APPENDICES

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OVEN MOUNTAIN PUMPED HYDRO ENERGY STORAGE EIS

Rehabilitation strategy

OVEN MOUNTAIN PUMPED HYDRO STORAGE

EMM creating opportunities

Oven Mountain Pumped Hydro Energy Storage Project

Rehabilitation Strategy

Prepared for OMPS Pty Ltd

March 2023

Oven Mountain Pumped Hydro Energy Storage Project

Rehabilitation Strategy

OMPS Pty Ltd

J210465 OMPS EIS - Rehabilitation Strategy

March 2023

Version	Date	Prepared by	Approved by	Comments
1	11 November 2022	Nick Travers Michael Frankcombe	Amanda Weston	
2	28 February 2023	Nick Travers Michael Frankcombe	Emily McIntosh	
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1 Introduction

1.1 The Project

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

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

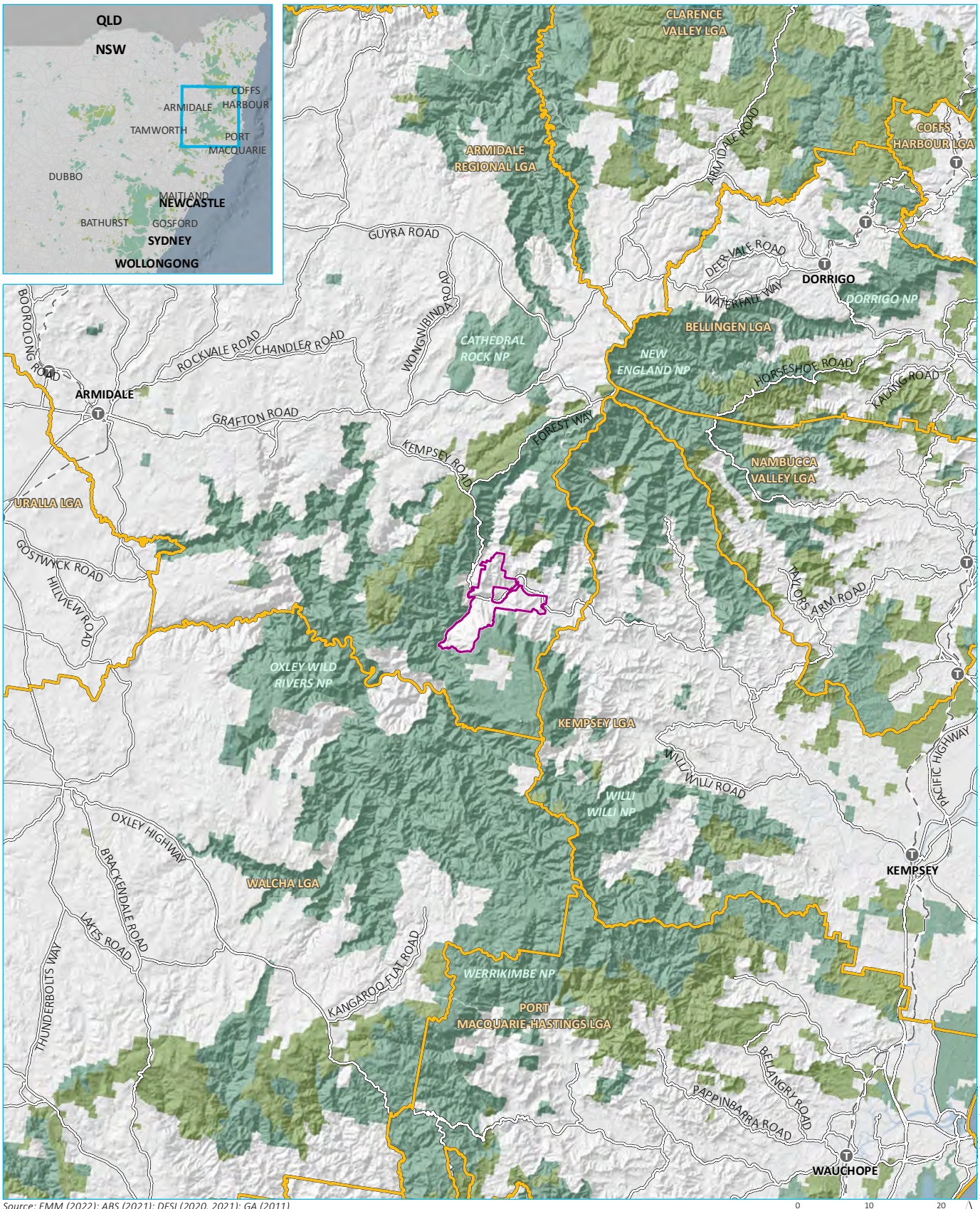
At a basic level, the Project will consist of upper and lower water reservoirs and an underground waterway connecting them via a hydro-electric power station.

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

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

1.2 Proponent

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



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

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KEY

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

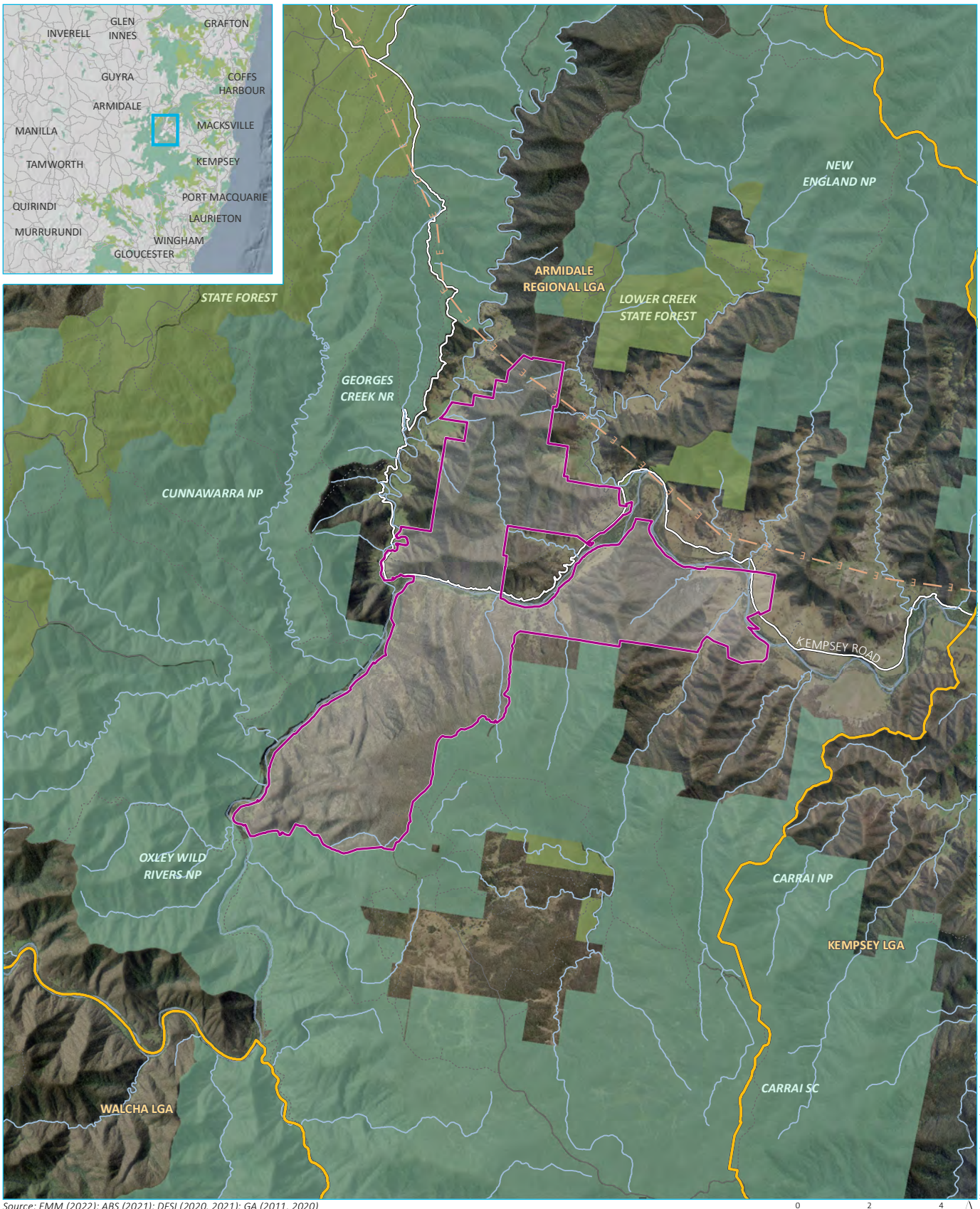
INSET KEY

- Major road
- NPWS reserve
- State forest

Regional setting

Oven Mountain Pumped Hydro Energy Storage Project
Rehabilitation strategy
OMPS Pty Ltd
Figure 1.1

EMM creating opportunities



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

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KEY

- Project area
- Existing transmission line
- Major road
- Minor road
- Vehicular track
- Named watercourse
- Named waterbody
- Local government area
- NPWS reserve
- State forest

INSET KEY

- Major road
- NPWS reserve
- State forest

The Project area - local context

Oven Mountain Pumped Hydro Energy Storage Project
Rehabilitation strategy
OMPS Pty Ltd
Figure 1.2

EMM creating opportunities

1.3 Report purpose and objectives

This rehabilitation strategy (hereafter referred to as 'the strategy' or 'this strategy') is an appendix to the Project's Environmental Impact Statement (EIS) and should be read in conjunction with the main EIS.

This strategy addresses the Secretary's Environmental Assessment Requirements (SEARs) issued for the Project and compiled in line with best practice rehabilitation guidelines including the *Form and Way: Rehabilitation Management Plans for Large Mines, 2 July 2021* (NSW Resources Regulator 2021) and the *Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry, September 2016* (Commonwealth of Australia 2016).

The overarching objective of the strategy is to guide the development of safe, stable and non-polluting landforms that can support and sustain future land uses post-project construction.

This strategy:

- identifies the final land uses for the site with consideration of existing and surrounding land uses
- identifies the conceptual final landform(s), including any to be constructed from waste spoil
- identifies site-specific risks to rehabilitation establishment and long-term success (e.g. landform design and stability; soil capability, quality and availability; climate and rainfall and other)
- identifies rehabilitation methodologies to suit the site, with consideration of identified risks
- describes how rehabilitation performance will be monitored (and provide evidence to demonstrate that rehabilitation completion criteria have been achieved)
- nominates conceptual rehabilitation objectives, completion criteria and performance indicators for relevant aspects (e.g. landform stability, agricultural productivity, native vegetation, groundwater, surface water)
- nominates proposed rehabilitation maintenance programs to address any deviation from desired rehabilitation standards and/or progress.

It is intended that this strategy would form the basis of a formal post-approval rehabilitation management plan (RMP) for the Project.

1.4 Report Structure

This report consists of the following sections:

- Chapter 2 – Project description
- Chapter 3 – Regulatory and best practice framework
- Chapter 4 – Environmental and land use setting
- Chapter 5 – Key rehabilitation risks and management
- Chapter 6 – Rehabilitation objectives and criteria
- Chapter 7 – Final land uses, landforms and rehabilitation domains
- Chapter 8 – Rehabilitation methodology

- Chapter 9 – Intervention and adaptive management.

