Myuchelys purvisi*) and Western Sawshelled Turtle (*Myuchelys bellii*) (Table 5.3; Figure 5.2). Three of these species are also listed under the EPBC Act; Eastern Freshwater Cod, Bellinger River Snapping Turtle (listed as *Wollumbinia georgesi*) and Western Sawshelled Turtle (listed as *Wollumbinia belli*) (DAWE, 2020).

Exotic fish species expected to be present include the Eastern Gambusia (**Gambusia holbrooki*) and the Goldfish (**Carassius auratus*).

Subterranean fauna communities, and individual species, are not yet listed as requiring protection under Commonwealth or NSW legislation; however, GDEs require protection under the WM Act. Therefore, investigation into their presence or absence within the Project area is required, and potential direct and indirect impacts to communities, if present, need to be quantified. Potential impacts will primarily consist of direct removal of habitat (ie tunnel construction) and groundwater drawdown. It is considered that subterranean fauna communities are the primary aquatic GDE relevant to the Project; however, other species may be indirectly groundwater-dependant, depending on their degree of reliance on aquatic habitat that may be affected by groundwater drawdown.

In addition to the aforementioned threatened species, the Platypus (*Ornithorhynchus anatinus*), not currently formally listed as threatened under NSW or Commonwealth legislation, has also been included at the scoping stage. There is currently a lack of knowledge regarding species abundance at a local catchment level (Australian Museum, 2019). The species depends entirely on freshwater systems which are often subject to a number of threats including stream bank erosion, loss of riparian vegetation and channel sedimentation (Temple-Smith & Grant, 2003), and it is likely that public interest in this species will be high.

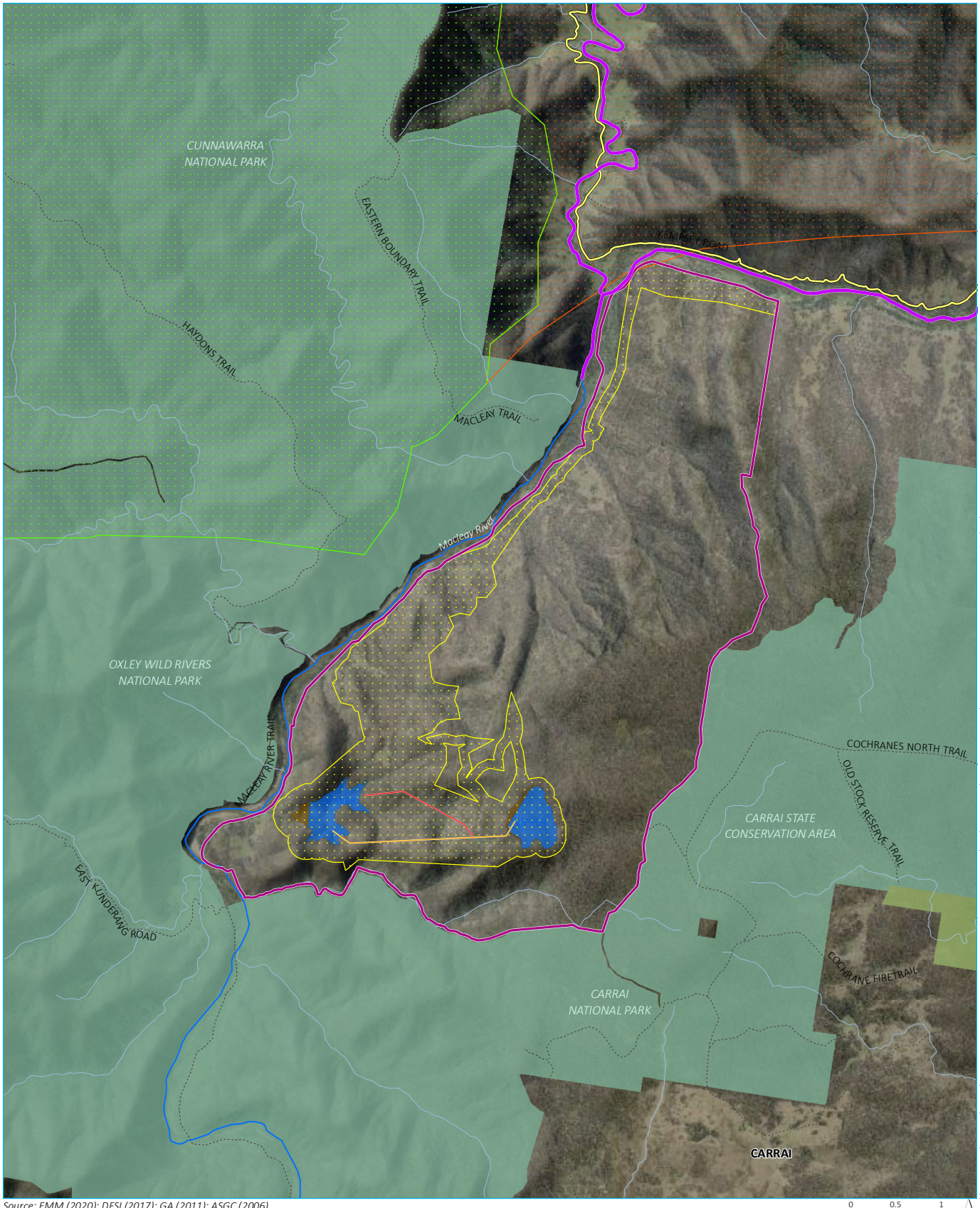
d Groundwater dependent ecosystems

The *Groundwater Dependent Ecosystems Atlas* (BoM, 2020) predicts, in terms of aquatic GDEs, that the majority of the Macleay River, as well as adjacent floodplain wetlands, in the vicinity of the Project area, are likely to have either a moderate or high reliance on groundwater. In addition, Kunderang Brook, a tributary of the Macleay River, is predicted to contain numerous areas of floodplain wetland that have a moderate likelihood of reliance on groundwater (BoM, 2020).

With regard to terrestrial GDEs, the majority of vegetation in the vicinity of the Project area is considered to have low reliance on groundwater, with areas of high dependent on groundwater limited to, likely, the floodplain immediately adjacent to the Macleay River. A number of the PCTs identified in Section 5.2.1 Terrestrial biodiversity have the potential to be GDEs; however, further assessment is required.

No databases are available in NSW which catalogue the presence of subterranean fauna; however, based on a brief literature review, it is considered possible that stygofauna may occur, with a number of stygobitic groups recorded within 60 km of the Project area. However, it should be noted that the predominant habitat type comprised cave/karst systems (Thurgate *et al*. 2001). It is considered that Eastern Australian stygofauna "…*represents a major element of continental subterranean biodiversity*…" and that many prospective areas are yet to be studied, with the majority of records limited to incidental surveys, usually undertaken by environmental consultants or similar (Hunter, 2003). A more exhaustive literature review would need to be undertaken and potentially a pilot stygofauna survey to confirm or deny presence of subterranean fauna.

Further assessment of groundwater availability and changes to groundwater during construction and operation will need to be undertaken to inform a more detailed GDE assessment. Further assessment of whether the Project area supports terrestrial, aquatic and/or subterranean GDEs will also be required as part of the EIS stage.



Source: EMM (2020); DFSI (2017); GA (2011); ASGC (2006)

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KEY

- Purple-spotted Gudgeon habitat extent
- Known Bellinger River Snapping Turtle habitat
- Known Manning River Helmeted Turtle habitat
- Project boundary
- Investigation area for construction footprint

Indicative tunnel alignments

- Main access tunnel
- Power waterway

Indicative water storage locations

- Dam
- Reservoir

Existing environment

- Macleay River
- Watercourse/drainage line
- Road
- Vehicular trail
- NPWS reserve
- State forest

Mapped aquatic threatened species habitat areas

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Table 5.3 Threatened species likelihood of occurrence (LoO)

Common Name	Scientific Name	Legal Status			LoO	Comments
		FM Act	BC Act/ WM Act	EPBC Act		
Fish						
Eastern Freshwater Cod	*Maccullochella ikei*	E	-	E	Unlikely	The PMST results indicates that the species or species habitat may occur within area. However, DPI Fisheries lists this species as only occurring within the Clarence and Richmond River catchments of northern NSW, making it unlikely that the species will occur within the Macleay River, or associated tributaries, adjacent to the Project area.
Southern Purple-spotted Gudgeon	*Mogurnda adspersa*	E	-	-	Likely	DPI Fisheries data indicates that this species occurs upstream and downstream of the location of the reservoirs within the Macleay River and several of its tributaries. Due to the anticipated relatively undisturbed nature of the waterways and riparian zone within the vicinity of the Project, it is considered Likely that this species, or species habitat, will occur.
Reptiles						
Bellinger River Snapping Turtle	*^Myuchelys georgesi* (listed as *Wollumbinia georgesi* under the EPBC Act)	-	CE	CE	Possible	DPIE (BioNet) data was not available for this species; however, DPIE (BC Act) data and PMST results suggests that this species may occur in the vicinity of the Project.
Manning River Helmeted Turtle	*Myuchelys purvisi*	-	E	-	Possible	DPIE (BioNet) data was not available for this species; however, DPIE (BC Act) data suggests that this species may occur in the vicinity of the Project.
Western Sawshelled Turtle	*Myuchelys bellii* (listed as *Wollumbinia belli* under the EPBC Act)	-	E	V	Possible	DPIE (BioNet) data indicates that more than 200 individuals have been recorded within the Armidale Regional Council LGA and data suggests that this species may occur in the vicinity of the Project.
Invertebrates						
Coastal Petaltail	*Petalura litorea*	-	E	-	Possible	Limited data and literature exist with regard to occurrence.
n/a	Subterranean fauna communities	-	✓*	-	Possible	Limited data and literature exist with regard to occurrence, abundance and diversity of subterranean fauna in NSW; however, stygofauna communities have been recorded to within 60 km of the Project.
Mammals						
Platypus^	*Ornithorhynchus anatinus*	-	-	PL	Known	Species known to occur within the Macleay River in the vicinity of the Project.

Note ✓* indicates that communities and species are not listed under WM Act; however, GDEs are addressed within the WM Act and associated policies; ^ indicates that the species is not formally listed under legislation; however, its conservation is likely to receive public interest; E = Endangered, PL = Provisional Management List, V=vulnerable, CE= critically endangered.

ii Summary of potential issues

In relation to aquatic and subterranean ecology, and without mitigation, it is considered that the main potential impacts of construction and operation of the Project may be associated with:

- the initial filling of the off river reservoir(s) (ie abstraction of water, entrainment of aquatic fauna) affecting aquatic habitat, threatened species and other aquatic fauna within the Macleay River;
- construction of infrastructure and roads (ie land clearing, sedimentation, erosion, runoff, removal or inundation of surface habitat) affecting water quality, EECs, aquatic habitat and threatened species;
- construction of dam walls and reservoirs (ie interruption of surface water flow, alteration of surface hydrology) affecting water quality, EECs, aquatic habitat and threatened species;
- construction of waterway crossings and dam walls (ie interruption of fish passage) affecting water quality, aquatic habitat and threatened species;
- excavation and operation of subsurface tunnels and associated groundwater impacts (ie removal of subsurface habitat, drainage/leakage from aquifers, reduction in baseflow) affecting subterranean water quality and GDEs (including some EECs);
- operational filling of the reservoir(s) (ie abstraction of water, entrainment of aquatic fauna) affecting aquatic habitat, threatened species, other aquatic fauna and GDEs; and
- flood events or failure of water containment structures (ie emergency release of reservoir water) affecting water quality (cold water pollution, sedimentation, etc), EECs, aquatic habitat and threatened species.

iii Possible cumulative impacts

It is possible that the exacerbation of key threatening processes, listed under the FM Act and/or the EPBC Act, within the broader region may occur as a result of the construction and operation of the Project. For example, barriers to fish passage due to the construction of waterway crossings, removal of water from the Macleay River during the filling stage contributing to broader river regulation and/or environmental water issues, and potential contribution to impacts to native riparian vegetation. Additionally, studies indicate that elevated concentrations of antimony and arsenic are present throughout the Macleay River catchment. Construction activities (ie clearing, earthworks, stockpiling), if not well-managed, have the potential to contribute to this issue, with the mineralogy of the catchment naturally high in both metals (GHD, 2016).

Additionally, it is acknowledged that the transmission component, which will form part of a separate and concurrent project, may also result in cumulative aquatic biodiversity impacts in context to the Project area.

iv Approach to assessment in the EIS

Upon issuance of the SEARs, a detailed aquatic ecology assessment (including an assessment of aquatic GDEs) will be undertaken in consideration of the FM Act, BC Act (if required), WM Act and EPBC Act. This will be informed by the collection of baseline data from key waterways in proximity to the Project area. Site-specific collection of data pertaining to water and sediment quality, algae and macrophytes, aquatic invertebrates, aquatic vertebrates, and subterranean fauna (stygofauna) will be undertaken within and downstream of key project infrastructure to determine the primary aquatic ecological receptors (abiotic and biotic, as well as threatened ecological communities and species listed in Table 5.3).

An assessment of potential impacts will be undertaken based on in-field survey, informed by modelling of changes in the hydrological and hydrogeological regime, and in accordance with FM Act, BC Act (if required) and EPBC Act assessments of significance. Identification of avoidance measures, where possible, together with the implementation of standard design and control measures during construction may address a range of potential impacts to aquatic habitat and threatened species. Mitigation and management measures to address impacts associated with, for example groundwater drawdown, will be further developed as part of the EIS stage. Offsets and/or compensation may be required for residual impacts that cannot be avoided or minimised in accordance with relevant policy requirements.

Potential impacts to aquatic ecology will be assessed according to relevant NSW and Commonwealth legislation and guidelines, where available, including:

- *Survey guidelines for Australia's threatened fish: Guidelines for detecting fish listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999* (DSEWPC 2011);
- *Policy and guidelines for fish habitat conservation and management* (DPI 2013);
- *NSW Biodiversity Offsets Policy for Major Projects. Fact Sheet: Aquatic biodiversity* (DPI 2014); and
- *Matters of National Environmental Significance: Significant impact guidelines 1.1* (Department of the Environment 2013).

5.3 Heritage

5.3.1 Aboriginal heritage

i Existing environment

The Thunggutti people have a traditional connection to the region. Other local Aboriginal groups include the Anaiwan people and Gumbaynggirr people.

A search of the Aboriginal Heritage Information Management System (AHIMS) was carried out on 10 February 2020. For the purposes of this scoping report, this search would be considered valid for 12 months. The search parameters and results are as follows:

- AHIMS Client Service ID 482893;
- Parameters: Lots 18, 19, 37 DP 756471;
- Buffer: 1,000 m;
- Aboriginal objects: 20; and
- Aboriginal Places: 0.

Table 5.4 Results of AHIMS search

Site type	Number
Artefact scatter	9
Habitation structure	6
Natural Mythological (Ritual)	2
Burial	1
Stone Arrangement	1
Restricted Site	1
TOTAL	**20**

The presence of 20 Aboriginal objects within 1,000 m of the Project area, indicates that the Project has the potential to impact on Aboriginal heritage values. The AHIMS team at Heritage NSW was contacted regarding the location of the restricted site and confirmation was received that this site is not within the Project area. None of the registered sites are within the investigation area for the construction footprint, and all but two are on the opposite side of the Macleay River (refer Figure 5.3). This distribution is likely related to previous studies undertaken in the Project area and should not be considered a comprehensive dataset for the Project area.