1.5 Assessment guidelines and requirements

This strategy has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) issued by NSW Department of Planning and Environment (DPE)[1] on 10 June 2022.

Relevant matters in the SEARs addressed by this strategy are listed in Table 1.1.

Table 1.1 Relevant matters raised in SEARs

Requirement	Section addressed
Land • a strategy to manage the progressive rehabilitation of the land disturbed by the Project and enhance any new landforms created.	This document
Water • a strategy to manage spoil and enhance any new landforms created.	This document

[1] Formerly the Department of Planning, Industry and Environment (DPIE).

2 The Project description

2.1 Project overview

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

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

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

2.2 Key Project design elements

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

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

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

Table 2.1 Key Project elements

Project element	Description
PHGW	
Underground power station complex	An underground pumped hydro-electric power station located below the upstream end of the pumped hydro system to optimise the hydraulic arrangement of the Project. The power station complex consists of: • two main caverns comprising; – the machine hall – the transformer hall • interconnecting tunnels, the transformer hall tunnel and isolated phase busbar (IPB) tunnels.
Dams and reservoirs	Two concrete faced rockfill dams (CFRD) and reservoirs, referred to as the upper dam and reservoir and lower dam and reservoir, with the following specifications:
	Upper dam and reservoir: • CFRD approximately 70 metres (m) high and 780 m long • reservoir covering a total area of approximately 20 hectares (ha) and an inundation extent of approximately 16.7 ha • reservoir height of 881 m Australian Height Datum (AHD) at full supply level (FSL) and 830 m AHD at minimum operating level (MOL) • total reservoir storage capacity of around 5.1 gigalitres (GL) at FSL.
	Lower dam and reservoir: • CFRD approximately 70 m high and 280 m long • reservoir covering a total area of approximately 24.7 ha and an inundation extent of approximately 21.6 ha • reservoir height of 250 m AHD at FSL, 215 m at MOL and 205 m AHD at lowest operating level (LOL) • total reservoir storage capacity of around 6.5 GL at FSL.
Water intake structures	Two intake structures, one at each reservoir, including: • a morning glory, vertical-type intake structure situated at the upper dam and reservoir • a lateral intake structure, with head gates and stoplog slots, and an intake channel, at the lower dam and reservoir.
Spillway	Two concrete lined spillway chutes, one for each of the upper and lower dams and reservoirs. Both spillway crests will comprise of ungated ogee-shaped overflow weirs on the upstream ends of the spillway chutes.
Macleay River pump facility	A pump facility on the Macleay River, which will include duty and standby pumps for the first fill and for ongoing reservoir refills.

Table 2.1 Key Project elements

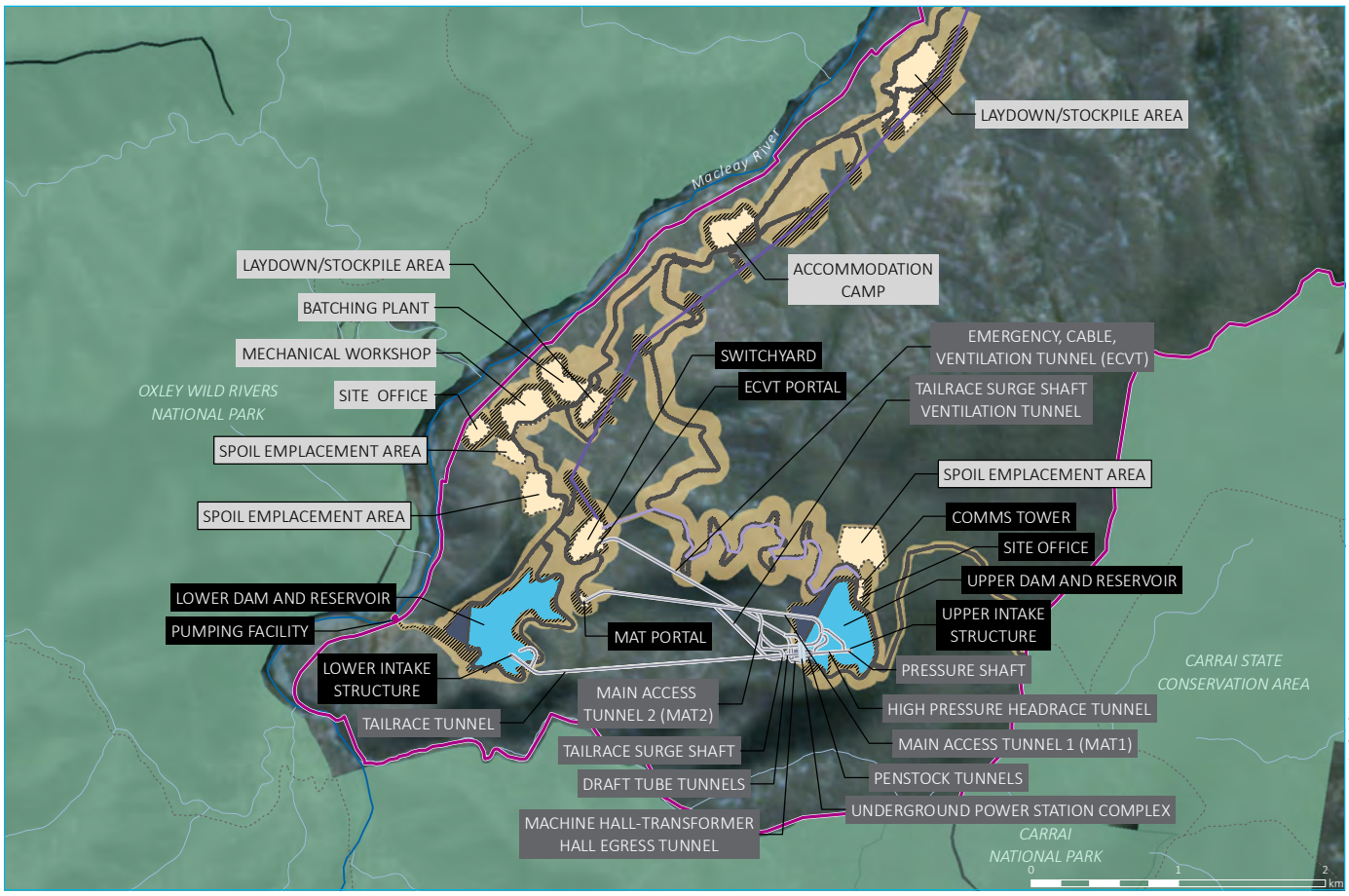
Project element	Description
Tunnels	Three main tunnels comprising of: • two main access tunnels (MAT1 and MAT2) • the emergency, cable, ventilation tunnel (ECVT). The MAT1 and MAT2 will provide loop access to the power station complex from the MAT portal. The ECVT will provide services access and egress between the switchyard portal and the transformer hall. The ECVT portal will contain the station switchyard, control rooms, ventilation and firefighting equipment, with blast walls separating important equipment.
Power waterway	The power waterway will consist of: • a 660 m deep, 5.1 m diameter vertical pressure shaft • 250 m concrete and steel lined high-pressure headrace tunnel • three or more 80 m long penstock tunnels • three or more 120 m long draft tube tunnels • an approximately 1,825 m long concrete lined tailrace tunnel.
Transmission connection works	
Connection works	The connection works will consist of: • an approximately 15km long transmission alignment comprising, at a maximum, double circuit single tower 330 kV overhead infrastructure and single circuit single tower 132 kV overhead infrastructure connecting to TransGrid Line 965 • up to 25 transmission tower sites (approximately 50 m x 50 m) containing the 132 kV and 330 kV infrastructure • a transmission easement width of a maximum of approximately 105 m. Note: The upgrade of existing Line 965 will be the subject of a separate application.
Sub-station	Construction of a substation and associated connection infrastructure of up to 330 kV rating.
Switchyard	A high voltage connection linking the connection transmission lines to the cables exiting the underground power station complex. The outdoor air insulated switchyard will likely include: • switchgear and control room • cable potheads • disconnector/earth switches • capacitive voltage transformer (VT) • lightning protection • security fencing, lighting and surveillance • surge arrestor.
Ancillary development (construction and operation)	
Access roads, access tracks and bridge	A variety of road works to improve existing access, and construction of new permanent roads to enable construction access, temporary establishment and use of construction sites, and general access to the Project area including transmission line infrastructure.
	The proposed main access will be via the construction of a new unsealed two-lane access road located to the east of the site. The main access road will interface with the existing Kempsey Armidale Road and will require the construction of one new single or two lane low-level bridge crossing over the Macleay River. A temporary bridge may be utilised prior to the construction of the permanent bridge.