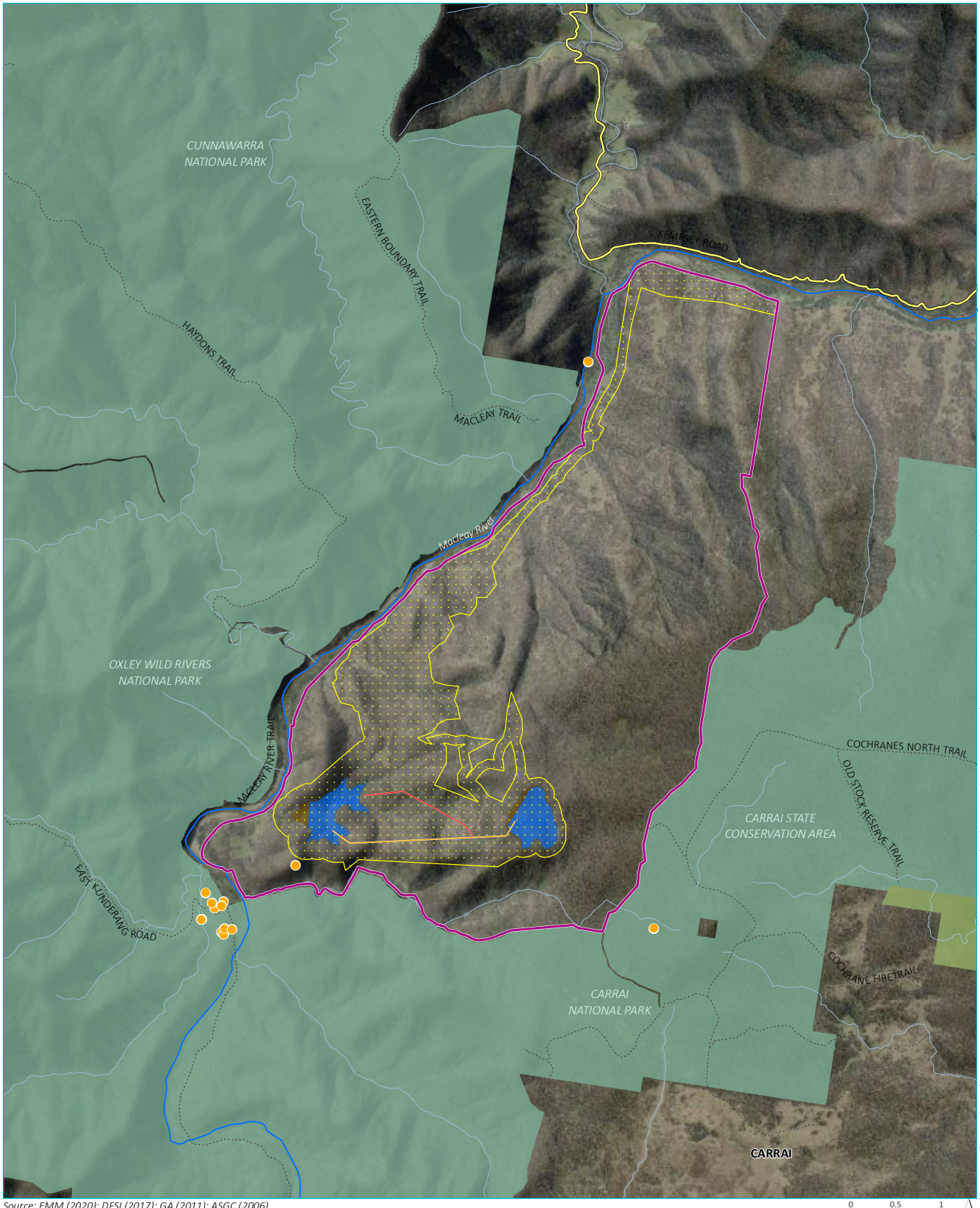
One Aboriginal Place, Carrai Waterholes is located within Carrai State Conservation Area, which is adjacent to the Project area. A preliminary heritage assessment was undertaken in 1996 (Mills, 1996) of a preliminary version of the Project area, which included a desktop review, literature review and site investigation. During the preliminary site investigation three sites were identified: an artefact scatter with a potential archaeological deposit (PAD), an isolated artefact and a historical burial of an Aboriginal youth. All of these sites fall outside the proposed development footprint, however within the Project area.

There are a number of landscape characteristics which can be utilised to assist in the predictive modelling for Aboriginal archaeological sites. The general locality comprises very steep slopes up to a plateau, with Macleay River flowing along the western boundary and a number of deeply incised gullies and streamlines which feed into the major watercourse.

The geology of the Project area comprises primarily Permian New England Corrai Adamellite, with portions of the Project area nearer to the Macleay River located on Quaternary alluvium and Dummy Creek Conglomerate. Quaternary deposits often contain gravels which include suitable raw materials for the manufacture of stone artefacts, such as silcrete, quartz, mudstone, and quartzite. Furthermore, adamellite may have been used in the form of hammerstones during the tool manufacturing process.

Soil profile reports indicate that the topsoils tend to be shallow, reaching between 15 and 45 cm, comprising sandy loam, with B horizon subsoils of clayey sand/sandy clay loam up to 70 cm before bedrock occurs.

Broad-scale vegetation mapping by Keith (2004) indicates that the primary vegetation communities present within the Project area are the North Coast Wet Sclerophyll Forests, the Northern Tableland Wet Sclerophyll Forests, and the Northern Gorge Dry Sclerophyll Forests (refer to Section 5.2.1i). These vegetation communities would have provided important flora resources for Aboriginal people including food and medicine, in addition to creating habitat for numerous fauna species which formed part of the diet and provided resources for clothing and implements.



Source: EMM (2020); DFSI (2017); GA (2011); ASGC (2006)

0 0.5 1 km

GDA 1994 MGA Zone 56

N

KEY

- Registered heritage location
- Project boundary
- Investigation area for construction footprint

Indicative tunnel alignments

- Main access tunnel
- Power waterway

Indicative water storage locations

- Dam
- Reservoir

Existing environment

- Macleay River
- Watercourse/drainage line
- Road
- Vehicular track
- NPWS reserve
- State forest

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Known Aboriginal and historic heritage within the Project area

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ii Summary of potential issues

Certain landforms are considered to have higher archaeological potential including areas within 200 m of water, raised flat areas near water, hill crest and sand bodies.

The existing AHIMS data indicates that previous studies have been undertaken on the western side of the Macleay River and identified a concentration of artefact sites associated with the confluence of the river and high order creeks. A ceremonial site and a stone arrangement are registered on the eastern side of the river, though neither are within the Project area. The landforms and environmental context indicate that sites are likely to be present along the gently sloping lower slopes and banks of the Macleay River, in the form of open artefact scatters. Burials are unlikely within the Project area due to the shallow soils, however where deep sandy soils are identified, the potential for burials would be increased. Additional sites may be present on the upper slopes and the plateau where appropriate outcrops of stone may have provided shelter, or where previously unrecorded cultural sites are present.

Potential Aboriginal heritage sites include the:

- presence of open artefact sites and archaeological deposits along lower slopes and banks of Macleay River, with specific reference to the access roads and laydown areas;
- presence of rock shelters, low density artefact sites on upper slopes and plateau, with specific reference to the upper reservoir and access; and
- presence of cultural sites (intangible and tangible) throughout the landscape, which can be determined only by local Aboriginal knowledge holders.

a Construction phase

The construction phase of works has the highest potential to harm Aboriginal objects, in particular the construction of access roads, the use of the lower slopes as a laydown/stockpile area requiring vegetation clearance and/or earthworks, and the construction of the upper reservoir.

Sites identified within construction impact zones would likely require salvage, where avoidance is not feasible.

b Operation phase

No impacts to Aboriginal heritage are likely during the operational phase. However, works may require regular monitoring of identified sites which are outside of, but in close proximity to, the Project area. This will be determined during the preparation of the EIS.

iii Possible cumulative impacts

Cumulative impacts to Aboriginal heritage would be limited given the extent of the Project area. However, consideration will be given to the connection of transmission supply to the Project, which is being carried out as a separate but concurrent project.

iv Approach to assessment in the EIS

An Aboriginal cultural heritage assessment (ACHA) and consultation with relevant Aboriginal stakeholders would be completed as part of the EIS. The report would be prepared in accordance with the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011) and the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010). Consultation would be undertaken in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2011) (ACHCRP).

5.3.2 Historic heritage

i Existing environment

Searches of the following heritage registers were completed:

- Australian Heritage Database, including the National and Commonwealth heritage lists, as well as the World Heritage List;
- State Heritage Inventory, including the State Heritage Register, Section 170 registers and local heritage items;
- Schedule 5 of *Armidale-Dumaresq Local Environmental Plan 2012* and Schedule 5 of *Kempsey Local Environmental Plan 2013*; and
- Register of the National Estate (non-statutory).

Within the Armidale Regional LGA, 358 items of heritage significance are listed by local government and state agencies of which one, the Kunderang East Pastoral Station, is within 10 km of the Project area. One item within 10 km of the Project area was identified on the National, Commonwealth and World Heritage Lists, which is the Gondwana Rainforests of Australia.

ii Summary of potential issues

There are no other identified issues associated with historic heritage within the Project area. There is low potential for unregistered historic heritage items to be present within the Project area.

While there are no historic heritage items located within the Project area, a couple are located within 10 km of it. Accordingly, there is some potential that the Project may have an indirect impact on the heritage values of these proximate sites.

a Construction phase

There is unlikely to be any direct impact on the known historic heritage values identified in proximity to the Project area during the construction phase of the Project. However, there is some potential for indirect impacts on the values of heritage sites proximate to the Project area, including visual impacts.

b Operation phase

Similar to the construction phase, there is some potential for indirect impacts on the values of heritage sites proximate to the Project area, including visual impacts, during the operational phase of the Project.

iii Possible cumulative impacts

Cumulative impacts to historic heritage would be limited given the extent of the Project area. However, consideration will be given to the connection of transmission supply to the Project, which is being carried out as a separate but concurrent project.

iv Approach to assessment in the EIS

A historic heritage assessment will be prepared for the Project which will consider potential impacts on the values of heritage sites proximate to the Project area. The assessment will be prepared in accordance with the NSW *Heritage Act 1977*, the Australia ICOMOS Charter for Places of Cultural Significance (the Burra Charter), the *Assessing Heritage Significance* (Heritage Office 2002) and *Statements of Heritage Impact* (Heritage Office 2001) and the *Local Government Heritage Guidelines (2002)*.

5.4 Water

5.4.1 Surface water

5.4.2 Existing environment

The Project is located within the Macleay River catchment, which covers an area of around 11,450 km^2 on the mid north coast of NSW. The Macleay catchment includes the towns of Armidale, Kempsey, Guyra, Walcha and South West Rocks.

The Macleay River catchment is bounded to the north by the Nambucca catchment, to the south by the Hastings River catchment, and to the west by the New England Tablelands, which forms part of the Great Dividing Range. The major tributaries that flow into the Macleay River include Apsley River, Chandler River, Styx River, Tia River, Dyke River, Yarrowitch River and Commissioners Waters.

The Macleay River terminates in an estuarine system, which opens to the Pacific Ocean north of South West Rocks. The tidal limit of the Macleay River is located approximately 54 km from the ocean entrance (25 km upstream from Kempsey at Belgrave Falls).

The Project will include the construction of an upper and lower reservoir on Fingerboard Crossing Creek, which is an ephemeral tributary of the Macleay River. The system will essentially be a closed loop with water cycling between the two storages. A temporary water storage (such as a turkey's nest or similar) may also be required to store construction water.

Fingerboard Crossing Creek displays typical characteristics of a high energy mountain stream. It is a steep, narrow channel with significant boulders in the water course, with little or no floodplain areas in the upper sections. Although it is essentially an ephemeral stream, it may have some baseflow that is fed by the plateau bogs.

Water will be required for construction activities, the initial filling of the system and for limited top-up water to replace any water that is lost due to evaporation and infiltration/seepage. Access to water will need to be consistent with the requirements of the following:

- *Water Sharing Plan for the Macleay Unregulated and Alluvial Water Sources 2016* (Macleay Unregulated WSP); and
- *Northern Rivers Catchment Action Plan 2013-2023*.

All rivers and creeks in the Macleay Unregulated WSP area are unregulated. However, some substantial instream structures exist, such as Malpas Dam (located on the Gara River), which provides Armidale's water supply. Generally, water users rely on natural flows for their water supply, although small dams and other small weirs are present.

There are several gauges within the Macleay River catchment that monitor daily stream flows. The following three gauges are used as flow reference points in the Macleay Unregulated WSP:

- 206001 Styx River at Jeogla;
- 206009 Tia River at Tia; and
- 206011 Macleay River at Turners Flat.

The closest stream flow gauge to the Project area is station 206024 (Macleay River at D/S Georges).

5.4.3 Summary of potential issues

A preliminary assessment of the surface water and hydrologic impacts associated with the Project, during the construction, filling and operational phases, was carried out based on a review of available information. This involved a high-level risk assessment to identify potential environmental impacts to surface water quality and hydrology associated with the Project.

Changes in surface water hydrology will result in potential environmental impacts to geomorphology and ecology, both upstream and downstream from the two storages. Upstream impacts for each storage will be largely defined by the inundation footprint at the FSL, plus any allowance for flood storage and/or operational requirements. Downstream impacts will be associated with changes to the natural flow regime, in terms of both quantity and quality.

The potential impact of the Project on water resources and hydrology will occur during various stages as follows:

- during the construction phase, which will be primarily erosion and sedimentation impacts associated with embankment construction and the removal of vegetation within the inundation area (if required) and any pre-construction activities (such as road works) and temporary works (such as work compounds, coffer dams and temporary flow diversions);
- during the filling phase, which may include impacts to the Macleay River flow regime, downstream from the Project, because of water extraction required for the initial filling; and
- during the operational phase, which may include impacts to the Fingerboard Crossing Creek flow regime caused by the two dams, including the capture of any necessary top-up water.

Changes to the existing flow regime may impact environmental values because of changes to timing and quantity of flows, and changes to water quality associated with erosion/sedimentation and cold-water pollution.

i Construction phase

Pre-construction activities (associated with clearing, site establishment and road works) and construction works (associated with embankments, tunneling and spoil disposal) may result in the following impacts:

- water quality impacts associated with erosion and sedimentation;

- changes to downstream flow regimes associated with water extraction; and
- changes to downstream flood extents because of the temporary works.

During the construction phase, water will be required for road works (eg dust suppression), site establishment, earthworks, concrete batching and tunnelling activities.

ii Filling phase

A significant volume of water (up to 6,000 ML) will be required for an initial one-off fill of the reservoirs.

Preliminary water balance modelling (SMEC, 2019) shows that the initial filling can be achieved via the Macleay River with minimal impact on the overall river flow. Infrastructure connecting the lower reservoir to the Macleay River coupled with pumping infrastructure at or near to Fingerboard Crossing Creek will be required.

The initial fill is intended to occur during high flow periods. Therefore, filling times will be largely dependent on environmental and flow conditions in the Macleay River.

Impacts associated with the initial filling may include the following:

- changes to the downstream flow regime in the Macleay River; and
- changes to water quality.

iii Operation phase

Following the initial fill, the system will operate essentially as a closed loop. However, due to losses from evaporation and infiltration/seepage, occasional top-up water will be required. At this stage, the volume of water has not been estimated but is expected to be relatively small and may be supplied by a combination of local tributary inflows, groundwater and additional extractions from the Macleay River.

To minimise downstream impacts, within Fingerboard Crossing Creek, it is likely that the lower storage will be used to capture the required top-up flows; it also has the larger contributing catchment. A portion of the local flows into the two storages may need to be released, based on appropriate transparency and/or translucency rules, to minimise impact on the downstream flow regime and resultant ecological impacts. However, this would be subject to findings from the ecological assessment.

Operation of the system may result in the following impacts:

- changes to the downstream flow regime in Fingerboard Crossing Creek;
- potential erosion associated with water discharge into the reservoirs (especially the lower reservoir);
- geomorphological impacts around the storages caused by the rapid drawdown of water (especially in the upper storage);
- potential erosion associated with the release of water into the Macleay River (emergency releases); and
- changes to downstream flood extents within Fingerboard Crossing Creek because of the two storages and other permanent works.

5.4.4 Possible cumulative impacts

Cumulative impacts are not anticipated for the Project. However, consideration will need to be given to the location and method of construction for the transmission component, in relation to potential cumulative surface water issues.

5.4.5 Approach to assessment in the EIS

A surface water assessment will be undertaken and documented in the EIS. The surface water assessment will document the following aspects.

i Water quality

Potential for sediment and other pollutants to be discharged into the local (and downstream) aquatic environment during construction of the Project.

The potential impacts on water quality during the construction phase can be effectively managed and mitigated with the implementation of appropriate erosion and sediment controls. Available water quality data for the Macleay River will be compiled to develop a baseline against which to assess any potential impacts including identifying any existing water quality issues from other river uses.

ii *Operational water requirements*: quantify water requirements throughout the life of the Project

A water balance model will be established to estimate the volume of top-up water required, which will vary throughout the life of the Project, based on local climatic conditions. The potential impacts associated with future climate change may also need to be considered when assessing future top-up water requirements. Potential losses from the system associated with seepage to groundwater will need to be determined.

iii *Water source(s):* identify the most appropriate source(s) of water

The source of construction water, water for the initial fill and the top-up water will be defined based on a review of available sources. These may include the Macleay River and local tributaries in the vicinity of the Project. Groundwater sources may also be considered depending on the availability of surface water.

iv *Impact to flow regimes*: changes to downstream flow regimes (especially baseflow and low flow conditions) will be quantified

Available stream flow data will be used to assess the impact of the Project on the existing flow regime within the Macleay River (ie during the initial filling phase); while a water balance model will be used to assess the impact on the Fingerboard Crossing Creek flow regime (ie any operational impacts). The Fingerboard Crossing Creek assessment will also need to consider the potential impact of groundwater drawdown on baseflow, especially in the plateau bog areas.

Impacts to the Macleay River flow regime could be largely mitigated, as water will most likely be extracted during periods of high flow. The construction of the dams across the Fingerboard Crossing Creek may result in more adverse impacts, which could potentially be mitigated with appropriate operational flow rules.

v Operational flow rules

The establishment of measures may be required to minimise impacts to Fingerboard Crossing Creek, as the dams will effectively block flows in Fingerboard Crossing Creek.

Operational rules will be developed to minimise any adverse impacts on the Fingerboard Crossing Creek flow regime (including any need to preserve environmental baseflows). This is likely to include transparency and/or translucency rules for the two storages to minimise ecological impacts. This will also need to consider any impacts associated with cold-water pollution.

vi Flood modelling

Construction of the two dams will alter flooding within the downstream section of Fingerboard Crossing Creek.

Hydrologic/hydraulic modelling of the Fingerboard Crossing Creek will be required to assess any impacts on downstream flooding, and to inform the geomorphological and ecological assessments. The flood modelling will need to consider both rainfall-induced flooding as well as flooding caused by potential operational failure (e.g. pump failure).

vii *Dam break impact*: safety considerations for the two reservoirs

Both the upper and lower reservoirs will include spillways to ensure that any inflows that exceed the reservoir capacity can be safely discharged. A dam break assessment will be undertaken to assess the consequence of failure and to inform the spillway sizing.

viii Geomorphology

Rapid drawdown in the storages may result in bank slumping and other geomorphologic impacts to the reservoirs and any inflow tributaries.

It is likely that power generation will result in rapid drawdown of the upper storage, and a slightly more gradual drawdown may occur when water is transferred from the lower to the upper storage. A geomorphological assessment will be undertaken to determine any potential impacts within the inundation areas caused by the rapid drawdown. The assessment will also document the existing geomorphology of Fingerboard Crossing Creek and assess any potential impacts associated with the Project.

ix Guidelines

The following guidelines, practice documents, and references will also be relevant to the hydrologic/hydraulic modelling, water assessment and mitigation measures:

- *Guidelines for Controlled Activities on Waterfront Land* (NRAR, 2018);
- *Floodplain Development Manual* (DIPNR, 2005);
- bunding and spill management guidelines:
    - *Liquid Chemical Storage, Handling and Spill Management: Part B Review of Best Practice Regulation* (DEC 2005)
    - *Storing and Handling Liquids: Environmental Protection: Participant's Manual* (DEC 2007);
- *NSW Water Quality and River Flow Objectives* 2006;
- erosion and sediment control guidelines:
    - Ma*naging Urban Stormwater: Soils and Construction Volume 1* (Landcom, 2004);

- *Managing Urban Stormwater: Soils and Construction Volume 2A Installation of Services* (DECC, 2008a);
- *Managing Urban Stormwater: Soils and Construction Volume 2C Unsealed Roads* (DECC, 2008b);
- *Managing Urban Stormwater: Soils and Construction Volume 2D Main Road Construction* (DECC, 2008c);
- *Best Practice Erosion and Sediment Control (BPESC) Books 1-6* (IECA, 2008);
- *Land-based pipeline construction* (IECA, 2015).

- *Australian Rainfall and Runoff* (Ball et al, 2019);
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ, 2000); and
- web-based guideline (ANZG 2018).

5.4.6 Groundwater

5.4.7 Existing environment

The Project area is located regionally within the Early Permian to late Carboniferous Nambucca Block, of the New England Orogen. Originally a rift basin, Nambucca Block has undergone multiple phases of deformation and metamorphism (Shaanan et al 2014). The Project area is located on the western slope of the Carrai Plateau, which comprises early-mid Triassic aged granodiorite that was emplaced within the surrounding late Permian metasedimentary Nambucca Beds Group, specifically the Parrabel Beds in the area under the proposed project alignment (Gilligan et al 1992). Overlying these units are thin (likely <5 m) soils comprising alluvium, colluvium, and landslide debris (SMEC 2020). There are no major faults or lineaments mapped within the Project area (Gilligan et al 1992).

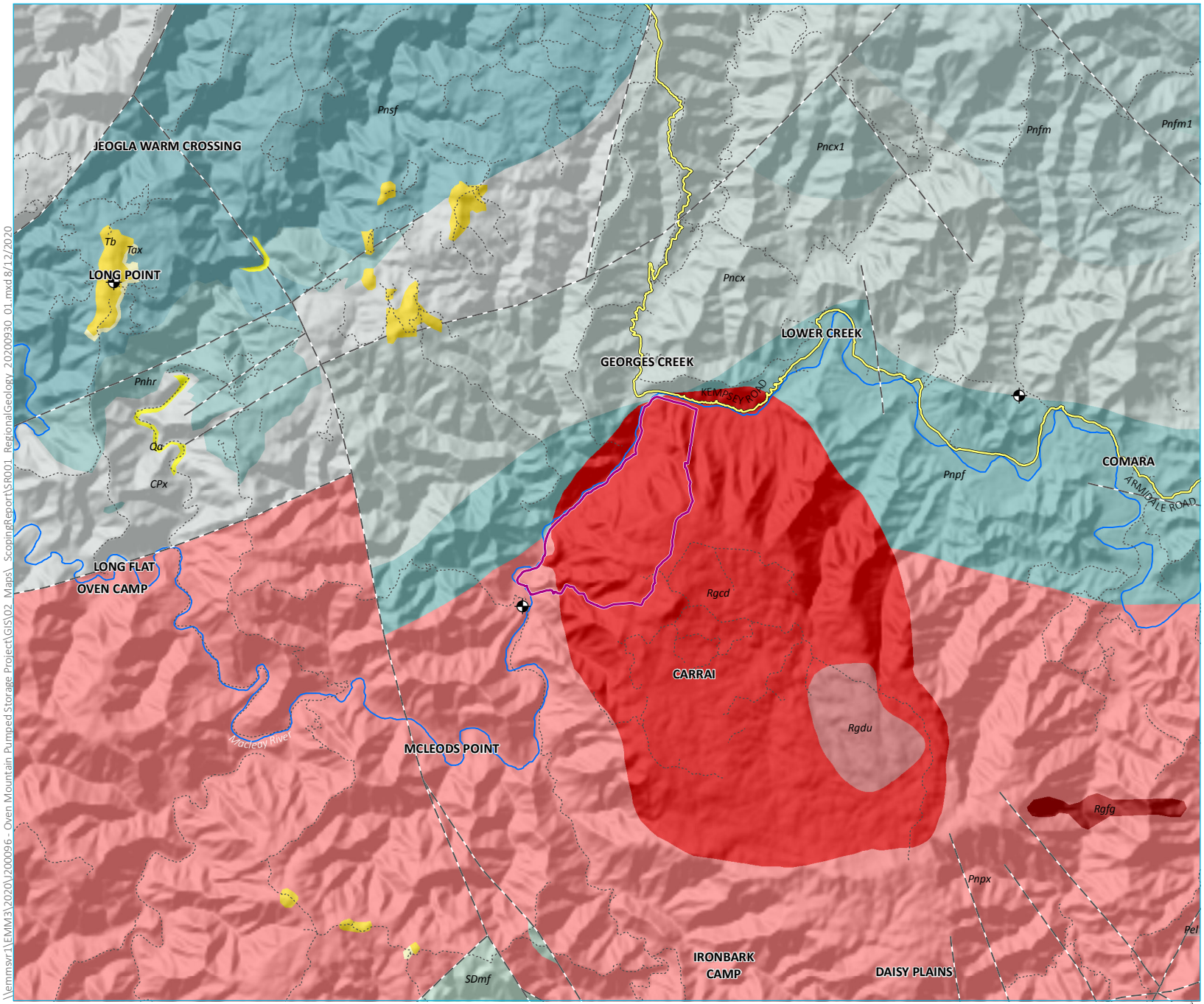
There are two main groundwater resources within the region:

- local shallow groundwater associated with alluvium; and
- regional deeper groundwater associated with fractured rocks of the New England Fold Belt.

The regional, deeper groundwater system is likely to be present within the vicinity of the Project's proposed alignment (to be confirmed with the Project's established groundwater monitoring program). The groundwater is understood to be contained within, and moving through, fractures in the rock that are present due to the folding and faulting of the rock formations. Yields within the greater New England Fold Belt rocks are typically low, being around 1 litre per second (L/s), although yields up to 10 L/s may be obtained from highly fractured fault systems. Groundwater is typically recharged by direct rainfall infiltration which, combined with the degree of mineral leaching occurring over time, results in typically good quality water (DPI Water 2016).

Springs (bogs) are present on the plateau, with groundwater preferentially discharging at the contact between the soil profile and low permeability granodiorite. As discussed in Section 5.2.2id , the majority of vegetation in the vicinity of the Project area is considered to have low reliance on groundwater, with areas of high dependence on groundwater limited to, likely, the floodplain immediately adjacent to the Macleay River (BOM 2020).

There are three registered landholder water supply bores located within 20 km of the Project area (refer to Table 5.5 and Figure 5.4).



KEY

- Project boundary

Existing environment

- Registered bore
- Road
- Vehicular track
- Macleay River
- Fault

Geology 250k period and formation

Quaternary

- Qa - Quaternary, unnamed

Tertiary

- Tax - Tertiary
- Tb - Tertiary

Permian

- Pel - Permian, Nambucca and Parrabel bed
- Pnpx - Permian, Parrabel bed
- Rgcd - Permian, Carrai Granodiorite
- Rgdu - Permian, Daisy Plains Leucoadamellite
- Rgfg - Permian, Fife Adamellite

Carboniferous

- CPx - Carboniferous, Coffs Harbour association
- Pncx - Carboniferous
- Pncx1 - Carboniferous
- Pnfm - Carboniferous
- Pnfm1 - Carboniferous
- Pnhr - Carboniferous
- Pnpf - Carboniferous, Pee Dee bed
- Pnsf - Carboniferous

Silurian

- SDmf - Silurian - Myra bed

Source: EMM (2020); DFSI (2017); GA (2011); OMPS (2020); DPI (2003)

0 2.5 5 km

GDA 1994 MGA Zone 56

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Regional geology

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Figure 5.4

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Table 5.5 Registered landholder water supply bores within 20 km of the Project area

Number	Licence number	Location	Installation date	Bore depth (m)
GW307320	Licence 30WA307847	Lot 3, DP751444	November 2013	60
GW303314	Licence 30WA312972	Lot 18, DP751451	July 2002	30.5
GW063924	Licence 30WA311261	Within the Macleay Valley, approximately 18.5 km north west and upstream of the OMPS lower reservoir	January 1988	6.7

5.4.8 Summary of potential issues

The Project will be located within fractured rocks that are part of the New England Fold Belt. The interconnection of groundwater systems and flow paths associated with these rocks are complicated because the occurrence and intersection of faults and fractures in three dimensions is complex.

The groundwater systems can be categorised as either:

- local (perched or shallow water bearing zones/aquifers in weathered rock); or
- regional (all the individual aquifers that occur below the regional water table in fractured rock).

It is anticipated the Project will be constructed and operated within the regional groundwater system (to be confirmed with the Project's established groundwater monitoring program). Perched zones that are generally disconnected from the regional groundwater system are generally unaffected by dewatering that may be occurring at depth. However, site investigations are required to assist in determining whether there is connectivity between the shallowest zones and the deep depressurised zone.

i Construction phase

It is anticipated the Project may partially dewater the regional groundwater system at depth and potentially affect adjacent local systems, where hydraulically connected, resulting in water level changes at sensitive surface receptors, including springs and rivers and creeks. These potential changes require further assessment of potential impacts to water available in the local and regional groundwater systems.. These water features may provide habitat for EECs and have high conservation value. Groundwater, accessed via production bores, will be considered as a construction water supply option.

Key groundwater issues for construction include:

- loss of spring flows that may be sustaining creeks, rivers and GDEs;
- loss of baseflow in permanent streams;
- lowered regional groundwater levels and loss of yield in existing water supply bores and loss of water supply to terrestrial GDEs;
- high groundwater inflows when heavily fractured or faulted geology is encountered;
- degraded inflow water quality because of construction activities (e.g. sediment and explosive residues);
- degraded groundwater quality due to leachate from waste rock to shallow groundwater system;

- management of groundwater captured by construction dewatering activities;
- maintaining a viable shallow and deep groundwater monitoring network; and
- groundwater licensing consistent with the requirements of the North Coast Groundwater WSP (accounting for water take, as the construction works are an aquifer interference activity).

ii Operation phase

Once tunnels are constructed, groundwater inflows from major structural features such as open fractures and faulted zones are expected to be minimal, however, there is still likely to be a contribution from minor fracture systems. Groundwater from production bores may be considered as a water supply option for ad-hoc reservoir top-ups if required. These contributions could result in lowered regional groundwater levels compared to pre-construction levels.

Key groundwater issues for the operational phase include:

- recovery of regional groundwater levels, and seasonal variability during operational periods;
- changes to surface flow regimes due to groundwater level changes;
- maintaining a long-term shallow and deep groundwater monitoring network; and
- groundwater licensing (for any operational losses from groundwater).

5.4.9 Possible cumulative impacts

Cumulative impacts are not anticipated for the Project. However, consideration will need to be given to the location and method of construction for the transmission component, in relation to potential cumulative groundwater issues.

5.4.10 Approach to assessment in the EIS

A groundwater assessment will be prepared and documented in the EIS.

The existing groundwater environment will be characterised using the following data and/or information:

- a spatial groundwater monitoring network of monitoring bores and piezometers, with baseline water level and water quality datasets;
- temporal data from the monitoring network of at least 12 months duration;
- other hydrological data, such as rainfall and evaporation;
- permeability testing of monitoring bores and test production bore pumping tests; and
- numerical flow modelling to replicate the current head distribution (based on known hydrogeological characteristics) and to predict future impacts during construction and operation.

Groundwater management controls will be established to mitigate identified groundwater changes. All practical controls will be considered. These mitigation measures during construction may involve:

- pre-grouting of known highly fractured or faulted zones;

- progressive lining of headrace and tailrace tunnels;
- maintaining baseflows to permanent streams, springs, and bogs (as required); and
- treatment of groundwater inflows.

The following guidelines will be considered as relevant during the preparation of the groundwater assessment:

- *Australian Groundwater Modelling Guidelines* (Waterlines Report, National Water Commission 2012);
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ 2000); and
- *NSW Aquifer Interference Policy* (DPI 2012).

5.5 Land and rehabilitation

5.5.1 Existing environment

i Geology and topography

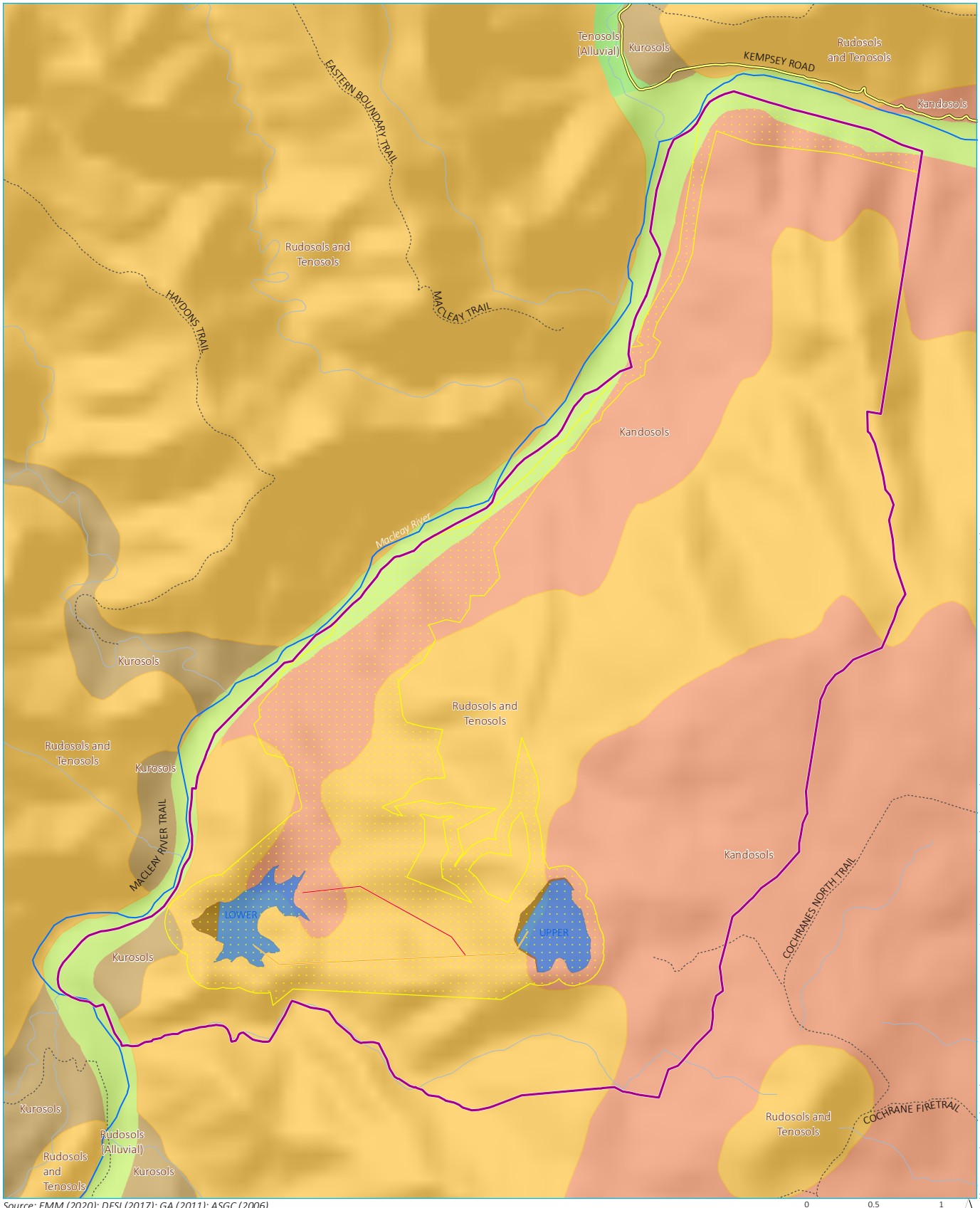
The Project area is located within the New England tablelands (New England Orogen geological province), which forms part of the New England fold belt. Geology consists of extensively faulted Carboniferous and Permian sedimentary rocks, granite intrusions and extensive Tertiary basalts. This geology has strongly influenced the variability in topography (hills and plains ranging from 600–1,500 m elevation), soil types, and rainfall and temperature patterns in the region (DPIE 2016).