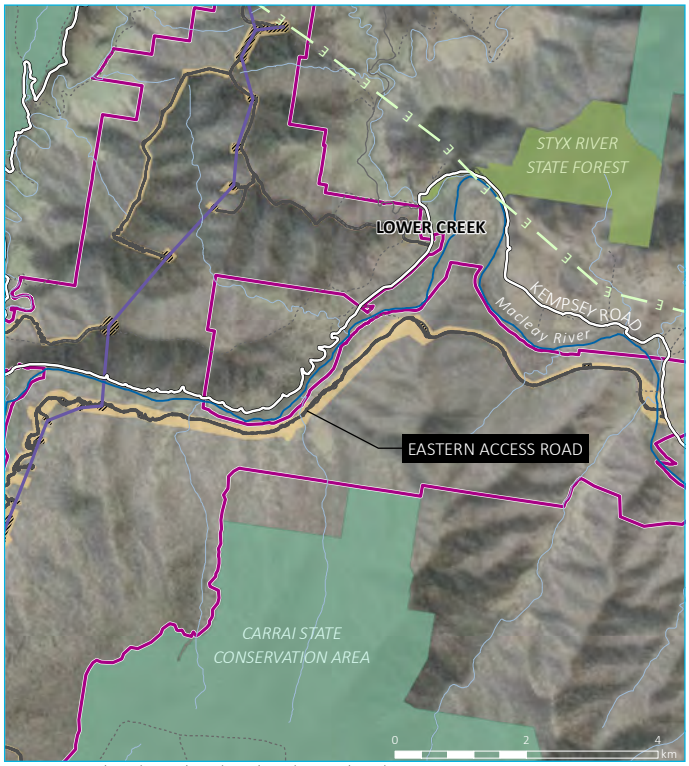
Table 2.1 Key Project elements

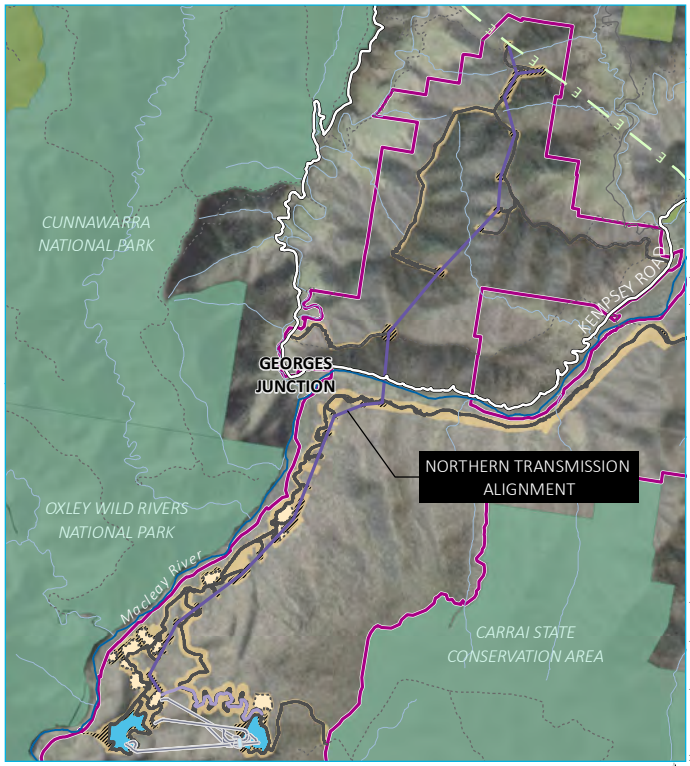
Project element	Description
	There will be approximately 40 km of permanent roads connecting the dams, surface works, portals, transmission assets and spoil sites. Some of these roads are existing roads, however approximately 25 km will be newly constructed roads. The key road components include: • Main Access Road (approximately 4.7 km) • Eastern Access Road (up to approximately 11. 4 km) • Lower Dam Access Road (approximately 3.6 km) • Upper Dam Access Road (approximately 7.1 km) • access to portals and underground works • Upper Dam Emergency Egress Road (approximately 2.2 km). Access to the transmission infrastructure north of the Macleay River will be via two roads accessed from the Kempsey Armidale Road. These two roads include the: • Northern Transmission Access Road (approximately 15 km) • Southern Transmission Access Road (approximately2.3 km). To support access along the transmission line easement south of the Macleay River and to each of the tower sites, a network of interconnecting access and maintenance tracks will be constructed, to a large extent utilising existing access tracks.
Surface works pads and facilities	There are four main construction pads in addition to surface portals which will be used temporarily during construction for different services (workers camp, construction site offices, workshop area, and laydown storage).
	Construction works will require the establishment of the following ancillary support infrastructure and areas: • Main accommodation camp(s), which will temporarily accommodate the majority of workers as required workers as required throughout the construction period • Temporary or fly camps, which will temporarily accommodate the majority of workers as required throughout the construction period • two works areas including Works Area 1 and Works Area 2, which will contain ancillary facilities such as CBPs, mechanical and electrical workshops, a laboratory and various water treatment and wash areas • spoil emplacement areas • staging area • stockpiling areas • temporary site offices to be used during construction.
Communications	Communication infrastructure such as fibre optic cables are required for the operation of the Project and will be located: • on an overhead line linking the upper and lower dams and reservoirs (in conjunction with the electrical line) • buried in road corridors. The communication network will also include a communications tower near the upper dam and reservoir.
Utilities during construction	• Construction water will be supplied either via groundwater bores, or via pumping of water from the Macleay River to support camp operations, the CBP, dust suppressions and other activities across the site. • Construction power will be supplied primarily by use of portable diesel generators and supported where possible by leveraging off existing electricity distribution infrastructure running through the generation site.
Utilities for operation	Alignment and length of utilities (electricity, water, etc.) will be combined into a single corridor (total length of about 5.4 km).

Table 2.1 Key Project elements

Project element	Description
Water diversion and water treatment facilities	• Site drainage will include a combination of cross drainage culverts, drainage pits and pipe, open channels/open drains (vegetated, rock-lined or concrete), levees/bunds, and detention basins. • Various water treatment plants will be used for construction drainage and water treatment facilities – for the main accommodation camp, temporary or fly camps, CBP, tunnel, etc. • Specific discharge locations are planned for stormwater and surface water runoff.
Laydown/stockpile areas	Temporary laydown/stockpile areas will be utilised across the Project area, with a total allocated stockpile area of around 114,000 m^2.
Spoil emplacement areas	To accommodate spoil generated through excavation of the underground caverns and tunnels, three permanent spoil placement locations have been identified with a capacity to store around 2 million cubic metres (Mm^3) of material. Dead storage space within the reservoirs will also be used for spoil placement, with a capacity to store approximately 300,000–400,000 m^3.
Ancillary operational facilities	Primary operation of the Project can be undertaken remotely and will require minimal onsite operational staff, other than for maintenance activities. Operational facilities include maintenance housing, work area, car parking, workshop and storage, control room and switchgear, water treatment plant, office area, heating, ventilation and air conditioning (HVAC), backup generators and Macleay River pump facility.
Other	
Construction	• Construction duration of around four to five years. • Construction workforce of over 600 to approximately 1,000 workers at construction peak.
Rehabilitation	Rehabilitation of areas disturbed during pre-construction and construction will be undertaken progressively during all stages and phases of the Project. Progressive rehabilitation will occur over about 70 ha including spoil emplacement areas and areas used for construction ancillary facilities no longer needed during operation. At the end of the Project's life, 192 ha in total will be rehabilitated to native ecosystem (including native vegetation and rock landscape). Approximately 138 ha will be retained permanently for the water storages and access roads, subject to agreement with relevant landowners/land managers.
Operation	• The Project will provide up to 900 MW of electricity generating capacity and up to eight hours of energy storage at full generating capacity. • Maintenance and operational activities will include power station operations, infrastructure inspections, maintenance to assets, vegetation management, auditing and compliance and other activities. • It is expected that the operation of the new power station will require around 30-50 full-time workers, as well as additional contractors for regular and ad hoc maintenance and repairs.
Hours of operation	• Construction of the Project will be 24/7 and 365 days per year. • Operation of the Project will be 24/7 and 365 days per year.
Project timeline	The Project will involve the construction and operational stages, and numerous phases which are outlined in the Project's EIS.
CIV	Estimated to be about $1.8 billion.







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

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KEY

- Project area
- Disturbance footprint
- Construction envelope
- Surface works

Project operational elements

- Underground power station complex
- Power and communications lines
- Transmission overhead lines
- Tunnels, portals, intakes, shafts
- Permanent road
- Reservoir
- Dam wall

Existing environment

- Macleay River
- Watercourse/drainage line
- Kempsey-Armidale Road
- Vehicular track
- Existing transmission line
- NPWS reserve

Label format

- SURFACE PERMANENT INFRASTRUCTURE
- UNDERGROUND PERMANENT INFRASTRUCTURE
- TEMPORARY INFRASTRUCTURE
- PERMANENT SPOIL EMPLACEMENT

Key Project Elements

Oven Mountain Pumped Hydro Energy Storage Project
Rehabilitation strategy
OMPS Pty Ltd
Figure 2.1

EMM creating opportunities

2.3 Project area terminology

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

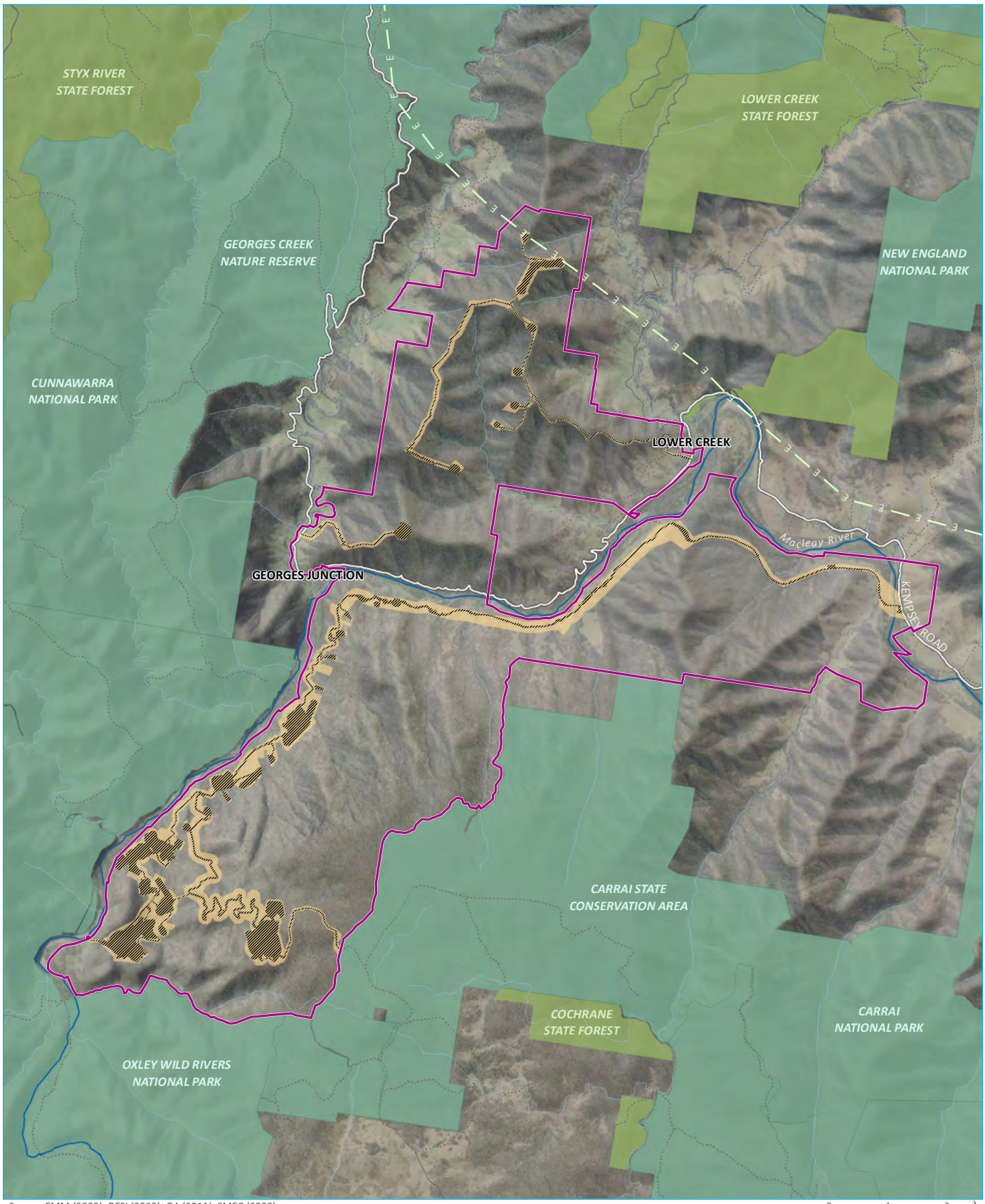
The *Project area* is the broader area within which the Project will be built and operated, and the extent within which direct impacts from the Project are anticipated. Importantly the Project area does not represent a footprint for the construction works, but rather indicates an area that was investigated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

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

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

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

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



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

0 1 2 km

GDA 1994 MGA Zone 56

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KEY

- Project area
- Disturbance footprint
- Construction envelope

Existing environment

- Macleay River
- Watercourse/drainage line
- Kempsey-Armidale Road
- Minor road
- Vehicular track
- Existing transmission line
- NPWS reserve
- State forest

Project area overview

Oven Mountain Pumped Hydro Energy Storage Project
Rehabilitation strategy
OMPS Pty Ltd
Figure 2.2

EMM creating opportunities

3 Regulatory and best practice framework

3.1 Legislation and environmental planning instruments

Statutory instruments (legislation, policies and guidelines) considered in the development of this rehabilitation strategy are summarised below.