The Project area is underlain by two main geological units, Triassic granites (Carrai Granodiorite, Rg) in the steeper eastern/north-eastern portion of the area, and Permian sedimentary rocks (Parallel beds, Ps) corresponding to the lower hillslopes and alluvial flats in the western portion of the area (Geoscience Australia 2020; DPIE 2016).

ii Soil and land resources

Based on geological and soil information for the nearby Oxley Wild Rivers National Park and other conservation areas (per NPWS 2005), and modelled soil mapping in the eSPADE database (OEH 2016), the soils in the area are expected to be highly variable reflecting the variability in the underlying parent material and landforms. Rudosols and Tenosols are expected to occur on hillslopes and in gullies and lower hillslopes, present as skeletal stony soils with minimal structure (other than accumulated organic matter) on steeper slopes to deeper colluvial material in gullies and lower hillslopes, respectively. Deeper, more fertile and better structured alluvial soils (likely as Kandasols and Kurosols) are expected to occur on flats adjacent rivers and creeks (DPIE 2016).

Based on eSPADE modelling (OEH 2016) most of the soils within the Project area are likely to have generally low inherent fertility with modelled land and soil capability (LSC) ranging from Class 4–8. With reference to *The Land and Soil Capability Assessment Scheme* (OEH 2012) these soils are described as having moderate (Class 4) to extremely low capability (Class 8) for intensive (eg agricultural) land use, with careful management required to prevent soil limitations (eg low fertility and high potential erodibility) from resulting in land degradation. In most cases, soils are unlikely to be saline although slightly saline soils may occur in some locations (DPIE 2016).



Source: EMM (2020); DFSI (2017); GA (2011); ASGC (2006)

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KEY

- Project boundary
- Investigation area for construction footprint

Existing environment

- Macleay River
- Watercourse/drainage line
- Road
- Vehicular track

Indicative tunnel alignments

- Main access tunnel
- Power waterway

Indicative water storage locations

- Dam
- Reservoir

ASC - Order Level

- Kandosols
- Kurosols
- Rudosols (Alluvial)
- Rudosols and Tenosols
- Tenosols (Alluvial)

Project area modelled ASC soil mapping

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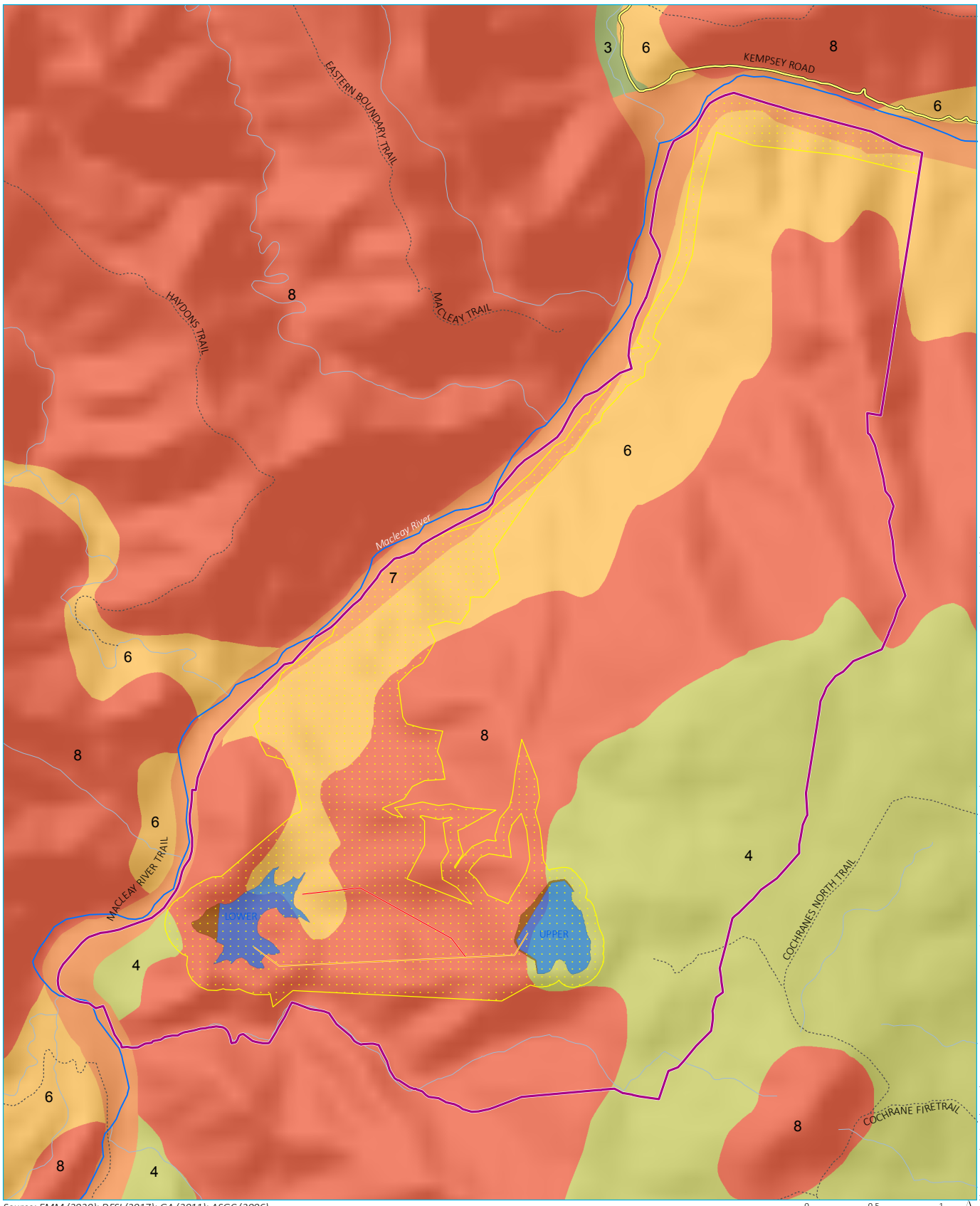

Source: EMM (2020); DFSI (2017); GA (2011); ASGC (2006)

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KEY

- Project boundary
- Investigation area for construction footprint

Existing environment

- Macleay River
- Watercourse/drainage line
- Road
- Vehicular track

Indicative tunnel alignments

- Main access tunnel
- Power waterway

Indicative water storage locations

- Dam
- Reservoir

Land and soil capability

- 3
- 4
- 6
- 7
- 8

Project area modelled land and soil capability

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Figure 5.6

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iii Land contamination

Land within the Project area consists of undisturbed native vegetation given the steep terrain, though there is disturbance due to periodic logging and some vegetation clearing on alluvial flats bordering the Macleay River, associated with agricultural land use (grazing). It is therefore unlikely that anthropogenic land contamination exists within the Project area.

5.5.2 Summary of potential issues

i Construction phase

Land and soil capability

Construction works will expose the natural ground surface and subsurface through the removal of vegetation and the excavation of soil for surface infrastructure works and the establishment of access roads, construction yards, equipment laydown areas, and other ancillary works.

Successful rehabilitation requires access to suitable soil resources (ie weed-free and uncontaminated topsoils and subsoils) to support revegetation. If soils are not stripped (including those soils in areas proposed for inundation) this may result in a rehabilitation soil deficit. Other mechanisms for soil impact (loss of soil capability for site rehabilitation) include the mixing of subsoils and/or lower-class topsoils during soil stripping activities, soil compaction by vehicles and earthmoving plant, and the long-term stockpiling of stripped soils.

Access to adequate topsoil resources for rehabilitation will also be strongly influenced by the type and extent of weeds, the ability to safely access and strip these soils, and whether the soils and subsoils present on site are inherently suitable for rehabilitation re-use.

Soil disposal and management

Material quantities of excavated materials will be generated during the construction of the Project, particularly from the construction of the power waterway tunnels, underground power station, MAT and ECVT. At this stage of the Project it is not yet known where the excavated rock will be managed and stored. This would form part of the next phase of engineering design which is being undertaken to inform the EIS and DIAA process (refer to Section 3.4.3 for further detail).

Erosion and sediment

Per NPWS (2005), soils in the region have low to moderate erodibility in their undisturbed state, although granite-based soils are easily eroded. Soils on steep slopes will be more susceptible to erosion given their thin (skeletal) nature and lesser vegetation cover, particularly on drier north-facing slopes. Sediments eroded from soil material at higher elevations can be deposited in different habitat zones and waterways downslope potentially impacting ecosystem functions of terrestrial vegetation communities and receiving waters.

The objective of erosion and sediment control practices is to take all reasonable and practicable measures to minimise short and long-term soil erosion, whilst minimising sediment transport which can cause damage to assets and result in the need for re-work during and post construction.

Contamination

Contamination of land, surface water and groundwater may occur during construction works due to spills and leaks from vehicles, plant and equipment; stored fuels and hazardous materials; and inappropriate disposal of wastes.

Other potentially contaminating activities include the disturbance of acid sulfate soils (ASS) and/or potentially acid forming (PAF) bedrock material during tunnel excavation. The presence of any such material will be identified prior to and during excavation activities, and mitigation plans developed to ensure appropriate re-use or disposal.

ii Operations phase

Land and soil capability

The Project has limited potential to impact soil and land resources during the operational phase. Inadvertent impacts may occur from changes to landform and land use. Maintenance works may require minor land disturbance with similar impacts as in the construction phase, although at a lesser scale. The primary impact on soils would be associated with permanent inundation in the upper and lower reservoirs if these soils are not recovered during the construction phase.

Erosion and sediment

A lower potential exists for soil erosion and sediment and turbid water runoff in the operations phase as long as appropriate erosion and sediment controls, designed and constructed to suit the properties of site soils and climatic conditions per best-practice guidelines (eg Landcom 2004, IECA 2008 and IECA 2016), are implemented during the construction phase. Where new ground disturbance occurs in the operations phase the erosion hazard will need to be assessed and mitigation measures implemented.

Decommissioning phase

Disturbance associated with the removal of infrastructure and temporary landforms may have similar impacts to those described in the construction and operations phases above. The ability to achieve successful rehabilitation may be impacted if a soil deficit exists or soils are unsuitable for revegetation establishment. The ability to construct safe, stable and non-polluting final landforms may also be impacted if the design and construction of these landforms is not sympathetic to the properties of the soils and any waste rock/spoil used.

iii Rehabilitation phase

Indicative rehabilitation activities are provided in Section 3.5.

Key issues for successful rehabilitation may include:

- landform instability or failure if landforms are designed and constructed without consideration of the physical and chemical properties (constraints) of the materials used in their construction;
- access to sufficient uncontaminated (weed-free) topsoil and subsoil resources to support vegetation establishment;
- the ability to re-establish native vegetation species through direct seeding or tubestock planting, with several species likely to be difficult to re-establish through one or both methods;
- the ability to rehabilitate steeper terrain; and
- the impact of weeds and other disturbance events (eg fire, animal activity) on rehabilitating systems.

These risks will be managed through risk and evidence-based management and mitigation measures such as soil assessment and characterisation, erosion and landform evolution modelling, rehabilitation trials, rehabilitation technical specifications and project life-cycle rehabilitation and closure planning.

5.5.3 Possible cumulative impacts

i Land and soil capability

Potential cumulative impacts on land and soil capability include future development and infrastructure works (eg project expansion and enhancements) resulting in further land clearing, contamination events and increased potential for weed migration and colonisation into the area. The loss or sterilisation of soil resources due to inappropriate handling and management practices (eg long-term stockpiling, compaction, mixing of soil layers) may impede successful rehabilitation.

ii Land contamination

Unexpected finds or uncontrolled contamination events may contribute to impacts. For example, without proper management measures, the disturbance of soils, or increased infiltration, through excavation workings could potentially mobilise contaminants. Similarly, if PAF bedrock material occurs at the site this could result in acid leaching if not adequately identified and appropriate disposal, re-use or other management options implemented.

iii Rehabilitation

Inadequate or failed rehabilitation could lead to unfavourable ecological outcomes and visual amenity impacts. This is particularly relevant given the location of the Project area and its proximity to national parks, conservation areas and nature reserves.

5.5.4 Approach to assessment in the EIS

i Soil and land resources

The potential for soil and land resource impacts will be investigated through a land resources assessment (LRA) in accordance with the standard assessment approaches and relevant guidelines. A comprehensive LSC assessment will be undertaken as part of the LRA. The assessment will identify soil properties and constraints critical to informing rehabilitation planning including final land uses, stable final landform design, soil management and rehabilitation methodology.

The following government guidelines will be considered as relevant during the preparation of the LRA:

- *Australian Soil Classification System* (Isbell 1996).
- *Guidelines for surveying soil and land resources* (McKenzie et al 2008).
- *Acid Sulphate Soils Assessment Guidelines* (Ahern et al 1998).
- *Soil and Landscape Issues in Environmental Impact Assessment* (DLWC 2000).
- *The land and soil capability assessment scheme* (OEH 2012).
- *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom 2004).
- *Managing Urban Stormwater: Soils and Construction Volume 2A* (DECC 2008).

ii Land contamination

A contamination assessment of the project area will be completed involving a detailed assessment of the existing environment considering all media including soil, groundwater, surface water and sediment. The assessment will include a review of the site history, identification of current or historical contaminating activities and potential receptors. The assessment will provide key measures for managing soils during the construction and operational phases, and preparation of the project areas during decommissioning works.

The following government guidelines will be considered as relevant during the preparation of the contamination assessment:

- *Acid Sulfate Soils Assessment Guidelines* (Ahern et al 1998).
- *National Environment Protection (Assessment of Site Contamination) Measure* (NEPC 2013).
- *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land* (EPA 1998).
- *Guidelines for Consultants Reporting on Contaminated Sites* (OEH 2011).
- *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997* (EPA 2015).
- *Approved Methods for the Sampling and Analysis of Water Pollutants in NSW* (DEC 2004).
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC & ARMCANZ 2000).
- *Using the ANZECC Guidelines and Water Quality Objectives in NSW* (DEC 2006).

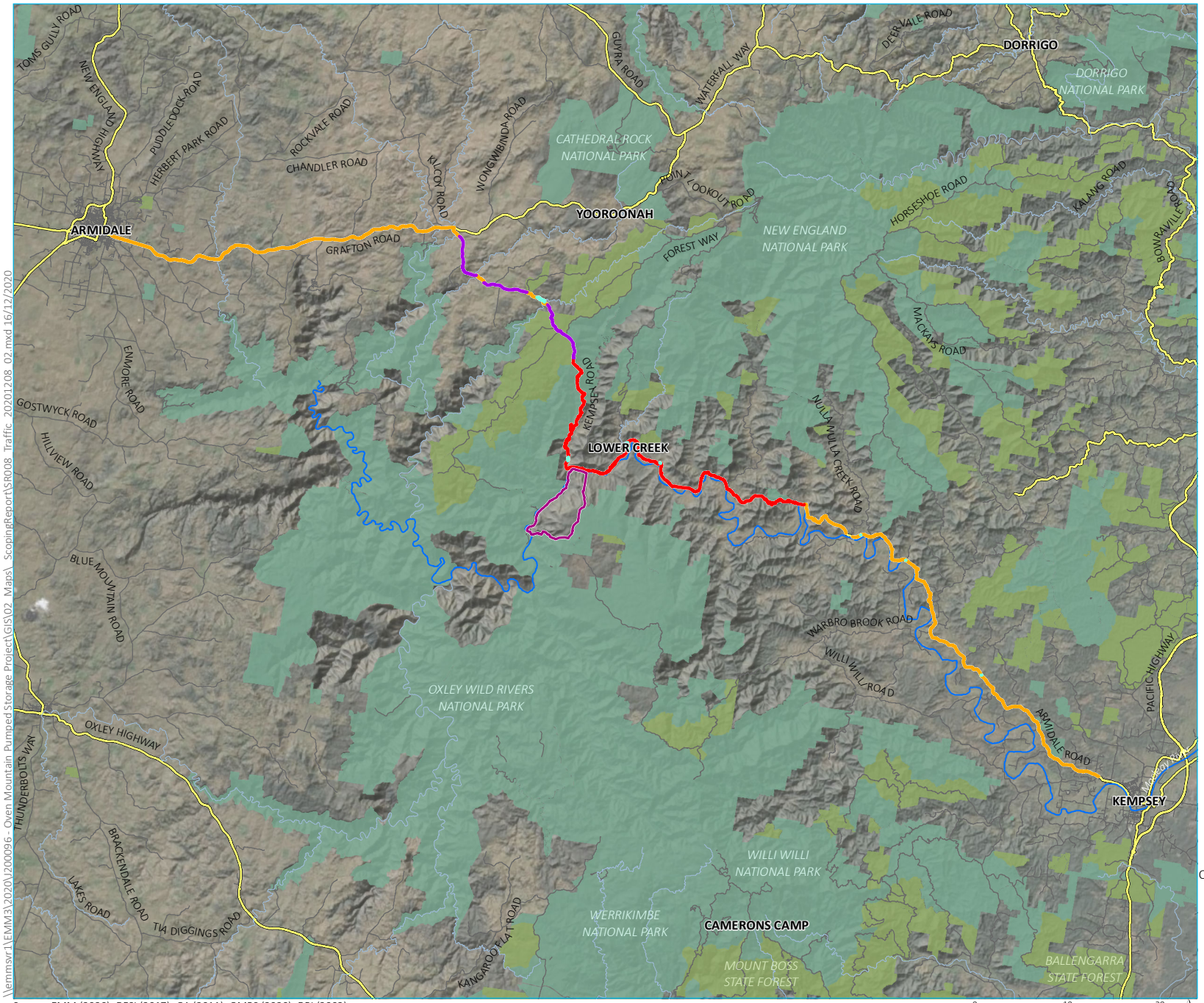
5.6 Transport and access

5.6.1 Existing environment

There are two potential transport routes, depending on the chosen option – from Armidale or from Kempsey. Both potential routes include existing sections of unsealed roads that are in poor condition. The key transport and access locations most likely to be affected by the Project include the following:

- Armidale option;
  - Kempsey Road between Waterfall Way and the site access road;
  - Waterfall Way between Armidale and Wollomombi;
- Kempsey option;
  - Kempsey Road between Comara and the site access road;
  - Armidale Road between Comara and Yarravel; and
  - other connecting roads between Armidale Road and Pacific Highway.

The Armidale option includes a longer unsealed section of Kempsey Road (refer to Figure 5.7), however the impact to the local community may be smaller as this option has a lesser overall length of local road access.



KEY

- Project boundary

Kempsey - Armidale road

- Sealed surface (two or more lanes)
- Sealed surface (one lane)
- Unsealed surface (two or more lanes)
- Unsealed surface (one lane)

Existing environment

- Macleay River
- Watercourse/drainage line
- Road
- Local road
- NPWS reserve
- State forest

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Source: EMM (2020); DFSI (2017); GA (2011); OMPS (2020); DPI (2003)

0 10 20 km

GDA 1994 MGA Zone 56

N

Existing traffic and access routes to the Project area

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Figure 5.7

EMM creating opportunities

The Kempsey option will potentially affect existing road traffic movements over a wider area, including the communities and smaller townships of Bellbrook, Hickeys Creek, Willawarrin, Deep Creek and Yarravel. The existing road users use this road for a combination of local and regional access, and agricultural and recreational access. This includes local residents, tourists and business operators and other visitors to the region.

Kempsey Road at Georges Creek (approximately 1.3 km north of the Project area) recorded an Annual Average Daily Traffic (AADT) of 40 vehicles in 2004. According to Transport for NSW (TfNSW) Traffic Volume Viewer, Waterfall Way (Grafton Road) at 27 km west of Kempsey Road showed the following numbers in AADT from 2007 to 2012 as follows:

- Year 2007 daily traffic = 1,391 vehicles;
- Year 2008 daily traffic = 1,450 vehicles;
- Year 2011 daily traffic = 1,295 vehicles, and
- Year 2012 daily traffic = 1,326 vehicles.

This data loosely indicates the annual traffic growth trends for Waterfall Way, Kempsey Road and other roads in the region since 2007 as having either minimal or negative annual traffic growth.

5.6.2 Summary of potential issues

i Construction phase

A new surface access road will be required for the construction, operation, and maintenance of the reservoirs, dam and pipelines. At least one new access will be required over the Macleay River to the Project area, then road access will travel generally towards the hydro works site parallel to, and set back from, the river.

There will be noticeable increases in traffic on the external road network for the duration of construction, in particular an increase in heavy vehicles due to deliveries of materials to site. For safety reasons, nearby trails may need to be closed to public access for the duration of the project construction work due to the need to intensively utilise the road for construction access.

ii Operation phase

No significant increase to traffic movements are expected during operation, although vehicle access to the Project area for plant management and maintenance access will be ongoing. There are also potential long-term benefits to local residents via the implementation of road upgrades.

iii Decommissioning

Plant and equipment required for decommissioning works is expected to require a smaller fleet and lower overall daily traffic movements compared to those required for construction activities; accordingly traffic impacts are expected to be more limited.

5.6.3 Possible cumulative impacts

No cumulative construction and operational impacts are expected at this stage.

Liaison will be undertaken with the appropriate State and local government agencies (ie TfNSW, Armidale Regional Council and Kempsey Shire Council) to identify any potential comparable construction or other major projects within the locality or other adjoining regions, for which it would be appropriate to undertake cumulative construction stage or operational traffic impacts.

5.6.4 Approach to assessment in the EIS

A traffic and access impact assessment will be prepared as part of the EIS and will include:

- characterisation of the existing road network, including the existing road widths and the condition of the road surface, existing road capacity (or 'level of service'), daily and peak traffic volumes (considering the peak holiday period and at other times of the year), and the proportion of light and heavy vehicle traffic movements;
- review of key intersection performance on designated construction access routes and document relevant accident history and safety requirements;
- quantifying expected traffic movements during the relevant project stages, including the maximum and average light and heavy vehicle traffic movements travelling to the Project area; and
- recommendation of management measures to mitigate identified potential impacts of the Project.

The existing road network and traffic conditions assessment will also consider the requirements for maintaining local resident road access and vehicle and other access to active and passive recreation areas in the national parks and conservation areas.

The assessment of traffic and access impacts would be prepared using the following the appropriate guidelines, policies and design requirements, as follows:

- NSW Roads and Traffic Authority (now TfNSW) *Guide to Traffic Generating Developments 2002*;
- *Austroads Guides to Road Design* (various publications);
- *Austroads Guides to Traffic Management* (various publications);
- Australian Standard AS 2890 Parts 1 and 2; and
- *Australian Code for Dangerous Goods Transport*.

5.7 Amenity

5.7.1 Noise and vibration

The Project area is within a private undeveloped parcel of land on the eastern side of the Macleay River. Access to and from the Project will be either via Armidale or Kempsey. The current road build is insufficient for the level and nature of Project transport requirements and upgrades will be required.

Within the Project area, up to 15 km of surface access roads will be required to be constructed so as to allow access to the upper and lower reservoirs, main access tunnel and emergency access, cable and ventilation tunnel and associated infrastructure.

i Existing environment

The ambient noise environment in the Project area and its surrounds is defined by natural elements and limited human activity. The Project area is remote, accordingly minimum rating background noise levels (RBLs) as outlined in the NSW Environment Protection Agency (EPA) Noise Policy for Industry (NPfI) could reasonably be adopted. It is anticipated that some supplementary noise monitoring may be conducted at communities along Kempsey Road and Armidale Road that will be utilised to access the Project area.

Potential local receivers are shown in Figure 2.7 and will be confirmed during the EIS phase. The nearest dwellings to the Project area are located at Lower Creek (which is over 10 km to the north-east of the Project area) and the Carrai community (located approximately 5 km to the south east of the proposed generation infrastructure). There is also a homestead used for recreational accommodation (known as East Kunderang Homestead), located approximately 2 km south west of the Project area, west of the Macleay River, along E Kunderang Road. A number of other dwellings or buildings are scattered throughout the local area. There are a number of state forests and national parks to the east, south and north-west of the Project that accommodate a wide variety of areas for the purpose of passive and active recreational uses and potential for items of historic and Aboriginal heritage. These areas have the potential to be exposed to noise and vibration associated with construction of the Project.

ii Summary of potential issues

Dwellings and buildings, located at Lower Creek and state forests, and national parks to the east, south and north-west for passive and active recreation are the closest and most potentially affected assessment locations for noise emissions from the main construction activities including road construction. The noise assessment would need to consider dedicated walking/fire trails and campgrounds/huts within the study area.

The assessment locations most likely to be affected by construction road traffic noise are residences along Kempsey Road and Armidale Road either on the way to Armidale or Kempsey (pending confirmation of construction traffic routes). Traffic movements on the internal access road would be considered as part of the construction activities and assessed under the requirements of the Interim Construction Noise Guideline (ICNG).

Construction vibration from the works has potential to impact Aboriginal and historic heritage sites in and around the proposed tunnelling alignment, as will works such as compaction activities associated with upper and lower dams and road construction.

The following noise and vibration aspects have been identified and considered relevant to this report:

- construction noise impacts on nearest noise sensitive receivers such as dwellings and buildings surrounding the Project area, recreation areas, camping grounds and tourist destinations in the nearby state forests, and national parks (including designated walking trails and huts);
- assessment of adverse weather conditions for daytime and out of hours construction activities;
- blast vibration and overpressure impacts at residences;
- vibration impacts from blasting and from construction plant and equipment on existing infrastructure and historic and Aboriginal heritage items;
- assessment of adverse weather conditions for daytime, evening and night operational activities; and
- road traffic noise impacts on public roads due to Project-related traffic.

a Construction phase

During the construction phase principal noise and vibration issues will relate to operation of fixed and mobile plant and equipment, concrete batch plant, excavation, tunnelling and blasting activities. An overview of the Project configuration for construction, operation and scheduling is provided in Sections 3.1-3.3. Potential for noise impacts will be largely restricted to the two main surface work locations (upper and low reservoirs) and site access road. Other construction works would be conducted underground including excavation of the MAT and ECVT tunnels and power station hall and could result in vibration impacts at assessment locations when works are relatively shallow.

Road traffic noise related to construction activities has the potential to impact a number of residential properties and recreation areas. Increased road traffic on local roads is expected from materials supply and subject to final design, spoil haulage. In addition, due to the relatively large work force required for the Project it is anticipated that there could be fly in fly out workers from nearby airports (from Armidale, Port Macquarie and Coffs Harbour).

b Operation phase

In terms of operational noise, the power station is to be located underground with limited surface infrastructure. Accordingly, operation of the Project is not expected to give rise to any adverse noise impacts. Where plant or equipment is required to be installed on the surface or vent to the atmosphere, an assessment would be conducted to ensure emissions satisfy the requirements of EPA 2017, and NPfI.

iii Possible cumulative impacts

Cumulative impacts are not anticipated for the Project. However, consideration will need to be given to the location and method of construction for the transmission component, in relation to potential cumulative noise and vibration issues. Construction sites for the Project are typically located sufficiently far apart that cumulative noise from multiple sites is unlikely to result in additional adverse noise impacts. However, where for example road works occur concurrently with nearby compound activities, this will be assessed cumulatively.

iv Approach to assessment in the EIS

A noise assessment would be completed for the Project in support of the EIS. The subject site is remote with little impact from human activity, accordingly minimum RBLs as outlined in the NSW EPA's NPfI could reasonably be adopted. Supplementary noise monitoring may be conducted at communities along Kempsey Road and Armidale Road that will be utilised to access the Project area.

The noise levels from proposed construction and operational activities would be predicted using a computer-generated model using DGMR Software proprietary modelling software, iNoise software (the model). The model allows prediction under the ISO9613-2 *"Acoustics – Attenuation of Sound during Propagation Outdoors – general method"* algorithm. This algorithm is accepted by the EPA. Features which affect the predicted noise level that are considered in the noise modelling include:

- equipment sound power levels and locations;
- screening from structures;
- receiver locations;
- ground topography;
- noise attenuation due to geometric spreading;

- ground absorption; and
- atmospheric absorption.

The model would assess prevailing adverse weather conditions including temperature inversions in accordance with the requirements of the NPfI.

The model would be populated with topography of the Project area and its surrounds, extending out to include nearest assessment locations. Following a review of the proposed methodology, construction and operational plant and equipment representing the range of proposed construction and operation scenarios would be placed at locations which would represent worst case noise levels throughout the Project.

Little evidence is available in literature on the direct impacts that noise and vibration have on fauna. However, it is likely that if levels are suitable for humans, they would also to a large extent be tolerable for fauna. In any case, any impacts from construction would be temporary. Studies referenced in other noise assessments undertaken in and surrounding conservation areas such as national parks would be reviewed in terms of noise impacts on fauna.

5.7.2 Air quality and greenhouse gas

i Existing environment

A review of the National Pollution Inventory (NPI) and NSW EPA EPL register was completed and indicates that there are no significant existing industrial air pollution emission sources within 50 km of the Project area. In the absence of significant industrial sources, the primary contributing sources of air pollutant emissions to baseline air quality in the vicinity of the Project include:

- dust entrainment due to vehicle movements along unpaved and paved rural roads with high silt loadings;
- fuel combustion-related emissions from on-road and non-road engines;
- wind generated dust from exposed areas within the surrounding region;
- seasonal emissions from household wood burning; and
- episodic emissions from vegetation fires.

More remote sources which contribute episodically to suspended particulates in the region include dust storms and bushfires. It is considered that these regional scale events will have the most significant influence over ambient air quality conditions at the Project area.

There is no ambient air quality monitoring data available for the Project area. DPIE maintain air quality monitoring stations (AQMS) at Armidale (64 km north west of the Project area), Coffs Harbour (106 km north east of the Project area) and Port Macquarie (92 km south east of the Project area). Continuous measurements of PM_{10}[1] and $PM_{2.5}$[2] have been recorded at these DPIE AQMS locations since April 2018 (Armidale), June 2018 (Port Macquarie) and November 2019 (Coffs Harbour).

[1] PM_{10} = particulate matter less than 10 micrometres (µm) in aerodynamic diameter

[2] $PM_{2.5}$ = particulate matter less than 2.5 µm in aerodynamic diameter

While spatially distant from the Project area, these three monitoring resources provide a useful indicator of regional influences to ambient air quality (eg bushfire and dust storm events). To illustrate this point, the monthly average PM_{10} concentrations at the three AQMS locations between April 2018 and October 2020 are presented in Figure 5.8.

The following points are noted in relation to Figure 5.8:

- for both 2018 and 2020, the cooler months (May to August) demonstrate a higher average concentration at Armidale relative to the Port Macquarie and Coffs Harbour (2020 only), reflective of local domestic wood heater emissions in Armidale;

- due to an intensification of drought conditions, monthly average concentrations increase throughout 2019;

- the extensive bushfire events across the east coast of Australia are the influencing source of emissions between November 2019 and January 2020;

- from February 2020 onwards, following the completion of the bushfire events and extensive state-wide rainfall, the monthly average PM_{10} concentrations are very similar at all three AQMS sites (with the exception of the cooler months at Armidale) despite the distance between monitoring locations.

This analysis shows that comparable trends in fine particulate matter concentrations can be experienced across a significant distance when regional scale events are a dominant contributing factor. In the absence of local air quality monitoring data for the Project area, these three regional AQMS will be referenced to provide a conservative estimate of background air quality concentrations.

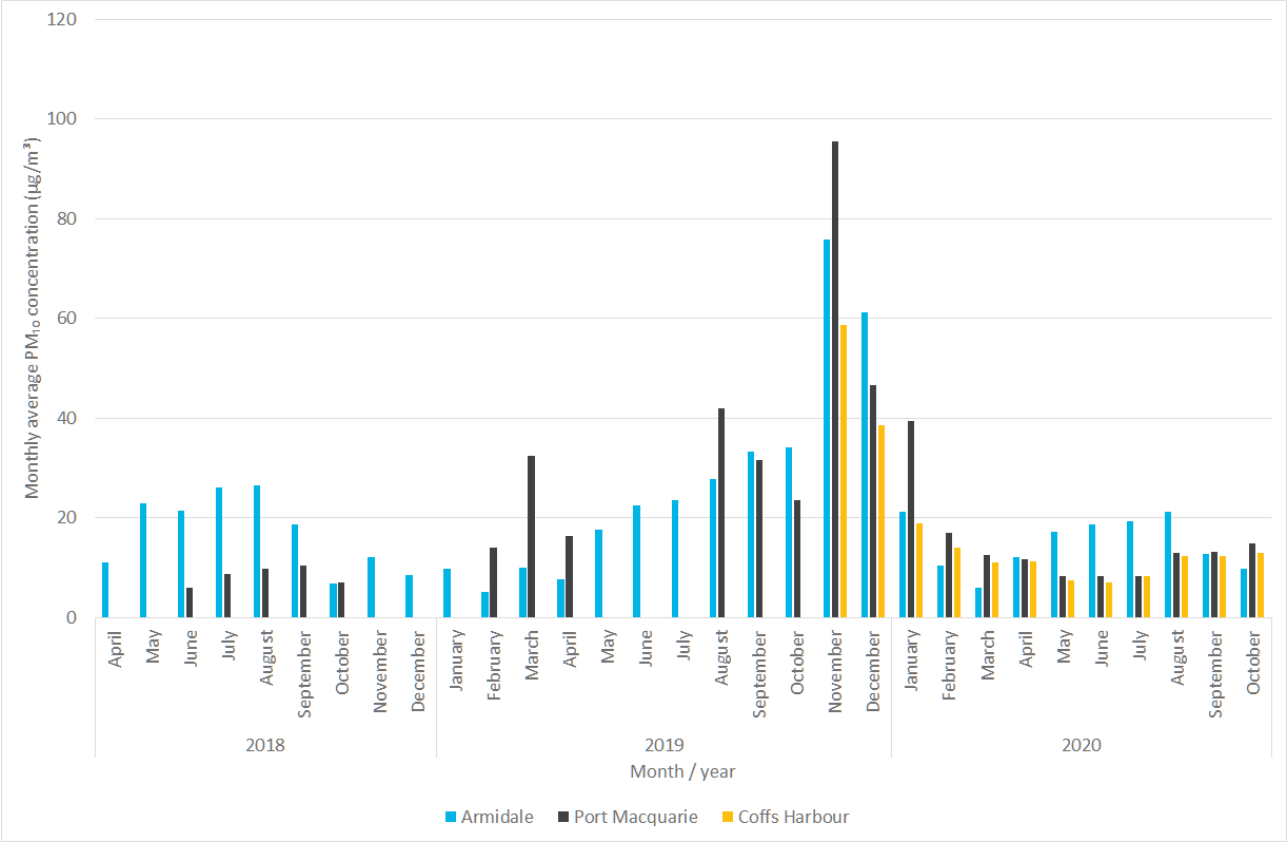


Figure 5.8 Monthly average PM_{10} concentrations – regional DPIE AQMS locations – April 2018 to October 2020

There is also no meteorological monitoring conducted at the Project area. The closest resources are the BoM automatic weather stations (AWS) at Armidale Airport (67 km to the north west) and Kempsey Airport (60 km to the east south east). Data from these monitoring locations would be used as input to regional meteorological modelling to be completed using the CSIRO prognostic meteorological model TAPM. Outputs from the TAPM modelling would then be combined with local land use and terrain datafiles to undertake local meteorological modelling using the CALMET meteorological model.