3.1.1 NSW Protection of the Environment Operations Act 1997

The NSW *Protection of the Environment Operations Act 1997* (POEO Act) establishes the State's environmental regulatory framework and includes licensing requirements for certain activities. Section 3 of the POEO Act contains objectives relevant to rehabilitation, specifically:

- Section 3(a) – to protect, restore and enhance the quality of the environment in NSW.
- Section 3(d) – to reduce risks to human health and prevent the degradation of the environment through mechanisms that promote:
  - pollution prevention
  - elimination of harmful wastes and reduction of harmful discharges
  - reduced use of materials and re-use, recovery or recycling of materials
  - progressive environmental improvements, including reduction of pollution at source
  - the monitoring and reporting of environmental quality.

These POEO Act objectives are consistent with the overarching objective of the strategy and have therefore been adopted.

3.1.2 NSW State Environmental Planning Policy (Resources and Energy) 2021

The NSW *State Environmental Planning Policy (Resources and Energy) 2021* ('the Resources and Energy SEPP)', made under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act), contains planning provisions for the assessment and development of mining, petroleum production and extractive material resource proposals in NSW.

Although the Resources and Energy SEPP is not applicable to the Project by virtue of Section 5.22(2) of the EP&A Act, the rehabilitation-related matters in the Resources and Energy SEPP remain a useful point of reference given the Project will involve the excavation of rock and placement of excavated material (i.e. 'extractive operations').

Section 2.2.3(2) of the Resources and Energy SEPP gives direction to consent authorities on whether conditions of consent for a proposed development should include conditions for rehabilitation, such as the requirement to:

- prepare a plan that identifies the proposed end use and landform of the land once rehabilitated, or
- manage wastes and/or contaminated soil generated by the development in accordance with relevant guidelines, or
- manage land, both during and after rehabilitation, in a manner that does not jeopardise public safety.

These considerations are consistent with the overarching objective of the strategy and have therefore been adopted as best practice.

3.1.3 Strategic regional planning policies

i New England Development Strategy 2010

The New England Development Strategy 2010 (Worley Parsons 2010) ('the NED Strategy') outlines key land use policies and principles for the former Armidale Dumaresq, Guyra, Uralla and Walcha local government areas (LGAs).

The NED Strategy was developed to provide key land use policies, principles and planning context for the preparation of local environmental plan (LEP) provisions, for the period up to 2032. The NED Strategy identifies locations of expected growth and change, and land use planning objectives and strategies to guide this growth and change.

Aims and objectives of the NED Strategy considered relevant to rehabilitation planning for the Project are summarised in Table 3.1.

Table 3.1 New England Development Strategy 2010 objectives – rehabilitation considerations

NED Strategy – relevant aims and objectives [1]	Rehabilitation considerations
(e) to encourage the proper management, development and conservation of resources by protecting, enhancing and conserving: (i) land currently used for agricultural production (ii) native vegetation, biodiversity, minerals, soils, water and other natural resources (iii) areas of high scenic or recreational value (iv) places and buildings of heritage significance, including Aboriginal places and relics.	• type and extent of final rehabilitated land uses to be consistent with pre-project land uses, as far as reasonably practicable • rehabilitation of agricultural land to its existing productive potential, as far as reasonably practicable • rehabilitation of native vegetation based on pre-disturbance plant community types (PCTs) and/or suitable local analogues, as far as reasonably practicable • reinstatement of Aboriginal cultural heritage (e.g. artefacts, places), if applicable • historical heritage incorporated into or reinstated as part of rehabilitation, if applicable.
(h) to adapt to major…environmental changes…such as climate change.	• Consideration of climate change effects, e.g: – final landform design considers potential for increased frequency and intensity of storm events – frequency and intensity of droughts and fires and risks to rehabilitating vegetation.

1. Source: New England Development Strategy 2010 (Worley Parsons 2010)

ii Armidale Dumaresq Local Environmental Plan 2012

The Armidale Dumaresq Local Environmental Plan 2012 (ADLEP 2012) identifies land use zones, and the type of land uses that are permitted (with or without consent) or prohibited in each zone on any given land, within the former Armidale Dumaresq Shire local government area (LGA).

The Armidale Dumaresq Shire and Guyra Shire Councils were merged on 12 May 2016 to form the Armidale Regional Council; a single, consolidated local environmental plan (LEP) for the Armidale Regional Council is still in development and the ADLEP 2012 remains in effect in the interim.

The Project area is zoned RU1–Primary Production under the ADLEP 2012. Rehabilitation planning considerations for the Project, based on the land use zoning objectives for RU1 zoned land, are summarised in Table 3.2.

Table 3.2 RU1-Primary Land Use Zoning objectives – rehabilitation considerations

RU1–Primary Production – Objectives of zone [1]	Rehabilitation considerations
Encourage sustainable primary industry production by maintaining and enhancing the natural resource base.	• Extent of existing agricultural land to be impacted by the Project and its existing productive potential (land and soil capability (LSC) Class)). • Reinstatement of agricultural land to its original LSC Class, as far as reasonably practicable.
Encourage diversity in primary industry enterprises and systems appropriate for the area.	• Not applicable/relevant.
Minimise the fragmentation and alienation of resource lands.	• Type and extent of rehabilitated final land uses to be consistent with pre-project land uses, as far as reasonably practicable.
Minimise conflict between land uses within this zone and land uses within adjoining zones.	
To allow for non-agricultural land uses that will not restrict the use of other land in the locality for agricultural purposes.	

1. Source: Armidale Dumaresq Local Environmental Plan 2012 – RU1 Land Use Table

iii New England North-West Regional Plan 2036 (DPE 2017)

The New England North-West Regional Plan 2036 (NSW Government 2017) ('the NENW Regional Plan') aims to guide the NSW Government's land use planning priorities and decisions over the period 2017–2036 in the New England North-West region ('the region'). It provides an overarching framework to guide subsequent and more detailed land use plans, development proposals and infrastructure funding decisions.

The NENW Regional Plan includes priority, medium and longer-term actions to maintain and protect key industry sectors (agriculture, resources, tourism), protect significant biodiversity, and provide opportunities for renewables and green technology.

The plan identifies 4 goals for the region:

- Goal 1 – A strong and dynamic regional economy.
- Goal 2 – A healthy environment with pristine waterways.
- Goal 3 – Strong infrastructure and transport networks for a connected future.
- Goal 4 – Attractive and thriving communities.

A number of directions have been outlined in the NENW Regional Plan in order to achieve the 4 goals. Those directions considered relevant to rehabilitation planning for the Project are summarised in Table 3.3.

Table 3.3 New England North-West Regional Plan 2036 – directions relevant to rehabilitation

Goal [1]	Relevant direction(s) [1]	Rehabilitation considerations
Goal 1	Direction 3: Protect and enhance productive agricultural lands	• Extent of existing agricultural land to be impacted by the Project and its existing productive potential (LSC Class). • Rehabilitation of agricultural land to its existing LSC Class, as far as reasonably practicable.
Goal 2	Direction 10: Sustainably manage and conserve water resources (water quality and aquatic habitats)	• Risks to receiving water quality due to erosion during and following decommissioning and rehabilitation. • Long-term erosional stability of final landforms. • Integration of final landform with surrounding drainage lines
	Direction 11: Protect areas of potential high environmental value	• Extent of existing native vegetation areas to be impacted by the Project. • Rehabilitation of native vegetation based on pre-disturbance plant community types (PCTs) and/or suitable local analogues, as far as reasonably practicable.
	Direction 12: Adapt to natural hazards and climate change	• Final landform effect on downstream hydrology and flood risk. • Consideration of climate change effects, e.g: – final landform design considers potential for increased frequency and intensity of storm events (risk to long-term landform stability) – frequency and intensity of droughts and fires and risks to rehabilitating vegetation.
Goal 3	Direction 23: Collaborate with Aboriginal communities to respect and protect Aboriginal culture and heritage	• Potential reinstatement of Aboriginal cultural heritage (e.g. artefacts, places), if applicable and subject to consultation with relevant stakeholders.
	Direction 24: Protect the region's historic heritage assets	• Historical heritage incorporated into or reinstated as part of rehabilitation, if applicable and where practicable.

1. Source: New England North-West Regional Plan 2036 (NSW Government 2017)

3.2 Best practice rehabilitation guidelines

In the absence of statutory guidelines specific to the rehabilitation of land disturbed by renewable energy and/or hydro-electric developments, this strategy has been prepared with regard to the following best-practice guidelines for mining projects:

- *Form and Way: Rehabilitation Management Plans for Large Mines, 2 July 2021* (NSW Resources Regulator 2021)
- *Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry, September 2016* (Commonwealth of Australia 2016).

Although the Project is not a mining project it will involve several comparable activities (e.g. land clearing, tunnelling and generation of waste rock spoil, construction of large water storages etc) and these guidelines therefore provide an appropriate point of reference for the structure and content of this strategy.

Rehabilitation planning principles from these guidelines adopted in this strategy include:

- identification of rehabilitation-related **regulatory requirements**

- identification of key environmental baseline matters relevant to rehabilitation planning (**knowledge base)**
- **assessment of final land use options** with regard to the existing environment and land uses, statutory requirements, and stakeholder consultation
- assessment of **key rehabilitation risks** (risks to rehabilitation being achieved) and proposed risk controls
- nomination of **final land uses**
- **final landform designs** or concepts
- identification of **final land use/rehabilitation domains**
- nomination and **rehabilitation objectives**, **completion criteria** and **measurement/verification methods** for each identified final land use rehabilitation domain
- description of the rehabilitation **methodology**
- programs to **monitor rehabilitation** performance.

4 Environment and land use setting

A summary of the environmental and land use baseline for the Project area that informs rehabilitation planning is provided below.

4.1 Climate

The Project area is characterised by warm and persistently wetter summers and cooler and drier winters; long-term mean maximum and minimum annual temperature are 24.4°C and 11.9°C respectively, average annual rainfall is 1,877 millimetres per year (mm/year) and annual average pan evaporation rates between 1,000–1,200 mm/year (EMM 2023a).

4.2 Topography

The Project area is situated on the western slope of the Carrai Plateau within the New England Tablelands. The plateau has steep topography ranging from about 150 m to 1,000 m above sea level with vegetation throughout the area varying from cleared to heavy. The Macleay River, on the western portion of the Project area, flows south to north and then west to east, predominantly at an elevation of approximately 140 mAHD. The upper reservoir area lies on a plateau at around 900 metres relative to Australian Height Datum (mAHD) before sloping down at up to 30% to the west to the lower reservoir at around 300 mAHD (NSW SS 2017a).