Potential local receiver locations are shown in Figure 2.7 and will be confirmed during the EIS phase. The nearest dwellings to the Project area are located at Lower Creek (which is over 10 km to the north-east of the Project area) and the Carrai community (located approximately 5 km to the south east of the proposed generation infrastructure). There is also a homestead used for recreational accommodation (known as East Kunderang Homestead), located approximately 2 km south west of the Project area, west of the Macleay River, along East Kunderang Road. A number of other isolated dwellings or buildings of temporary accommodation are scatter throughout the area. There are a number of state forests, and national parks to the east, south and north west of the Project that accommodate passive and active recreational activities. These areas have the potential to be exposed to air pollutant emissions associated with the Project.

In order to assess compliance with applicable air quality impact assessment criteria specified by the NSW EPA, all surrounding dwellings (permanent and temporary accommodation) and key recreational sites (camp sites, active recreation etc) will be included for prediction of air quality impacts.

ii Summary of potential issues

a Construction phase emissions

The generation of particulate matter emissions from the construction phase of the Project represents the most significant risk for air quality impacts to the surrounding environment. The construction phase will likely generate emissions of:

- particulate matter, specifically:
  - total suspended particulate matter (TSP);
  - PM_{10}; and
  - $PM_{2.5}$.
- gaseous pollutants, specifically:
  - oxides of nitrogen (NO_x)[3], including nitrogen dioxide (NO_2);
  - sulfur dioxide (SO_2);
  - carbon monoxide (CO); and
  - volatile organic compounds (VOCs).

Of the above listed pollutants, it is expected that emissions and impacts from particulate matter (TSP, PM_{10} and $PM_{2.5}$) will be the most significant during the construction phase and will be the focus of the air quality impact assessment.

The potential for air pollutant emission generation will be largely associated with the two main surface work locations (upper and low dams) and the site access road. It is anticipated that the construction phase of the Project may involve the following activities that could generate emissions of air pollutants:

- vegetation clearing and topsoil removal;
- road upgrades and site preparation works;
- tunnel excavation (e.g. drill and blast methods);
- conveyors transferring spoil to the surface;
- handling and transfer of tunnel spoil from tunnelling site to the surface;
- management of tunnel spoil at the surface (handling, truck loading/unloading, dozer shaping);
- temporary concrete batching plant operations;
- the movement of trucks on unpaved and paved roads;

3 By convention, NOx = nitrous oxide (NO) + NO_2.

- wind erosion of exposed areas and surface spoil storage areas; and
- diesel combustion from plant equipment, trucks and electricity generators.

Construction phase traffic has the potential to generate wheel-generated dust emissions along existing paved and unpaved roads which could impact residential properties and active or passive recreation areas. Increased road traffic on local roads is expected from materials supply and subject to the final design, spoil haulage. In addition, due to the relatively large work force required for the Project, it is anticipated that there would be fly in fly out workers from nearby airports.

b Operation phase emissions

Operational phase emissions would principally consist of emissions from:

- wheel-generated dust emissions from the more limited movements of vehicles along sealed and unpaved traffic routes between Project surface infrastructure components;
- preventative fuel load reduction for fire safety; and
- fuel combustion (petrol, diesel) from vehicles travelling between Project surface infrastructure components.

Air pollutant emissions generated by the operational phase of the Project will be notably lower than the construction phase due to the absence of construction-related material handling activities and a reduction in the number of traffic movements and associated fuel combustion. Consequently, no quantification of air pollution emissions from the operational phase of the Project is anticipated.

c Greenhouse gas emissions

Both the construction and operation of the Project have the potential to generate greenhouse gas (GHG) emissions. The principal emissions will be associated with the combustion of fuel (primarily diesel) and purchased electricity. Emissions from construction and operational phase GHG emissions will be quantified for the Project. The Project will also facilitate the development renewables in the region, positive impacts will also be assessed for the Project during the EIS phase.

iii Possible cumulative impacts

As discussed in above section, the Project area is remote with no significant existing sources of industrial air pollution emissions. Cumulative impacts are therefore associated with the combination of Project-generated emissions with minor local scale emission sources and regional scale air pollution events (dust storms and bushfires). Cumulative impacts will be quantified through the paired analysis of model predicted concentrations for Project construction emissions and regional monitoring datasets. This approach is consistent with the NSW EPA *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW EPA 2016).

iv Approach to assessment in the EIS

An air quality impact assessment (AQIA) would be completed for the Project in support of the EIS. The AQIA will likely consist of the following key sections:

- a description of the local setting and surrounds of the Project;
- the pollutants which are relevant to the assessment, and the applicable impact assessment criteria;
- a description of the existing environment, specifically:

- the meteorology and climate; and
- the existing air quality environment;

- a detailed air pollutant emissions inventory for the construction works;
- atmospheric dispersion modelling for the quantified emissions, including an analysis of Project construction-only and cumulative impacts accounting for baseline air quality;
- an overview of mitigation measures and air quality monitoring requirements; and
- a detailed GHG assessment.

The AQIA will be prepared in general accordance with the guidelines specified in the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW EPA 2016).

5.7.3 Landscape and visual amenity

i Existing environment

The Project area is located within the New England tablelands, which includes hills and plains ranging from 600–1,500 m elevation, and surrounded by deeply incised creeks and tributaries associated with the Macleay River. The area is rugged and remote with a diversity of landscapes and forest types providing opportunities for recreation activities such as bushwalking, nature study and camping. Several recreational sites are located in proximity to the Project area, including Georges Junction camp ground, Marys View, and East Kunderang Homestead. Potential local receiver locations are shown in Figure 2.7 and will be confirmed for the EIS phase and landscape and visual amenity assessment for the Project.

ii Summary of potential impacts issues

a Construction phase

It is expected that there will be areas of construction visible to potential nearby receivers, in particular construction works associated with the access roads and the crossing at the Macleay River.

b Operation phase

The Project will introduce new permanent elements into the landscape. This includes above-ground structures such as tunnel portals, intake structures and new roads. These elements will result in changes to existing views and landscape settings within localised areas of the Project

iii Possible cumulative impacts

A separate project application for the transmission component to the Project has potential to result in cumulative impacts with the Project, due to the introduction of new infrastructure into the landscape setting.

iv Approach to assessment in the EIS

A landscape and visual impact assessment (LVIA) of the Project will be prepared as part of the EIS. The assessment will consider potential changes to the landscape character and visual setting of the Project area, as well as visual impacts of the project in relation to identified sensitive receptors. The LVIA will focus on those locations where permanent infrastructure is proposed, as well as discuss temporary impacts during construction.

The visual impact assessment will be prepared with regard to industry standards included within the UK document *Guidelines for Landscape and Visual Impact Assessment* (GLVIA) Third Edition (2013), prepared by the Landscape Institute and Institute of Environmental Management and Assessment.

The visual impact assessment will also be prepared with regard to Australian Standards (AS4282) *Control of Obtrusive Effects of Outdoor Lighting*.

5.8 Social

5.8.1 Existing environment

Armidale is the major centre for the Armidale Regional LGA located in the New England Region of NSW. Local Aboriginal groups with traditional connections to the region include the Thunggutti people and the Anaiwan people. Armidale is also home to many Gumbaynggirr people. Kempsey is the major centre for the Kemspey Shire LGA, located to the east of the Project area.

In 2018, the Armidale Regional LGA had a population of 30,707 of which 65.3% were aged 15 – 64 years. The unemployment rate is higher at 7.7% when compared to NSW at 6.3%. Those living in the Armidale Regional LGA aged 15 years and over were less likely to complete year 12 or equivalent (50.9%).

In 2016 the top industries of employment were:

- education and training (19.4%);
- health care and social assistance (13.7%); and
- retail trade (10.8%) and agriculture, forestry and fishing (10.8%).

In 2019, Kempsey had a population of 15,378 people, and a median age of 40.4 (ABS, 2019).

In 2016, the top industries of employment were:

- health care and social assistance (17.8%);
- retail trade (13.8); and
- construction.

5.8.2 Summary of potential issues

i Construction phase

Potential social impacts are likely to relate to:

- public safety issues as a consequence of increased traffic and road conditions;
- livelihood of local businesses, both positive and negative. Some will experience increased in business due to workers spending in the area and ability to service the Project. Others may see a decrease as tourist or locals choose other locations due to access and amenity related issues such as dust and noise;
- way of life impacts related to reduced access to recreational areas and facilities;

- way of life impacts related to changed conditions due to the in migrating workforce, either residing or FIFO/DIDO that may increase the availability and affordability of housing; and
- access to, and use of, social services and infrastructure may be hindered.

ii Operation phase

It is anticipated that the operational phase will see primarily social benefits due to improved roads and small amounts of increased employment and increased economic and access to the services benefits of a pumped hydro scheme in the region.

As described in Section 4.2, the Project will contribute a range of services to facilitate the transition to more reliable, cheaper and cleaner electricity in NSW, and both pumped hydro energy storage and the New England REZ are prioritised in the NSW Government's Roadmap released in November 2020.

5.8.3 Possible cumulative impacts

Cumulative social impacts may arise from the Project if there are other factors impacting on the social aspects of the local community at the same time as the construction of the Project, including other construction projects. The New South Wales Government has identified (and enacted) New England as a high priority 'Renewable Energy Zone', indicating a possible increase in the development of other renewable projects causing cumulative impacts on the region. In addition, it is possible that the impacts of an increased workforce in the area could be exacerbated by concurrent construction projects, such as the transmission component of the Project.

5.8.4 Approach to assessment in the EIS

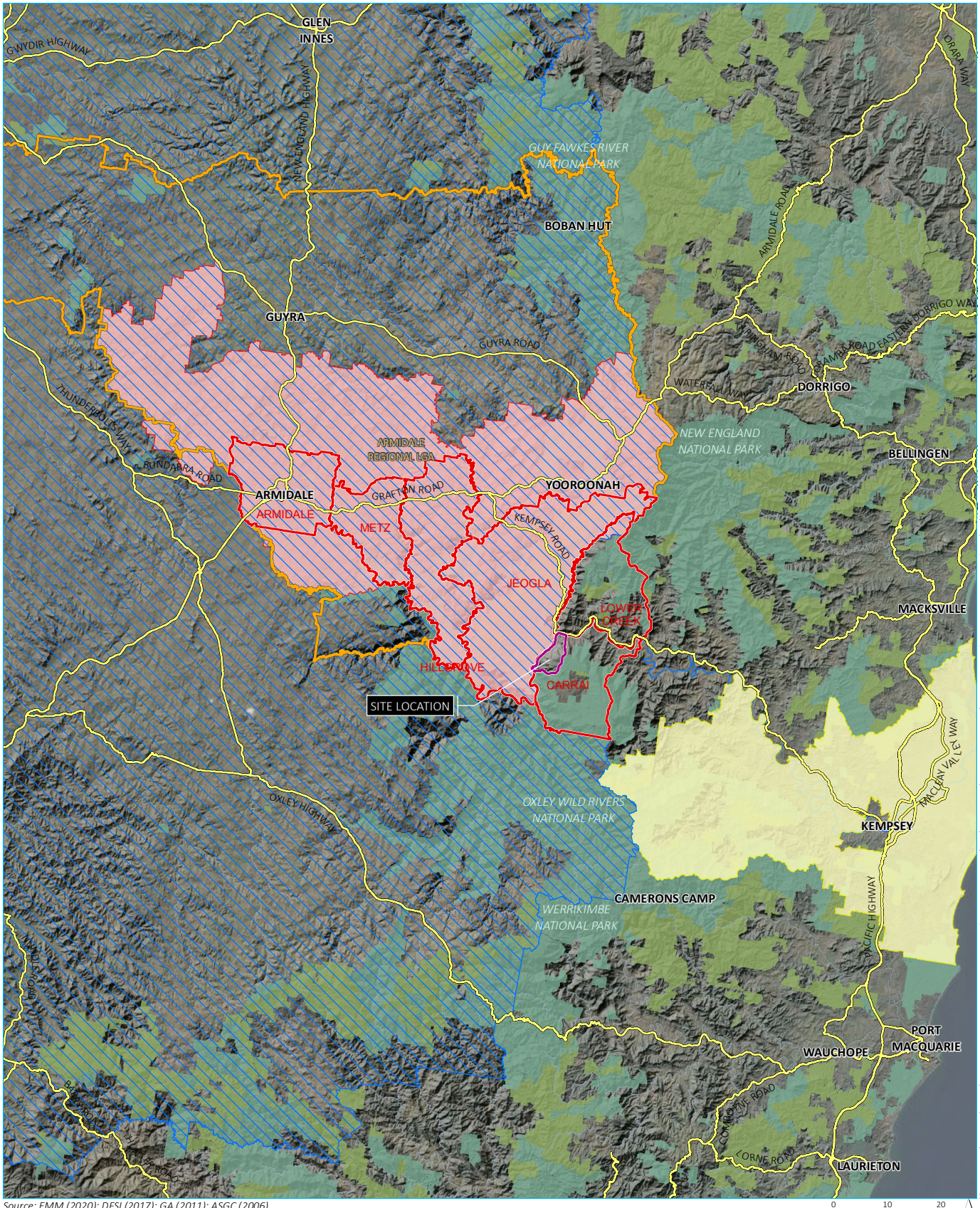
i Area of social influence

An overview of the likely area of social influence for investigation in the EIS for the social impact assessment (SIA) is provided in Table 5.6Table 5.6 and shown in Figure 5.9, it includes the Armidale Regional LGA, the Kempsey Shire LGA, relevant suburbs, and Armidale and Kempsey Indigenous locations (ILOC). The defined area of social influence is the area likely to experience the direct impacts of the project through construction, operation and ongoing.

The area of social influence and regional area of reference shown in Figure 5.9 will also be used for the development of the demographic profile to inform the social baseline.

Table 5.6 Area of social influence

LGA	Suburbs	ILOC
Armidale Regional	Armidale	Armidale
	Hillgrove (Armidale Regional - NSW)	
	Carrai	
	Lower Creek	
	Jeogla	
Kempsey Shire	Bellbrook	Kempsey
	Willawarrin	
	Kempsey	



Source: EMM (2020); DFSI (2017); GA (2011); ASGC (2006)

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KEY

- Project boundary
- Armidale LGA
- SLA4 - New England and North West
- Suburb

Area of social influence

- Armidale
- Kempsey - Surrounds

Existing environment

- Macleay River
- Watercourse/drainage line
- Road
- NPWS reserve
- State forest

Area of social influence

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Figure 5.8

EMM
creating opportunities

5.9 Economic

5.9.1 Existing environment

The economic baseline of the Armidale Regional and Kempsey Shire LGAs was provided in Section 5.8.1.

5.9.2 Summary of potential issues

i Construction phase

The Project comprises a significant proportion of site based civils works and as a result a significant amount of expenditure will be spent within the local, regional and NSW economies during the construction phase over a relatively short period of time. The Project's capital expenditure is estimated to be in excess of $1 billion over a three to four-year period, ignoring indirect expenditure. In addition, the construction phase will generate around 600 full-time equivalent jobs over the construction period and an estimated 1,500 indirect jobs. Accordingly, it is expected that the Project will have positive impacts on the local, regional and NSW economies during the construction phase through capital costs, contractor and employee salaries and associated local spending.

ii Operational phase

During the operational phase, capital expenditure will significantly reduce. Notwithstanding this, it is expected that during operations the Project will generate significant economic benefit to the national economy by contributing to energy reliability and the growth of renewable energy in the NEM.

Ongoing significant long-term benefits (e.g., economic, road and fire safety) are also expected to stem from improvements to local roads and communications infrastructure. Bushfire-prone areas will be particularly benefited and the Project reservoirs might serve as both a static water source for fire-fighting purposes and (potentially) an emergency water source for the Kempsey area.

iii Decommissioning phase

As the Project transitions from construction to operations, there will be reduction in the amount of capital expenditure and employment. Notwithstanding this, the decommissioning phase is expected to generate economic benefits with the local, regional and state economies.

5.9.3 Possible cumulative impacts

It is possible that the impacts of increased expenditure and workforce in the area could be exacerbated by concurrent construction projects within the local and regional economies.

5.9.4 Approach to assessment in the EIS

Infrastructure and energy projects have had different requirements when it comes to economic assessment in NSW, and all have used very different economic assessment methods. In this context the scope of the economic assessment for the Project would include two main components:

- an input-output (IO) analysis to address local economic effects; and
- a computable general equilibrium (CGE) analysis to address broader economic effects.

It is proposed to undertake an IO analysis of the impacts of the construction and operation of the Project on the local economy. This analysis will draw on information from the SIA (on employment movements) and model the likely wage expenditure and other purchases in the local economy. Results will be reported for direct and indirect output, value-added, income and employment.

The CGE analysis will draw on separate modelling of the impacts of the Project on the level and nature of investments required and investments deferred and the impacts on electricity prices. The CGE impacts will be modelled for the local area, the remainder of NSW, the remaining NEM states, and the rest of Australia. Results will be reported for key macroeconomic aggregates such as gross regional, state and national product, employment, industrial output, and any other indicators as required.

5.10 Other issues

5.10.1 Climate change and other risks

i Climate risk

Climate change risks during construction would primarily be associated with the occurrence of severe weather events, such as increased frequency and severity of rainfall events, as well as drought events, placing increased pressure on erosion and sediment control measures and/or flooding events in the tunnels or at the work sites.

Climate change risks during the operation of the Project are likely to include:

- an increase in the incidence of bushfires in the areas of vegetation surrounding the Project area; and
- changes in the seasonality of the region and the amount of annual precipitation and runoff.

ii Bushfire risk

The Project area was recently affected by a major bushfire during the 2019/2020 fire season. The main existing sources of ignition of unplanned fires in the region are reported to be lightning strikes, accidental ignition from high voltage power lines and vegetation management, escapes from legal and illegal burning, as well as campfires.

The potential for bushfire hazard and risk impacts of the Project will be investigated further through the EIS and through a detailed bushfire risk and hazard assessment (BFRHA) prepared in accordance with the relevant guidelines and standards. As the Project occurs on bushfire-prone land and is development that is potentially exposed to a bushfire threat, the BFRHA will be prepared in accordance with the NSW Rural Fire Service (RFS) *Planning for Bush Fire* Protection, A guide for Councils, planners, fire authorities and developers (2006) (PBP).

iii Subsidence risk

Subsidence, or ground movement, above tunnels is possible during the construction phase. The risk of the subsidence, or ground movement, is due to a range of factors, including overlying geology, the depth of the tunnelling, groundwater depressurisation and the tunnelling methodology. Subsidence has the potential to impact on:

- built infrastructure such as roads and transmission lines;
- natural features such as creeks, rivers, steep slopes and cliffs; and
- Aboriginal heritage features.

Subsidence, or ground movement, above tunnels during the operational phase are possible due to settling of land at the surface but are considered unlikely.

Geotechnical and seismic data that will be collected will assist in the provision of baseline information for the preparation of the EIS. This will identify the ground conditions for earthworks and tunnelling and inform potential subsidence, or ground movement, impacts.

5.10.2 Built environment

A number of the key issues discussed throughout Chapter 5 are relevant to the built environment. Scoping of these issues are predominantly addressed in Section 5.6 (Traffic and access) and Section 5.7.3 (Social).

6 Community and stakeholder engagement

6.1 Introduction

Stakeholder engagement and consultation for the Project commenced well in advance of the preparation of the EIS. Stakeholder activities have been led by OMPS.

6.2 Stakeholder engagement framework

OMPS has developed a Community Consultation Plan (CCP) for the Project. The aim of the CCP is to:

- identify effective methods to inform the community about the Project;
- facilitate engagement with the community, including allowing meaningful contributions from the community into the environmental assessment and project development; and
- obtain social license to operate from the local community to allow good long-term relationships with community stakeholders.

The CCP identifies:

- community stakeholders for the Project;
- a consultation plan for each stakeholder group; and
- a set of consultation activities against the project development timeline.

6.3 Stakeholder identification

Identified stakeholder groups with an interest in the Project and who have already been consulted include:

- nearby landholders;
- local Members of Parliament (State and Federal);
- State and Commonwealth government agencies;
- Armidale Regional Council;
- Kempsey Shire council;
- Aboriginal groups;
- community groups;
- nearby towns, townships and communities including Carrai, Armidale, and Kempsey.

6.4 Stakeholder engagement

Stakeholder engagement for the Project has been comprehensive to date. Stakeholder engagement commenced with the introduction of the Project to local community members in 2019, including provision of information on the Project's website. Table 6.1 provides a selective overview of the early stakeholder consultation completed to date. Rounds of briefing sessions and meetings with stakeholders including those in the above list and other interested parties and meetings have been extensive and will continue as the Project progresses.

Table 6.1 *Selective* overview of early stakeholder engagement to date

Date	Who was consulted	Matters discussed	Feedback/action undertaken (if required)
August 2017	Armidale Regional Council	• Early consultation, introduction to project	• Receptive to the project • Action: continued engagement and project updates
August 2017	Federal MP - Tamworth	• Early consultation, introduction to project	• Receptive to the project • Action: continued engagement and project updates
October 2017	Federal Department of Agriculture	• Follow up on project updated • Introductions to state counterparts	• No action required
December 2019	Local Landowners (Georges Junction)	• Project introduction • Impacts of drought & fires • Local services • Access options	• Supportive of the project concept • Area requires service upgrades (phone, electricity, roads) • Action: continued engagement and project updates
December 2019	Local Landowners (Lower Creek)	• Project introduction	• Action: continued engagement and project updates
December 2019	Local Landowners (Lower Creek)	• Project introduction	• Supportive of the project concept • Region has challenges with roads • Impacts of bushfire on local infrastructure • Area requires service upgrades • Action: continued engagement and project updates
December 2019	Local Landowners (Georges Junction)	• Project introduction	• Supportive of the project concept Drought impacts in the local area. • Action: continued engagement and project updates.
January 2020	Armidale Regional Council	• Project introduction	• Ensure local Councillors are aware of project • Concerns about roads being adequate for transport needs • Ensure East Kunderang is considered in development • Action: continued engagement and project updates
February 2020	State MP - Armidale	• Project introduction	• Supportive of project concept • Supportive of developing new jobs
February 2020	DPIE (Regional Development)	• Project introduction • Renewable energy facilitation	• Receptive to the project • Action: continued engagement and project updates

Table 6.1 *Selective* overview of early stakeholder engagement to date

Date	Who was consulted	Matters discussed	Feedback/action undertaken (if required)
February 2020	Armidale Regional Council	• Further project introduction to council	• Action: continued engagement and project updates
February 2020	Lower Creek Local Action Committee	• Community group presentation with focus on roads, effect of fires, communications	• Supportive of potential for project to help improve roads and local communications • Questions around effect of project during construction & water use • Action: More detailed consultation on raised issues & map development
March 2020	Thungutti Local Aboriginal Land Council	• Project introduction to council	• Action: continued engagement & project updates
April 2020	NPWS	• Project introduction • Impacts on proximate National Parks	• Action: Need for ongoing consultation around identified impacts; preliminary visual impact assessment undertaken
May 2020	Kempsey Shire Council	• Project introduction • Job growth; roads; water use	• Impact on water use • Action: continued engagement & development of project concept around water security improvement
May 2020	Save Our Macleay (Local Group)	• Project introduction • Environmental impacts & water use	• Action: continued engagement & development of water use methodology focused on draw during high flow periods only
June 2020	Local Landowners (Lower Creek & Carrai)	• Project introduction to Carrai community • Lower Creek project update	• Action: Site visit to Carrai & continued engagement
August 2020	• Local Landowners (Carrai) • Thungutti LALC • Kempsey Shire Council	• Additional project intro to Carrai • Project updates to Thungutti & Kempsey	• Action: Site visit to Carrai undertaken • Action: Development of heritage assessment strategy • Action: Development of water security concept
September 2020	Transport for NSW	• Project updates • Roads impact	• Action: Development of traffic impact assessment strategy
October 2020	• Local Landowners (Lower Creek & Carrai) • Thungutti LALC	• CSSI status awarded to project • Site access & construction impacts	• Supportive of CSSI status & potential flow-on effects • Action: Development of detail around site access & strategy to minimise construction impacts
November 2020	• Local Armidale Action Group • Local Landowners (Lower Creek) • NPWS	• Project introduction to NEV2030 Group • Project updates (Lower Creek/NPWS)	• NEV2030 receptive to project, including need for long duration storage to support renewables • Action (NEV 2030): Additional discussion around specific project questions • Action (Lower Creek): Development of powerline route modification • Action (NPWS): Ongoing consultation required

Table 6.1 *Selective* overview of early stakeholder engagement to date

Date	Who was consulted	Matters discussed	Feedback/action undertaken (if required)
December 2020	• Local Landowners (Lower Creek) • Thungutti LALC Board presentation	• Project updates to Lower Creek community and Thungutti LALC Board • Site access & heritage impacts	• Action: Feedback around site access, construction impacts incorporated into design • Action: Thungutti community site visit to be organised • Action: Additional Thungutti consultation around youth employment

6.5 Ongoing stakeholder engagement

OMPS is committed to continuing to engage with stakeholders during the approval process for the Project.

Engagement targeted specifically for the Project will comprise several initiatives, as follows:

- face to face meetings;
- videoconferencing;
- phone calls;
- newsletters;
- public forums such as community information sessions;
- establishment and maintenance of a website;
- production of educational materials; and
- media releases.

7 Conclusion

7.1 Request for assessment requirements

The purpose of this scoping report is to request and inform the content of the SEARs for the Project. The SEARs will specify the requirements for the EIS that will be prepared to accompany the application for the Project.

7.2 Scope of the Project

The scope includes the construction and operation of the Project, including the construction and operation of the key project elements outlined in Table 7.1.

Table 7.1 Project key elements

Project component	Description
Key project elements – operational infrastructure	• an underground pumped hydro-electric power station complex;
	• lower reservoir and intake;
	• upper reservoir and intake;
	• spillways;
	• power waterway tunnels, chambers and shafts;
	• access tunnels;
	• new and upgraded roads to allow ongoing access and maintenance; and
	• power and communication infrastructure.
To support the construction of operational infrastructure, the following elements and activities are needed and are referred to as construction elements, and include:	• construction water infrastructure and supply including: – a temporary water store such as a turkey's nest or similar for construction activities; – the ability to fill and maintain temporary water stores such as via surface water, bores, and/or extraction from the Macleay River; – associated infrastructure such as pumps and pipes;
	• an on-site borrow pit or quarry;
	• an on-site concrete batching plant;
	• establishment and removal of temporary structures including coffer dams;
	• management of cleared vegetation, soils and overburden;
	• construction compounds including laydown and logistics yards within the Project area boundaries;
	• supporting services infrastructure including: – construction power supply; – potable water supplies; – waste and wastewater management; – communications infrastructure; – site control infrastructure; – accommodation camps;

Table 7.1 Project key elements

Project component	Description
	• emergency infrastructure including: – water tanks for fire control; and – helicopter access.

This scoping report addresses works associated with the generation works and ancillary development (where relevant to the generation works for the Project. A separate application (and therefore separate scoping report) will be prepared for the transmission works.

The operation of the Project will involve the transfer of water through a series of newly established power waterway tunnels and the underground power station to provide for energy generation, as well as large scale energy storage.

Energy will be generated when water is transferred from the upper reservoir, through the headrace tunnel into the underground power station, before being transferred to the lower reservoir. Storage of energy will be possible by pumping water back through the tailrace tunnel, from lower reservoir up to the upper reservoir, where it can be used again for energy generation (when needed).

7.3 Approval requirements

The Project has been declared SSI and CSSI in accordance with the provisions of the EP&A Act with the declaration coming into effect on 4 September 2020. As a result, the Project may be carried out without development consent under Part 4 of the EP&A Act. However, the Project is subject to Division 5.2 of the EP&A Act that requires preparation of an EIS and approval from the NSW Minister for Planning and Open Spaces.

With respect to the provisions of the EPBC Act, while preliminary biodiversity surveys have been carried out, additional detailed surveys remain to be completed to determine potential impacts on MNES. Accordingly, OMPS has referred the Project to the Commonwealth Minister for the Environment and has conservatively nominated that there is potential to have a significant impact on MNES.

Accordingly, it has been assumed that a single EIS will be required for the Project, and that the EIS will address the requirements of all State and Commonwealth agencies. The EIS will be supported by comprehensive technical reports attached as appendices to the main report.

8 Abbreviations

ABS	Australian Bureau of Statistics
ACHA	Aboriginal Cultural Heritage Assessment
ACHCRP	*Aboriginal Cultural Heritage Consultation Requirements for Proponents*
AHIMS	Aboriginal Heritage Information Management System
ASC	Australian Soil Classification
ASS	Acid sulfate soils
AQIA	Air quality impact assessment
AQMS	Air quality monitoring stations
AWS	Automatic weather stations
BC Act	*Biodiversity Conservation Act 2016*
BDAR	Biodiversity Development Assessment Report
BFRHA	Bushfire Risk and Hazard Assessment
BoM	Bureau of Meteorology
BPESC	*Best Practice Erosion and Sediment Control*
CFRD	Concrete faced rockfill dam
CGE	Computable General Equilibrium
CO	Carbon monoxide
CSSI	Critical State significant infrastructure
DAWE	Department of Agriculture, Water and the Environment
DIAA	Design integration and assessment approach
DPIE	Department of Planning, Industry and the Environment
ECVT	Emergency cable and ventilation tunnel
EEC	Endangered ecological communities
EMM	EMM Consulting Pty Limited
EPA	Environment Protection Agency
EPIs	Environmental planning instruments
EIS	Environmental impact statement
EP&A Act	*Environmental Planning and Assessment Act*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPL	Environment protection licence
FM Act	*Fisheries Management Act 1994*
FSL	Full supply level
GDE	Groundwater dependent ecosystems
GHG	Greenhouse gas

GLVIA	*Guidelines for Landscape and Visual Impact Assessment*
GW	Gigawatts
ICNG	Interim Construction Noise Guideline
IBRA	Interim Biogeographic Regionalisation for Australia
ILOC	Indigenous locations
IO	Input-Output
IPB	Isolated Phase Busbars
kV	Kilovolt
L/s	Litre per second
LEPs	Local environmental plans
LGA	Local Government Area
LoO	Likelihood of occurrence
LRA	Land resources assessment
LSC	Land and soil capability
LVIA	Landscape and visual impact assessment
µm	Micrometres
MAT	Main access tunnel
MLF	Marginal loss factors
MNES	Matters of national environmental significance
MOL	Minimum operating level
MW	Megawatts
NEM	National Electricity Market
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
NPfI	Noise Policy for Industry
NSW	New South Wales
OMPS	Oven Mountain Pumped Storage Pty Ltd
OPGW	Optical ground wire
PAD	Potential archaeological deposit
PAF	Potentially acid forming
PCT	Plant community types
QNI	Queensland-NSW Interconnector
RCC	Roller compressed concrete
REZ	Renewable Energy Zone
SEARs	Secretary's Environmental Assessment Requirements
SO_2	Sulfur dioxide
SEPPs	State environmental planning policies
SMEC	SMEC Australia Pty Ltd

SRD SEPP	*State Environmental Planning Policy (State and Regional Development) 2011*
SSI	State significant infrastructure
TfNSW	Transport for NSW
TSP	Total suspended particulate
VOCs	Volatile organic compounds
WONS	Weed of National Significance

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Appendix A

Scoping worksheet

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

MATTERS		IMPACTS		ASSESSMENT LEVEL	CUMULATIVE IMPACTS	COMMUNITY ISSUES	ASSESSMENT APPROACH	SCOPING REPORT
Potential matters that could be affected by the project		Is the project (without mitigation) likely to cause an impact?	Are the impacts (without mitigation) likely to be significant based on the magnitude of the impacts and/or sensitivity of receivers?	What level of assessment is required to assess impacts and determine mitigation measures?	Will cumulative assessment be required?	Did the community raise any concerns about the impacts?	Indicative approach to assessment in EIS	Where was this addressed in the Scoping Report?
Group	**Specific**	**Impact?**	**Significant Impact?**	**Assessment Level**	**Cumulative Impact?**	**Concerns?**	**Category**	**Section**
ACCESS	access to property	Y	Unknown	Detailed	Yes	Yes	Detailed Assessment + CIA+ focussed engagement	Section 5.6
	port / airport facilities	Unknown	Unlikely	Standard	Yes	No	Scoping Report	Section 3.5.1
	road and rail network	Y	Unknown	Detailed	Yes	Yes	Detailed Assessment + CIA+ focussed engagement	Section 5.6
	offsite parking	N	N/A				None (include short explanation in Scoping Report)	Section 3.4.1
AIR	particulate matter	Y	Likely	Standard	Yes	No	Standard Assessment + CIA	Section 5.7.2
	gases	Y	Likely	Standard	Yes	No	Standard Assessment + CIA	Section 5.7.2
	atmospheric emissions	N/A	N/A	Standard	Yes	No	Standard Assessment + CIA	Section 5.7.2
AMENITY	noise	Y	Likely	Detailed	Yes	No	Detailed Assessment + CIA	Section 5.7.1
	vibration	Y	Likely	Detailed	Yes	No	Detailed Assessment + CIA	Section 5.7.1
	visual	Y	Likely	Detailed	No	No	Standard Assessment	Section 5.7.3
	odour	Unknown	Unknown	Detailed	No	No	Standard Assessment	Section 5.7.2
BIODIVERSITY	conservation areas	Y	Likely	Detailed	Yes	No	Detailed Assessment + CIA	Section 5.2.1
	native vegetation	Y	Likely	Detailed	Yes	No	Detailed Assessment + CIA	Section 5.2.1
	native fauna	Y	Likely	Detailed	Yes	No	Detailed Assessment + CIA	Section 5.2.1
	aquatic ecology	Y	Likely	Detailed	Yes	No	Detailed Assessment + CIA	Section 5.2.2
BUILT ENVIRONMENT	public domain	N	Unlikely			No	Scoping Report	Section 5.10.2
	public infrastructure	Y	Unlikely			No	Scoping Report	Section 5.10.2
	private property	Unknown	Unknown	Standard	Yes	No	Standard Assessment + CIA	Section 5.10.2
CLIMATE	macroclimate	N	Unlikely			No	Scoping Report	Section 5.7.2
	microclimate	N	Unlikely			No	Scoping Report	Section 5.7.2
ECONOMIC	natural resource use	Y	Likely	Standard	Yes	No	Standard Assessment + CIA	Section 5.9
	livelihood	Y	Likely	Standard	Yes	No	Standard Assessment + CIA	Section 5.9
	opportunity cost	Y	Likely	Standard	Yes	No	Standard Assessment + CIA	Section 5.9
	regional economic benefit	Y	Likely	Standard	Yes	No	Standard Assessment + CIA	Section 5.9
HERITAGE	natural	Unknown	Unknown	Standard	Yes	No	Standard Assessment + CIA	Section 5.3
	historic	Y	Likely	Detailed	Yes	No	Detailed Assessment + CIA	Section 5.3.2
	Aboriginal cultural	Y	Likely	Detailed	Yes	No	Detailed Assessment + CIA	Section 5.3.1
LAND	stability / structure	Y	Likely	Detailed	No	No	Standard Assessment	Section 5.5
	soil chemistry	Y	Likely	Detailed	No	No	Standard Assessment	Section 5.5
	land capability	Y	Likely	Detailed	No	No	Standard Assessment	Section 5.5
	topography	Y	Likely	Detailed	No	No	Standard Assessment	Section 5.5
RISKS	effects of climate change	Y	Unknown	Standard	Yes	No	Standard Assessment + CIA	Section 5.10.1ii
	coastal hazards	N	N/A				None (include short explanation in Scoping Report)	Section 5.10
	effects of flood waters	Y	Likely	Detailed	Yes	No	Detailed Assessment + CIA	Section 5.4.1
	bushfire	Y	Likely	Standard	Yes	No	Standard Assessment + CIA	Section 5.10.1ii
	effects of subsidence	Y	Likely	Standard	No	No	Standard Assessment	Section 5.10.1iii
	steep slopes	Y	Likely	Standard	No	No	Standard Assessment	Section 5.5
SOCIAL	health	Y	Likely	Standard	Yes	No	Standard Assessment + CIA	Section 5.8
	safety	Y	Likely	Standard	No	No	Standard Assessment	Section 5.8
	community services / facilities	Y	Likely	Standard	Yes	No	Standard Assessment + CIA	Section 5.8
	housing availability	Y	Likely	Standard	Yes	No	Standard Assessment + CIA	Section 5.8
	social cohesion	Y	Likely	Standard	Yes	No	Standard Assessment + CIA	Section 5.8
WATER	hydrological flows (incl. flooding)	Y	Likely	Detailed	Yes	No	Detailed Assessment + CIA	Section 5.4.1
	surface water quality	Y	Likely	Detailed	Yes	No	Detailed Assessment + CIA	Section 5.4.1
	ground water quality	Y	Likely	Detailed	Yes	Yes	Detailed Assessment + CIA+ focussed engagement	Section 5.4.2
	water availability	Y	Likely	Detailed	Yes	No	Detailed Assessment + CIA	Section 5.4.1