The transmission corridor will contain up to two transmission lines, a 132 kV single circuit overhead line, and a 330 kV double circuit overhead line that will sit alongside each other within the transmission corridor to minimise overall impacts. The transmission corridor will follow the route adjacent to the main access road, travelling north from the switchyard at the ECVT portal (approximately 300 m AHD), crossing over the Macleay River east of Georges Junction (approximately 125 m AHD) before rising up to connect with TransGrid Line 965 at approximately 576 m AHD.

4.3 Soils

Soils within the Project area are predominantly residual, with their composition influenced by the properties of the underlying granitic and metamorphic rock units.

Deposits of alluvial and colluvial soils occupy the incised valleys which support the ephemeral streams formed across the upper escarpment area; these deposits become more substantial in the lower escarpment and plains area reflecting the increased energy of the environment and wider catchment area, and generally comprise sub-rounded to rounded boulders, cobbles, gravel and sand. Further down the catchment, within the riparian corridor and along the fifth order Macleay River, the surficial geology is comprised of a relatively thin deposit of alluvium, comprising well rounded cobbles, gravel and sand.

In general, the soils in the Project area are characterised as:

- relatively shallow and poorly developed, with rock close to surface
- having minimal clay content (≤ 15%)
- exhibiting poor water holding capability.

Soils across the Project area were sampled, tested, analysed and mapped into four soil mapping units (SMUs) reflecting the variation in soil type, geology and landforms present. These SMUs, and the corresponding soil profile classes (SPCs) and Australian Soil Classifications (ASC) (after Isbell & NCST 2021), are summarised in Table 4.1.

Of the four SMUs, one is a 'simple' SMU, with one predominant soil profile class present and three are 'complex' SMUs with two or more soil profile classes, phases or variants present within these units that cannot be separated at the surveyed mapping scale. It is noted that due to the highly variable, high relief and rocky nature of the site that soils could frequently be shallow across the site, including areas not identified in the survey, and therefore the presence and occurrence of these shallow soils and rock outcrops has been discounted in the delineation and description of the SMUs.

Soil mapping across the Project area was extrapolated according to the results of the 53 surveyed areas (EMM 2023a). It is important to note that boundaries between soil units are based on field observations at an intensity of 1 site per 19 ha (non-linear disturbance areas) or 1 site per 0.95 km (linear disturbances), and desktop digital aerial photographs/LiDAR DEM interpretation. Boundaries between soil units can be abrupt (within 10 m) or diffuse (>50 m) or somewhere in between. Owing to the natural variability between soil types, boundaries and landforms, the confidence levels of the mapped SMUs decreases with distance from the originally surveyed sites. Any conclusions or interpretations of the data collected from this survey and presented in this report can only serve as an indication of the type and distribution of soils and SMUs potentially present and should not be relied upon as a comprehensive (exhaustive) assessment across the Project area.

Table 4.1 Project area soil mapping units

SMU	ASC	SPC	SMU class	Description	Sites	Project elements
A	Arenosol	SPC01 and 01a	Complex	Apedal to weakly structured sandy to loamy soils with variable depth and presence of coarse fragments. Chemically benign.	1, 27, 28, 4	Lower Reservoir, Lower Reservoir Access. Upper Reservoir
	Tenosol	SPC02 and 02a			2, 3, 5, 6, 13, 25, 51	
	Rudosol	SPC03			4, 8, 9, 10, 23	Lower Reservoir Access, Eastern Access Road
	Dermosol	SPC04			7, 11, 12	Lower Reservoir Access, Eastern Access Road
B	Dermosol	SPC05	Complex	Shallow to moderately deep yellow- to grey-brown clay loams and clays with chemical constraints of soil sodicity, magnesium and aluminium.	14, 16, 17, 18, 24, 26, 46, 47	Lower Reservoir, Eastern Access Road, Upper Reservoir
	Dermosol	SPC06			15, 19, 20, 21, 22, 39, 49, 50, 52	Lower Reservoir, Eastern Access Road, Transmission Line corridor
C	Kandosol, Rudosol	SPC07 and 7a	Complex	Shallow, acidic rocky loams on elevated landforms with chemical constraints of poor cation balance and aluminium.	29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 40, 41, 42, 43, 44, 45	Lower Reservoir, Transmission Line corridor
D	Tenosol	SPC08	Simple	Deep alluvial sands and loams on alluvial plains and terraces. Chemically benign.	53	Eastern Access Road

Source: EMM (2023a)

4.3.1 SMU A

SMU A consists primarily of deep, weakly structured soils with sandy and loamy textures, generally on the midslopes and lower slopes. The SMU consists of four SPCs and two associated soil phases, accounting for the varying presence of coarse fragments through the profiles and soil depth, including:

- SPC01 and 01A (Arenosols)
- SPC02 and 02A (Tenosols)
- SPC03 (Rudosols)
- SPC04 (Dermosols).

As discussed in greater detail in the Land, Soils and Erosion Assessment (LSEA) (EMM 2023a), differentiation between the SPC01 and SPC02 is based on the required texture depths and absence of coarse fragments in Arenosols (SPC01 and 01A) or their presence and subsequent classification of Tenosols (SPC02 and 02A) as per the ASC, whilst SPC03 is present where soil depths are very shallow, primarily in association with rock outcrops, but are expected to consist of SPC01 and SPC02 where depths are unconstrained.

This mapping unit had few identified soil chemistry constraints, being limited to occasional aluminium toxicity potential. Physically, the soils are sandy, weakly structured materials with variable depth and therefore may have stability limitations for structural foundations.

4.3.2 SMU B

SMU B consists of soils with heavier textures and soil structure than seen in SMU A, consisting of clay loam to clay soils with at least weak to moderate structure at some point in the subsoils, being classified as Dermosols, including;

- SPC05
- SPC06.

This mapping unit had identified soil chemical constraints of very poor cation balance (low calcium, high exchangeable magnesium) and magnesic and sodic subsoils with potential aluminium constraints in moderately to strongly acid profiles and occasionally subsoil salinity.

These soils are likely to be dispersive in the subsoil and subsequently pose a very high erosion risk.

4.3.3 SMU C

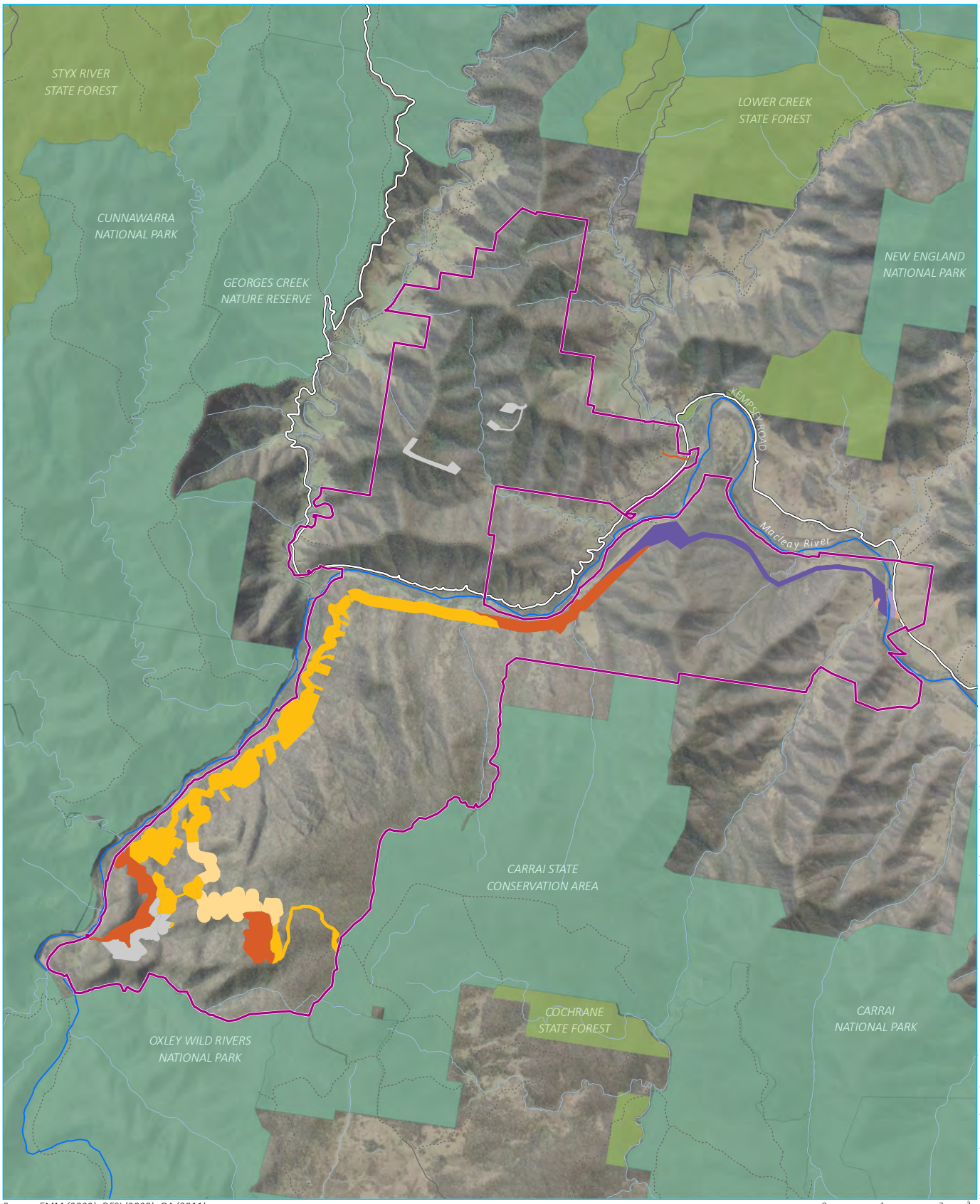
SMU C is a complex mapping unit comprised of SPC07 (Kandosols) and variant SPC07a (Rudosols), consisting of shallow to very shallow, acidic, weakly structured rocky loams and clay loams found on upper slopes and ridgelines.

This mapping unit has identified soil chemistry constraints of poor cation balance with common aluminium constraints. Physically, the soils are shallow, weakly structured materials with variable depth due to presence of bedrock and outcrops and therefore may have construction limitations.

4.3.4 SMU D

SMU D consists of alluvial Tenosol soils associated with the alluvial terraces and floodplains in proximity to the Macleay River, consisting of SPC08 (Site OMP53). This SMU will be inherently variable due to the nature of alluvial soils from the temporal and spatial variability of flooding and inundation events and the subsequent development of soils.

This mapping unit has no identified soil chemistry constraints whilst physically, the soils are likely to be highly variable but are likely to frequently be sandy and poorly structured with abundant coarse fragments of river cobbles.



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

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KEY

Project area

Existing environment
- Macleay River
- Watercourse/drainage line
- Major road
- Minor road
- Vehicular track
- NPWS reserve
- State forest

Soil mapping units (SMU)
- SMU A
- SMU A - low confidence
- SMU B
- SMU B - low confidence
- SMU C - low confidence
- SMU D
- SMU D - low confidence

Project area soil mapping units

Oven Mountain Pumped Hydro Energy Storage Project
Rehabilitation strategy
OMPS Pty Ltd
Figure 4.1

EMM
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4.4 Land and soil capability

The *Land and Soil Capability Assessment Scheme* (OEH 2012) ('LSC Scheme') assesses the capacity of subject land to support a range of land uses. The LSC Scheme considers the inherent biophysical features of the land and soil, and their associated hazards and limitations, to these land uses. Each hazard is given a rating between 1 (best, highest capability land) and 8 (worst, lowest capability land).

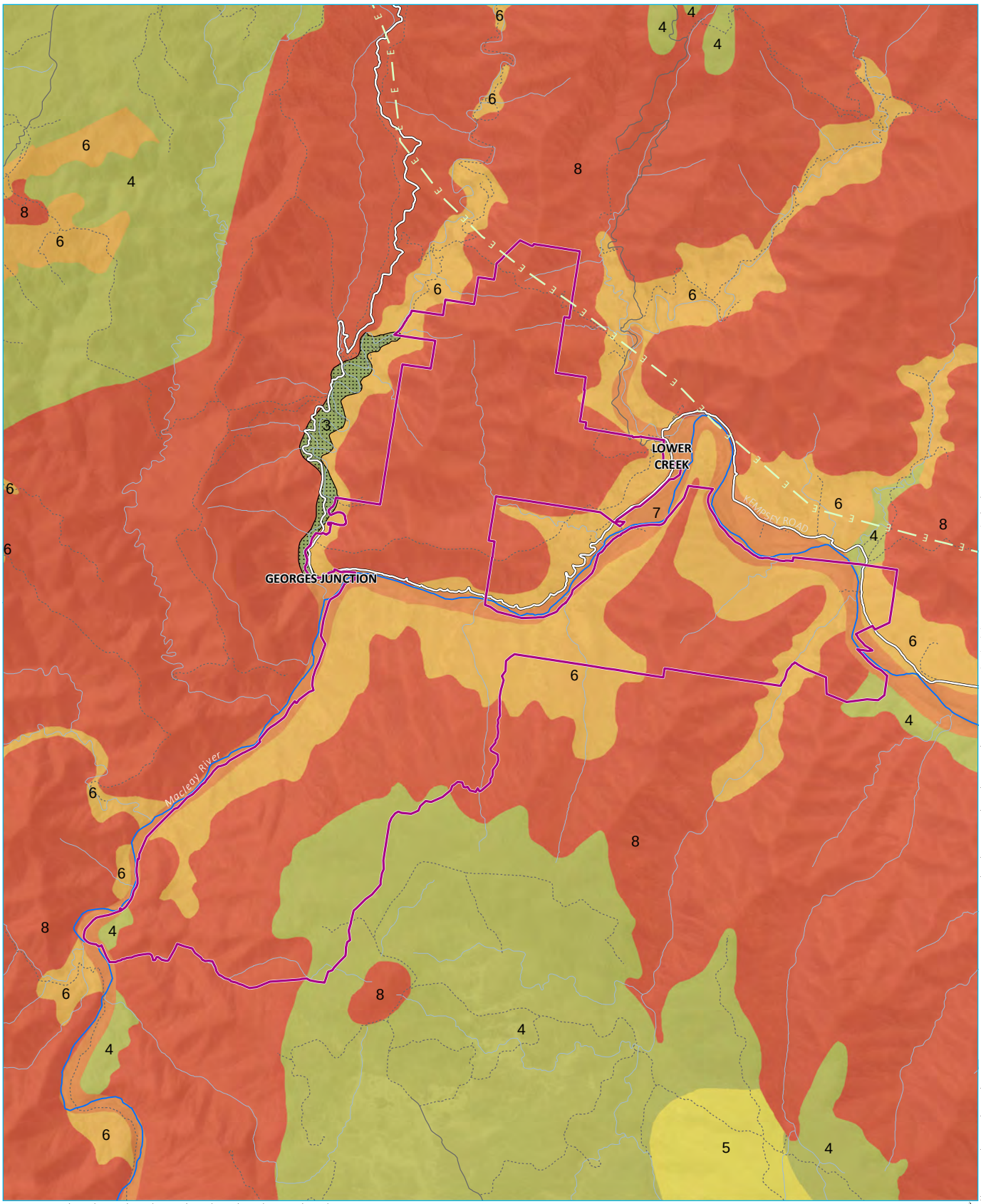
The overall LSC class of the land is based on the most limiting feature/hazard. The LSC classes present at a site can be determined at various scales, ranging from state, regional to farm scale, varying in accuracy according to the information and resolution associated with them. Based on NSW State scale mapping (after DPIE 2020; 2021), the Project area is mapped as modelled land and soil capability (LSC) Classes 3, 4, 6, 7 and 8 (Table 4.2) representing land with predominantly low to extremely low capability and very high to severe limitations (EMM 2023a).

Modelled regional LSC mapping from eSPADE (DPIE 2020) is presented in Figure 4.2 alongside Biophysical Strategic Agricultural Land ('BSAL'). A description of the BSAL scheme and relevance to the Project is provided in EMM (2023a).

Table 4.2 Land and soil classifications mapped for the Project area

LSC Class [1]	LSC description	ASC (GSG)
Class 3 – High capability land	• Land has moderate limitations. • Capable of sustaining high-impact land uses, such as cropping with cultivation, using more intensive, readily available and widely accepted management practices. • Careful management of limitations is required for cropping and intensive grazing to avoid land and environmental degradation.	Dermosols (Amh)
Class 4 – Moderate capability	• Land has moderate to high limitations for high-impact land uses. • Will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. • These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology.	Kandosols (Rel), Kurosols (Ypl)
Class 6 – Low capability land	• Land has very high limitations for high-impact land uses. • Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. • Careful management of limitations is required to prevent severe land and environmental degradation.	Kandosols (YE), Kurosols (BP)
Class 7 – Very low capability land	• Land has severe limitations that restrict most land uses and generally cannot be overcome. • On-site and off-site impacts of land management practices can be extremely severe if limitations are not managed. • There should be minimal disturbance of native vegetation.	Rudosols (alluvial) (Al)
Class 8 – Extremely low capability land	• Limitations so severe that the land is incapable of sustaining any land use apart from nature conservation. • There should be no disturbance of native vegetation.	Tenosols (ES), Rudosols (L)

1. As per OEH (2012)



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

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GDA 1994 MGA Zone 56

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KEY

- Project area
- Biophysical strategic agricultural land

Land and soil capability

- 3
- 4
- 5
- 6
- 7
- 8

Existing environment

- Macleay River
- Watercourse/drainage line
- Major road
- Minor road
- Vehicular track
- Existing transmission line

Project area land and soil capability

Oven Mountain Pumped Hydro Energy Storage Project
Rehabilitation strategy
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Figure 4.2

EMM creating opportunities

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4.5 Geology and geochemistry

Waste rock spoil will be generated from the drill and blasting of bedrock material during Project construction. EMM (2023b) completed geochemical characterisation of this bedrock material from which waste rock spoil would be derived, with seven (7) samples tested for acid rock drainage (ARD) properties and analysed for common acid base accounting (ABA) parameters and metals and metalloids. The results of these analyses are tabulated in Table 4.3 and summarised in accordance with AMIRA (2002) below.

Table 4.3 Acid generation capacity summary table[1]

Geology	Sulphur content (%)	Maximum Potential Acidity (kg H_2SO_4/t) [2]	Acid Neutralising Capacity (kg H_2SO_4/t)
Hornfels	0.03–0.18	0.918–5.508	9.5–17.8
Granodiorite	0.005–0.91	0.153–27.846	7.2–59
Sand – sandy gravel	0.16	4.896	18.7

1. Source: EMM (2023b)
2. Kilograms of Sulfuric acid per tonne (kg H2SO4/t)

The following summarises the results of the ABA testing:

- All samples were analysed for total percent sulphur (%S) and the maximum concentration was reported to be 0.91%.
- Acid neutralisation capacity (ANC) ranged from 7.2–59 kg H_2SO_4/t) based on the laboratory reported total sulphur content.
- A higher ANC/maximum potential acidity (MPA) ratio indicates a sample that is likely to be more acid consuming than producing, while a lower ratio indicates a sample that is likely more acid producing than consuming. An ANC/MPA ratio of 1.0 indicates that the maximum potential acidity equals the acid neutralisation capacity of the sample. The ANC/MPA ratio was greater than two for all samples, indicating that all samples contain at least two times the acid neutralisation capacity compared to their acid generation capacity, and all samples are therefore considered to be non-acid forming (NAF). This is shown in Figure 4.3 and Figure 4.4.
- Net acid generation (NAG) testing includes reacting a soil or rock sample with peroxide to oxidise all sulfide minerals. At the end of the test, the pH of the solution is measured. If the oxidised pH is <4.5 the sample may generate acidity. The NAG pH for all samples was >pH 4.5 (pH range 4.6–10.6).
- Net acid production potential (NAPP) represents the difference between the amount of acid the sample may generate (maximum potential acidity (MPA)) and the acid neutralisation capacity (ANC) of the sample. A positive NAPP value indicates that the sample may generate acidity and a negative NAPP value indicates that the buffering capacity of the sample exceeds the acid generation potential. The calculated NAPP value were negative for all samples indicating that the samples are non-acid forming (NAF).

Acid base accounting (ABA) classification is based on the calculated NAPP, NAG_{pH} (net acid generation), ANC/APP and sulphur content. Samples are classified as acid consuming (AC), NAF-barren, NAF, uncertain (UNC) and potentially acid forming PAF. The samples were classified according to the criteria presented in Table 4.4.

Table 4.4 Acid base accounting classification criteria

Classification	NAPP (kg H_2SO_4/t)	NAG_{pH}	ANC/APP	%S
AC	<-20	pH >4.5	≥2	<0.1
NAF Barren	<0	pH >4.5	>1	<0.1
NAF	<0	pH >4.5	>1	<1.0
UNC	<0	pH >4.5	>1 and <2	>1.0
	>0	pH ≤4.5	<1	<0.1
	Samples that do not fit into other categories due to the discrepancies between factors			
PAF	>0	pH ≤4.5	<1	>1.0

Notes: Criteria developed with reference to the GARD Guide (INAP 2009) and the AMIRA International ARD Test Handbook (AMIRA 2002).
NAG_{ph} = net acid generation
APP = acid production potential
%S = total percent sulphur.

The results of the ABA testing are graphically presented in Figure 4.3 to Figure 4.6. The results indicate that all samples either do not generate significant acidity or contain sufficient acid buffering capacity to prevent acid generation. No samples are classified as PAF.

The distribution of the samples in relation to their NAPP and NAG_{pH} is presented in Figure 4.5. NAGpH was also graphed against sulphur (%) in Figure 4.6.