Appendix B

MNES search results

Australian Government

Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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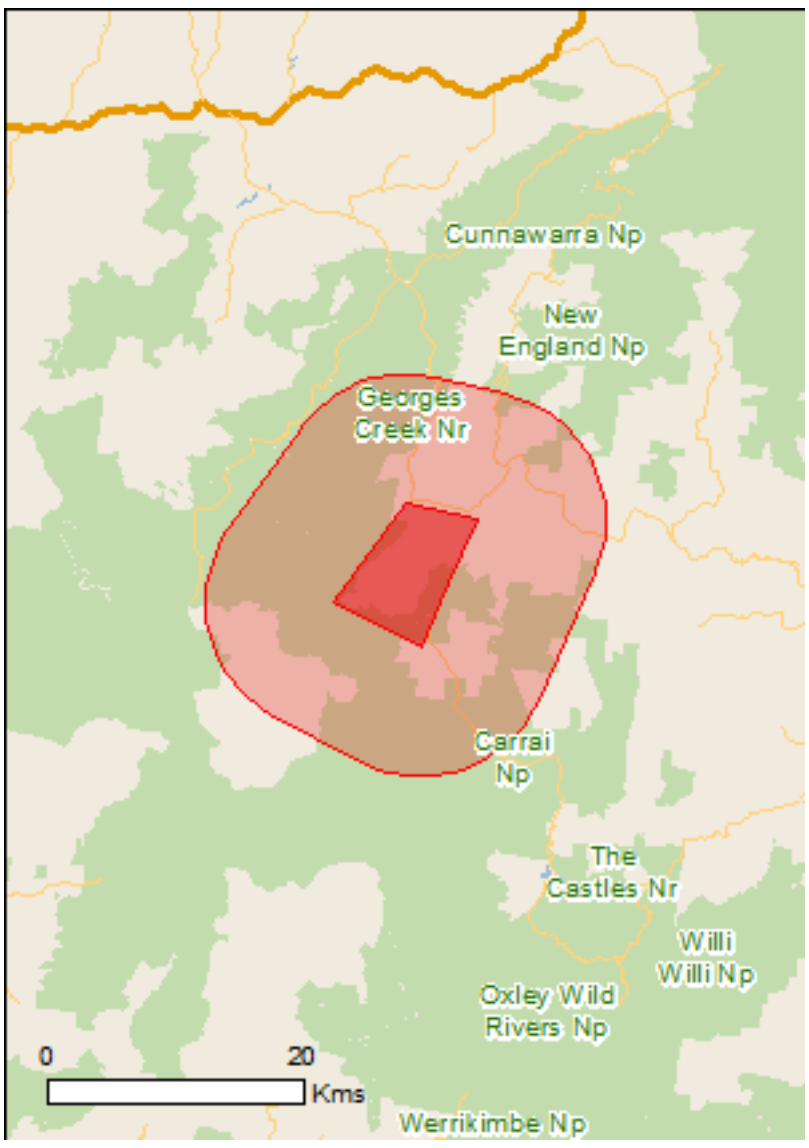

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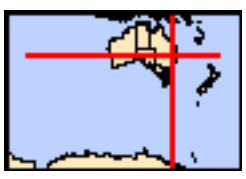

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	1
National Heritage Places:	1
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	42
Listed Migratory Species:	15

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	20
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	9
Regional Forest Agreements:	1
Invasive Species:	26
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

World Heritage Properties		[Resource Information]
Name	State	Status
Gondwana Rainforests of Australia	NSW	Declared property

National Heritage Properties		[Resource Information]
Name	State	Status
Natural		
Gondwana Rainforests of Australia	NSW	Listed place

Listed Threatened Ecological Communities		[Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community likely to occur within area
New England Peppermint (Eucalyptus nova-anglica) Grassy Woodlands	Critically Endangered	Community may occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Anthochaera phrygia		
Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour may occur within area
Atrichornis rufescens		
Rufous Scrub-bird [655]	Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus		
Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus		
Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Falco hypoleucos		
Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta		
Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Hirundapus caudacutus		
White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Turnix melanogaster Black-breasted Button-quail [923]	Vulnerable	Species or species habitat may occur within area
Frogs		
Mixophyes balbus Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat known to occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat known to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE Mainland) [66645]	Vulnerable	Species or species habitat likely to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat known to occur within area
Pseudomys oralis Hastings River Mouse, Koontoo [98]	Endangered	Species or species habitat known to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Plants		
Arthraxon hispidus Hairy-joint Grass [9338]	Vulnerable	Species or species habitat likely to occur within area
Callistemon pungens [55581]	Vulnerable	Species or species habitat known to occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area
Cynanchum elegans White-flowered Wax Plant [12533]	Endangered	Species or species

Name	Status	Type of Presence
		habitat known to occur within area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
Diuris eborensis [88275]	Endangered	Species or species habitat likely to occur within area
Diuris pedunculata Small Snake Orchid, Two-leaved Golden Moths, Golden Moths, Cowslip Orchid, Snake Orchid [18325]	Endangered	Species or species habitat may occur within area
Eucalyptus nicholii Narrow-leaved Peppermint, Narrow-leaved Black Peppermint [20992]	Vulnerable	Species or species habitat known to occur within area
Euphrasia arguta [4325]	Critically Endangered	Species or species habitat may occur within area
Grevillea guthrieana [64521]	Endangered	Species or species habitat known to occur within area
Haloragis exalata subsp. velutina Tall Velvet Sea-berry [16839]	Vulnerable	Species or species habitat known to occur within area
Macadamia integrifolia Macadamia Nut, Queensland Nut Tree, Smooth-shelled Macadamia, Bush Nut, Nut Oak [7326]	Vulnerable	Species or species habitat may occur within area
Marsdenia longiloba Clear Milkvine [2794]	Vulnerable	Species or species habitat may occur within area
Neoastelia spectabilis [6404]	Vulnerable	Species or species habitat may occur within area
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat may occur within area
Plectranthus nitidus Nightcap Plectranthus, Silver Plectranthus [55742]	Endangered	Species or species habitat may occur within area
Sarcochilus fitzgeraldii Ravine Orchid [19131]	Vulnerable	Species or species habitat may occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area
Tylophora woollsii [20503]	Endangered	Species or species habitat likely to occur within area
Reptiles		
Coeranoscincus reticulatus Three-toed Snake-tooth Skink [59628]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		

Name	Threatened	Type of Presence
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur

Name	Threatened	Type of Presence within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Carrai	NSW
Carrai	NSW
Cunnawarra	NSW
Forestry Management Areas in Styx River (FMZ2)	NSW
Georges Creek	NSW
LNE Special Management Zone No1	NSW
New England	NSW
Oxley Wild Rivers	NSW
UNE_LNE_OldGrowth	NSW

Regional Forest Agreements	[Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana,		Species or species

Name	Status	Type of Presence
Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		habitat likely to occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-30.75107 152.1854,-30.76159 152.23583,-30.83859 152.19631,-30.81115 152.1355,-30.75107 152.1854

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix C

Summary of EECs, threatened flora and fauna species known, or predicted to occur within the Project area

Table C.1 EECs known, or predicted to occur within the Project area

Species	Indicated in 10 km search area or calculator			Likelihood of Occurrence
	PMST	BioNet	BAM^	
EEC				
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	-	✓	-	Not within Project area
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	-	✓	-	Not within Project area
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	-	✓	-	Not within Project area
Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	✓	✓	-	Potentially within Project area
Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion	-	✓	-	Unlikely within Project area
Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions	-	✓	-	Present within Project area
New England Peppermint (*Eucalyptus nova-anglica*) Grassy Woodlands	✓		-	Unlikely within Project area
Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion	-	✓	-	Likely within Project area
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	-	✓	-	Not within Project area
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	-	✓	-	Not within Project area
Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner bioregions	-	✓	-	Not within Project area
White box yellow box Blakely's red gum woodland (listed as White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland under the EPBC Act)	✓	✓	-	Not within Project area
White Gum Moist Forest in the NSW North Coast Bioregion	-	✓	-	Unlikely within Project area

Note ^ indicates – a C Candidate Species.

Table C.2 Threatened flora and threatened fauna species known, or predicted to occur within the Project area

Species	Indicated in 10km search area or calculator			Likelihood of Occurrence/ Survey Period
	PMST	BioNet	BAM^	
Flora				
Arthraxon hispidus	✓	-	-	Low / Nov-April
Bertya ingramii	-	-	✓	Moderate / All Year
Cynanchum elegans	✓	✓	✓	High / All Year
Callistemon pungens	✓	✓	-	High* / Sept-Feb
Chiloglottis platyptera	-	-	✓	Low / Oct
Dichanthium setosum	✓	-	✓	Low / Nov-Dec
Diuris eborensis	✓	-	-	Moderate / Nov-Dec
Diuris pedunculata	✓	-	-	Moderate / Sept-Oct
Eucalyptus nicholii	✓	-	✓	Low / All Year
Eucalyptus magnificata	-	-	✓	Low / All Year
Euphrasia arguta	✓	-	-	Low / All Year
Grevillea beadleana	-	-	✓	Moderate / All Year
Grevillea guthrieana	✓	✓	✓	High* / All Year
Hakea fraseri	-	-	✓	Moderate / All Year
Haloragis exalata subsp. velutina	✓	✓	✓	High* / All Year
Marsdenia longiloba	✓	-	-	Moderate / Nov-Feb
Persicaria elatior	✓	-	-	Low / All Year
Plectranthus nitidus	✓	-	-	Low / All Year
Rhodamnia rubescens	-	✓	✓	Moderate / All Year
Sarcochilus fitzgeraldii	✓	-	✓	Moderate / Oct- Dec
Senna acclinis	-	-	✓	Low / All Year
Thesium australe	✓	-	✓	Low / Nov-Feb
Tylophora woollsii	✓	-	-	Low / All Year
Amphibians				
Litoria subglandulosa Glandular Frog	-	-	✓	Low / Oct- Dec
Mixophyes balbus Stuttering Frog	✓	-	✓	High / Sept-Mar
Avifauna				
Anthochaera Phrygia Regent Honeyeater	✓	-	✓	Moderate / All Year
Atrichornis rufescens Rufous Scrub-bird	✓	✓	-	Moderate / All Year

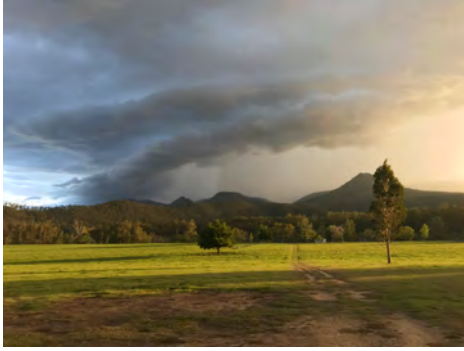
Table C.2 Threatened flora and threatened fauna species known, or predicted to occur within the Project area

Species	Indicated in 10km search area or calculator			Likelihood of Occurrence/ Survey Period
	PMST	BioNet	BAM^	
Botaurus poiciloptilus Australasian Bittern	✓	-	-	Low / All Year
Calidris ferruginea Curlew Sandpiper	✓	-	-	Low
Calyptorhynchus lathami Glossy Black-Cockatoo	-	✓	✓	High* / Mar-Aug
Climacteris picumnus victoriae Brown Treecreeper	-	✓	-	High / All Year
Chthonicola sagittate Speckled Warbler	-	✓	-	High / All Year
Daphoenositta chrysoptera Varied Sittella	-	✓	-	High / All Year
Dasyornis brachypterus Eastern Bristlebird	✓	-	-	High / All Year
Erythrotriorchis radiatus Red Goshawk	✓	-	-	Low / All Year
Grantiella picta Painted Honeyeater	✓	-	-	Low / All Year
Haliaeetus leucogaster White-bellied Sea-Eagle	-	✓	✓	High / July-Dec
Hieraaetus morphnoides Little Eagle	-	-	✓	High / Aug-Oct
Hirundapus caudacutus White-throated Needletail	✓	-	-	High / All Year
Lathamus discolor Swift Parrot	✓	-	-	High / Apr-Aug
Lophoictinia isura Square-tailed Kite	-	-	✓	High / Sept-Jan
Neophema pulchella Turquoise Parrot	-	✓	-	High / All Year
Ninox connivens Barking Owl	-	-	✓	Moderate / May-Dec
Ninox strenua Powerful Owl	-	✓	✓	High / May-Aug
Petroica phoenicea Flame Robin	-	✓	-	High / All Year
Ptilinopus magnificus Wompoo Fruit-Dove	-	✓	-	High / All Year
Rostratula australis Australian Painted Snipe	✓	-	-	Low / All Year
Turnix melanogaster Black-breasted Button-quail	✓	-	-	Low / All Year
Tyto novaehollandiae Masked Owl	-	✓	✓	High / May-Aug
Tyto tenebricosa Sooty Owl	-	✓	✓	High / May-Aug
Reptiles				
Hoplocephalus bitorquatus Pale-headed Snake	-	-	✓	High / Nov-Jan
Mammals				
Aepyprymnus rufescens Rufous Bettong	-	-	✓	Moderate / Nov-Jan
Cercartetus nanus Eastern Pygmy-possum	-	-	✓	High / Oct-Mar
Chalinolobus dwyeri Large-eared Pied Bat	✓	-	✓	High / Nov-Jan
Dasyurus maculatus Spotted-tailed Quoll	✓	✓	-	High / All Year

Table C.2 Threatened flora and threatened fauna species known, or predicted to occur within the Project area

Species	Indicated in 10km search area or calculator			Likelihood of Occurrence/ Survey Period
	PMST	BioNet	BAM^	
Miniopterus australis Little Bent-winged Bat	-	✓	✓	High / Dec-Feb
Miniopterus orianae oceanensis Large Bent-winged Bat	-	✓	✓	High / Dec-Feb
Myotis macropus Southern Myotis	-	✓	-	Moderate / Dec-Feb
Petaurus australis Yellow-bellied Glider	-	✓	✓	High / All Year
Petaurus norfolcensis Squirrel Glider	-	✓	✓	High / All Year
Petauroides volans Greater Glider	✓	✓	-	High / All Year
Petrogale penicillate Brush-tailed Rock-wallaby	✓	-	✓	High / All Year
Phascogale tapoatafa Brush-tailed Phascogale	-	-	✓	High / All Year
Phascolarctos cinereus Koala	✓	✓	✓	High / All Year
Phoniscus papuensis Golden-tipped Bat	-	✓	-	High / All Year
Potorous tridactylus tridactylus Long-nosed Potoroo	✓	-	-	High / All Year
Pseudomys novae-hollandiae New Holland Mouse	✓	-	-	Moderate / All Year
Pseudomys oralis Hastings River Mouse	✓	✓	-	Moderate / All Year
Pteropus poliocephalus Grey-headed Flying-fox	✓	✓	✓	Moderate / Oct-Dec
Scoteanax rueppellii Greater Broad-nosed Bat	-	✓	-	Moderate / All Year

Note * indicates species previously recorded in the Project area; ^ indicates – a C Candidate Species.



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