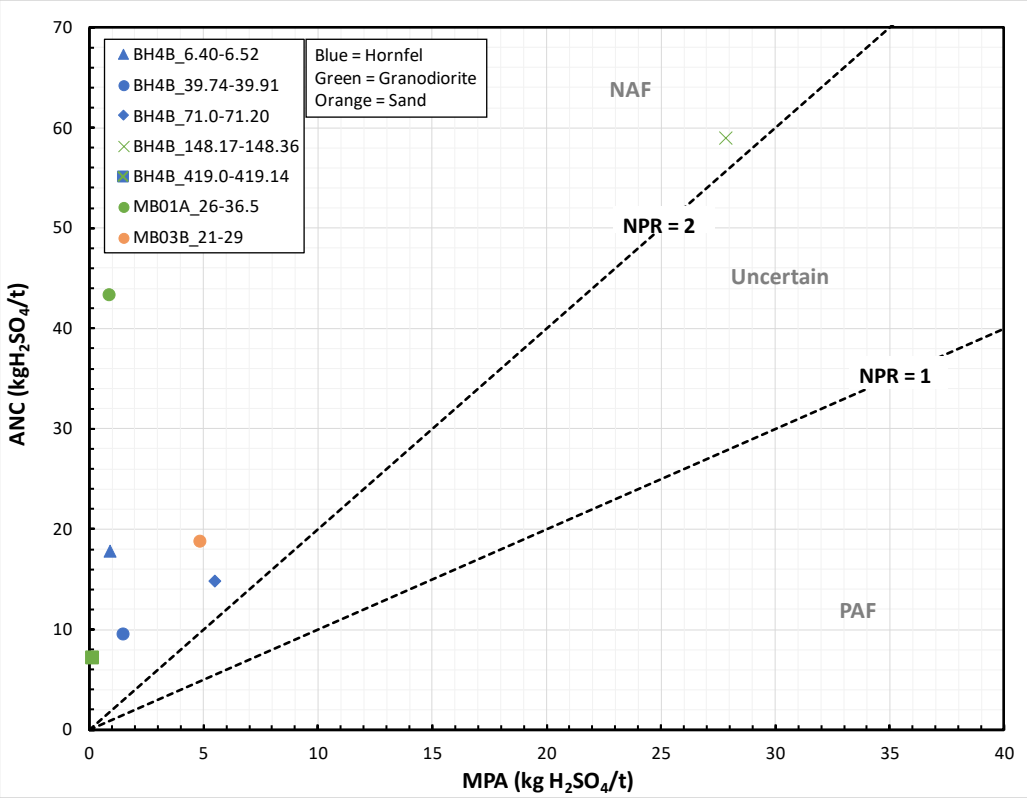


Figure 4.3 Laboratory analysis of ANC and MPA

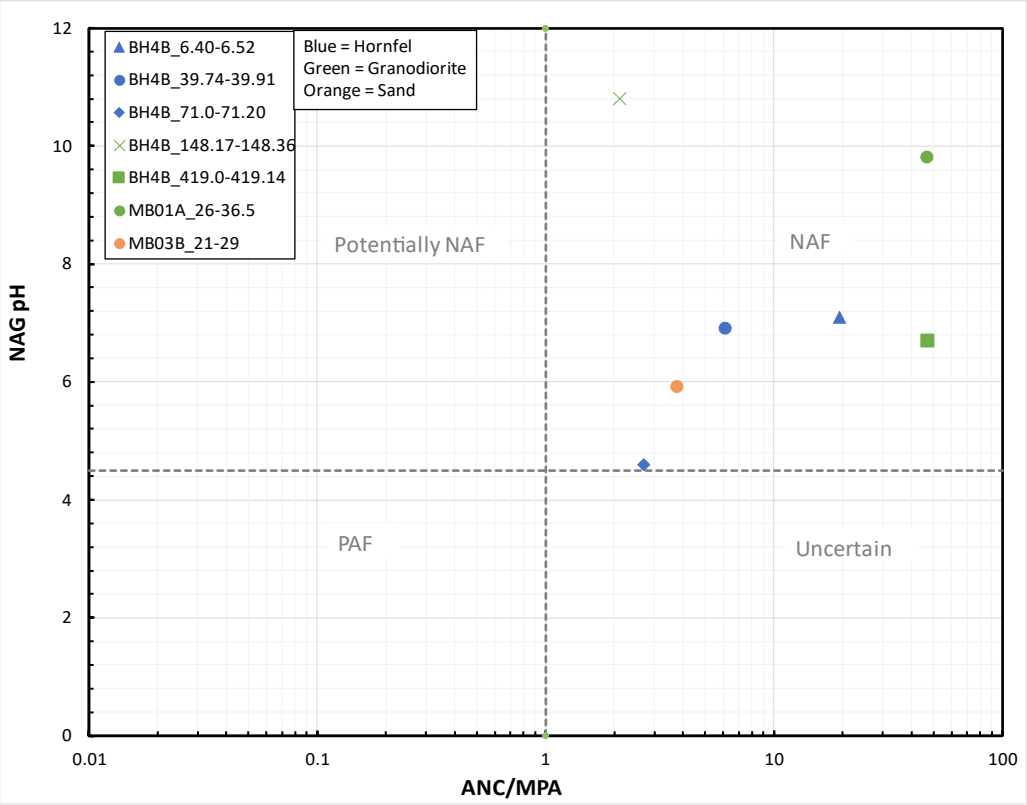


Figure 4.4 **Laboratory analysis of ANC/MPA vs NAG pH**

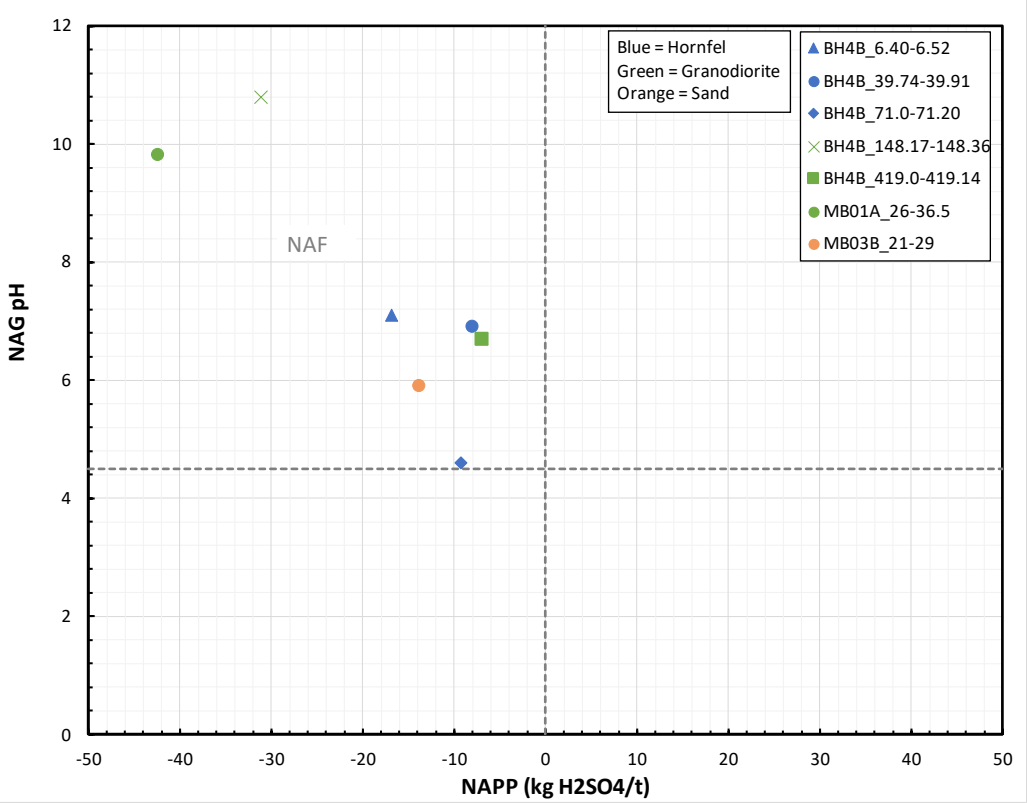


Figure 4.5 **Laboratory analysis of NAPP and NAG_{pH}**

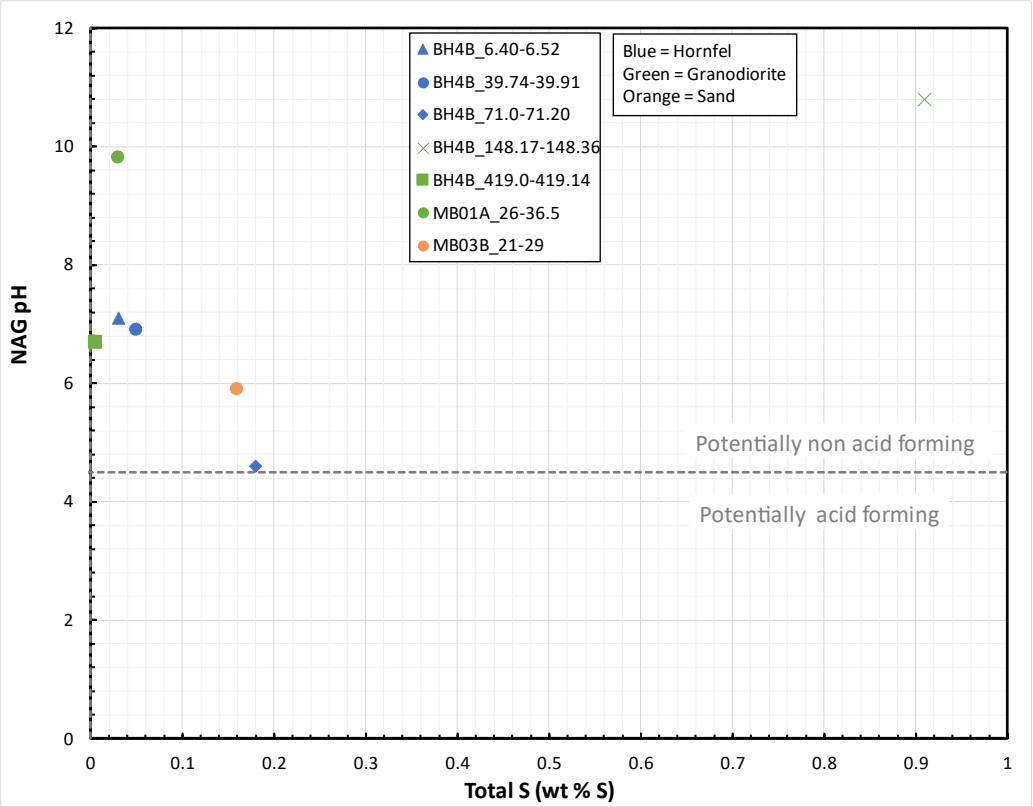


Figure 4.6 Laboratory analysis of NAG_{pH} and sulphur

Based on the results all samples analysed were assessed as either acid consuming (one sample) or NAF (six samples) with four of the samples containing less than 0.1% sulphur, indicating that those samples are barren of sulphur. These results indicate that there is a low risk that the spoil excavated will be acid generating.

Geochemical characterisation (EMM 2023b) also concluded that bedrock material does not leach metals or metalloids – satisfying the criteria for virgin excavated natural material (VENM) per the NSW Environment Protection Authority (EPA) waste classification guidelines – with emplaced rock spoil unlikely to generate metalliferous drainage.

The assessment of potential rock seepage impacts on receiving waters (EMM 2023c) identified that, while concentrations of some heavy metal species (e.g. aluminium and iron) within point-source rock seepage may exceed water quality objectives (WQOs) for receiving water beneficial uses, substantial dilution is anticipated to occur within watercourses immediately downstream of the emplacement areas with any residual sediment or metals entering the Macleay River further diluted by river flows.

4.6 Hydrology

Several minor, ephemeral tributaries to the Macleay River traverse the Project area in proximity to the construction envelope. Catchment characteristics across the Project area are generally uniform and are primarily comprised of steep bushland. Upland swamps are observed in the upper reaches of some watercourses while pockets of open grassland are observed at lower elevations.

Average annual runoff coefficients are lower in the upper catchment indicating less rainfall converts to streamflow on the tablelands compared to the gorges area and lower catchment (EMM 2023c).

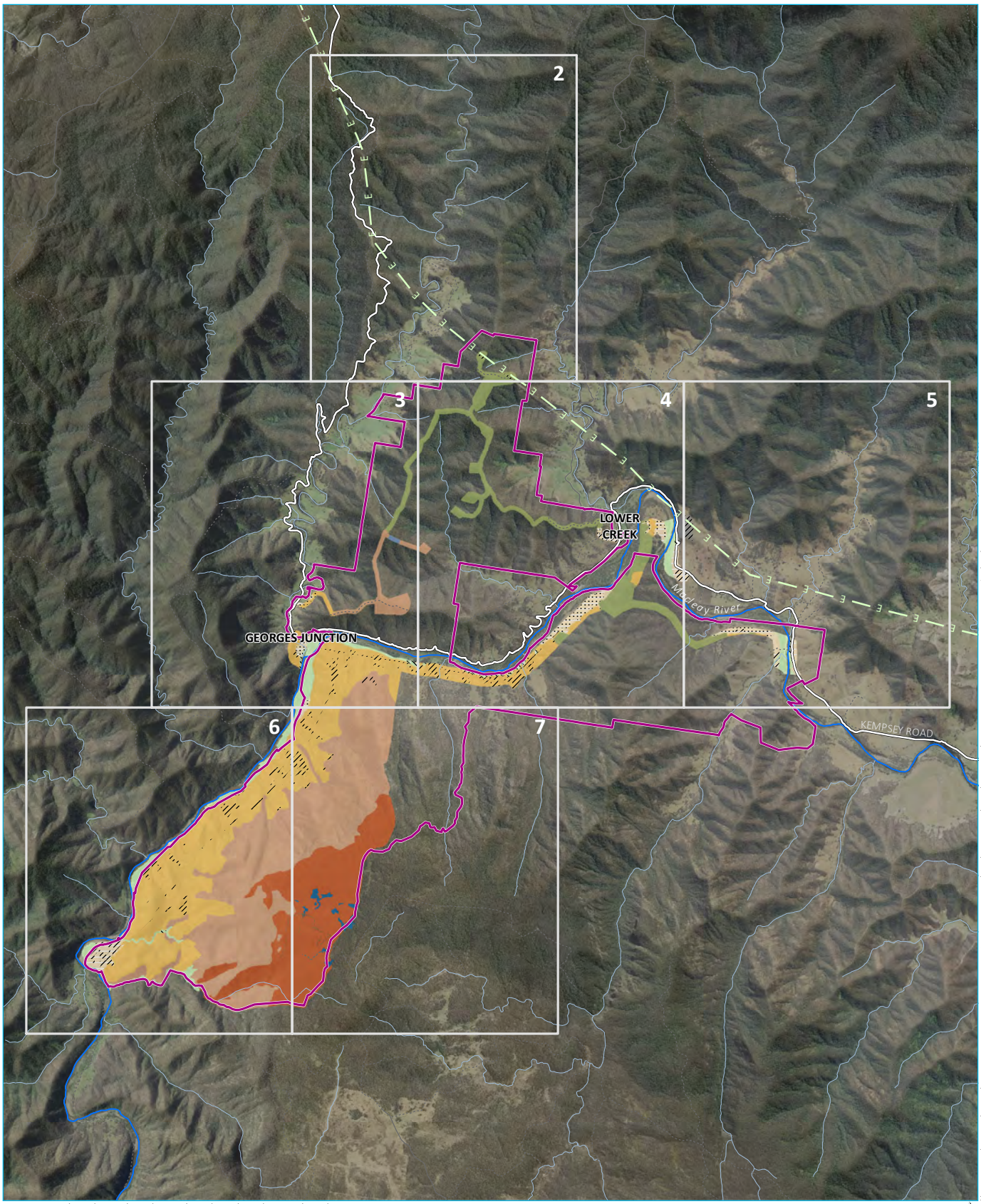
4.7 Native vegetation

Vegetation type is highly variable according to landscape elevation and position, though consists primarily of open grassy Eucalypt spp. forests with smaller wet sclerophyll areas influenced by hydrological surface water flows located on headwater tributaries. Disturbance due to previous anthropogenic land uses (e.g. rangeland grazing), bushfire events (e.g. 2019/2020 fires) and floodplain inundation in low-lying areas adjacent to the Macleay River is evident (EMM 2023d).

The higher forests are primarily dominated by New England Blackbutt (*Eucalyptus 30aculate30te*) and Tallowwood (*Eucalyptus microcorys*) in the south and Spotted Gum (*Corymbia 30aculate*) and Thick-leaved Mahogany (*Eucalyptus carnea*) in the north. In the mid-slopes, Small-fruited Grey Gum (*Eucalyptus propinqua*) and Broad-leaved Stringybark (*Eucalyptus caliginosa*) extend below the higher forests. In the lower slopes and foothills, the Broad-leaved Stringybark and Silver-top Stringybark (*Eucalyptus laevopinea*) continue to occur with the dominant canopy species Forest Red Gum (Eucalyptus tereticornis), which is associated with the lower slopes of the Macleay River (EMM 2023d).

In the floodplains and foothills, native and exotic grasslands also occur, and many are subject to grazing. On the banks of the Macleay River, the vegetation is primarily dominated by River Oak (*Casuarina cunninghamiana*) which are subject to inundation during periods of high rainfall and high river flows (EMM 2023d).

Plant community types in the Project are shown in Figure 4.7 (several maps).



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

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GDA 1994 MGA Zone 56

N

KEY

- Project area
- Existing environment
  - Macleay River
  - Watercourse/drainage line
  - Major road
  - Minor road
  - Vehicular track
  - Existing transmission line

Plant community type
- 762
- 842
- 868
- 983
- 1106
- 1215
- 1268
- 1287
- 1549

Threatened Ecological Communities (TEC)
- Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion
- Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion

Vegetation class
- Rainforest
- DNG
- Exotic grassland

Project area plant community types
Map 1 of 7

Oven Mountain Pumped Hydro Energy Storage Project
Rehabilitation strategy
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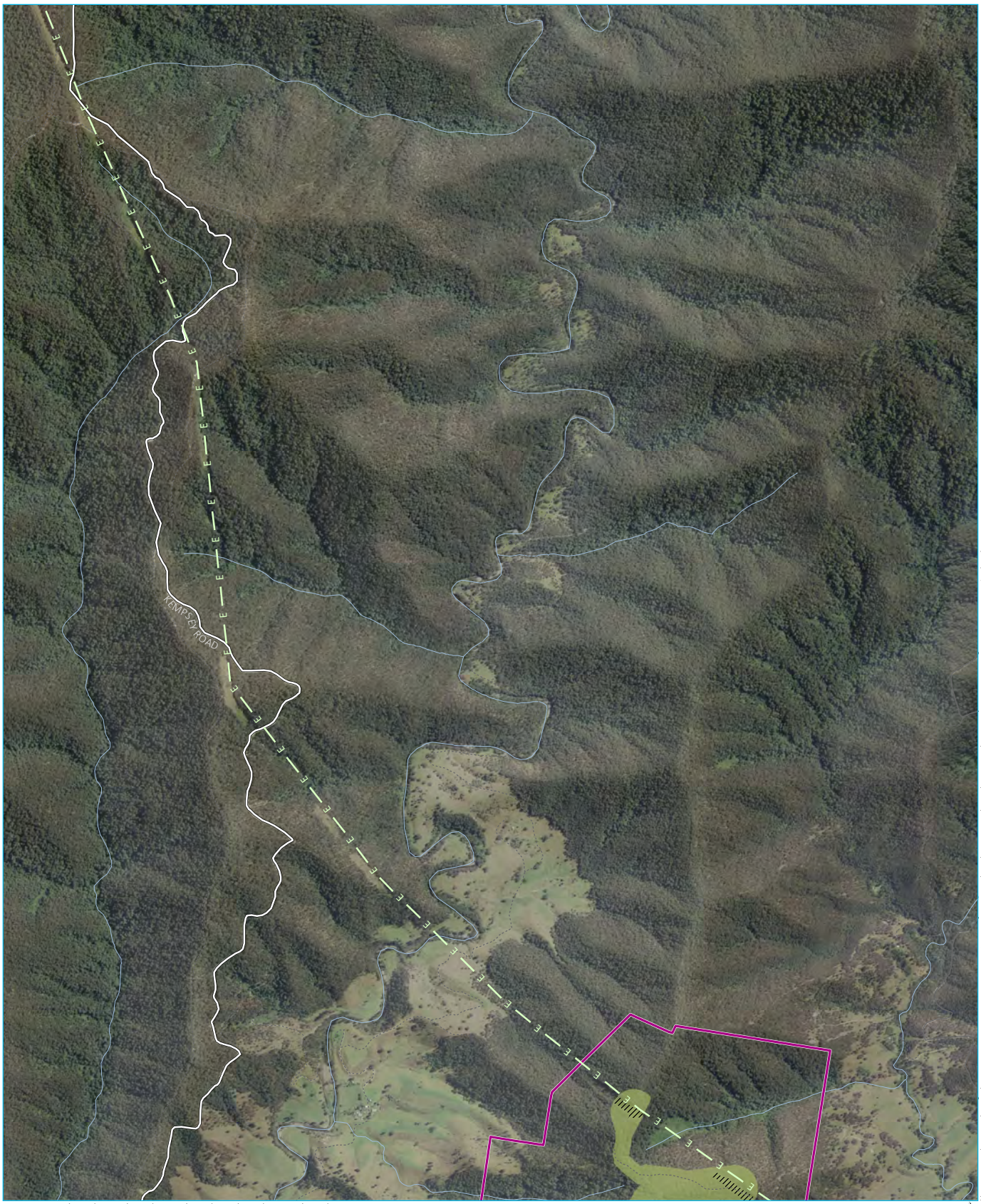
Figure 4.7

EMM creating opportunities



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

0 1 2 km

GDA 1994 MGA Zone 56

N

KEY

- Project area
- Watercourse/drainage line
- Major road
- Minor road
- Vehicular track
- Existing transmission line

Plant community type

- 1215

Vegetation class

- DNG

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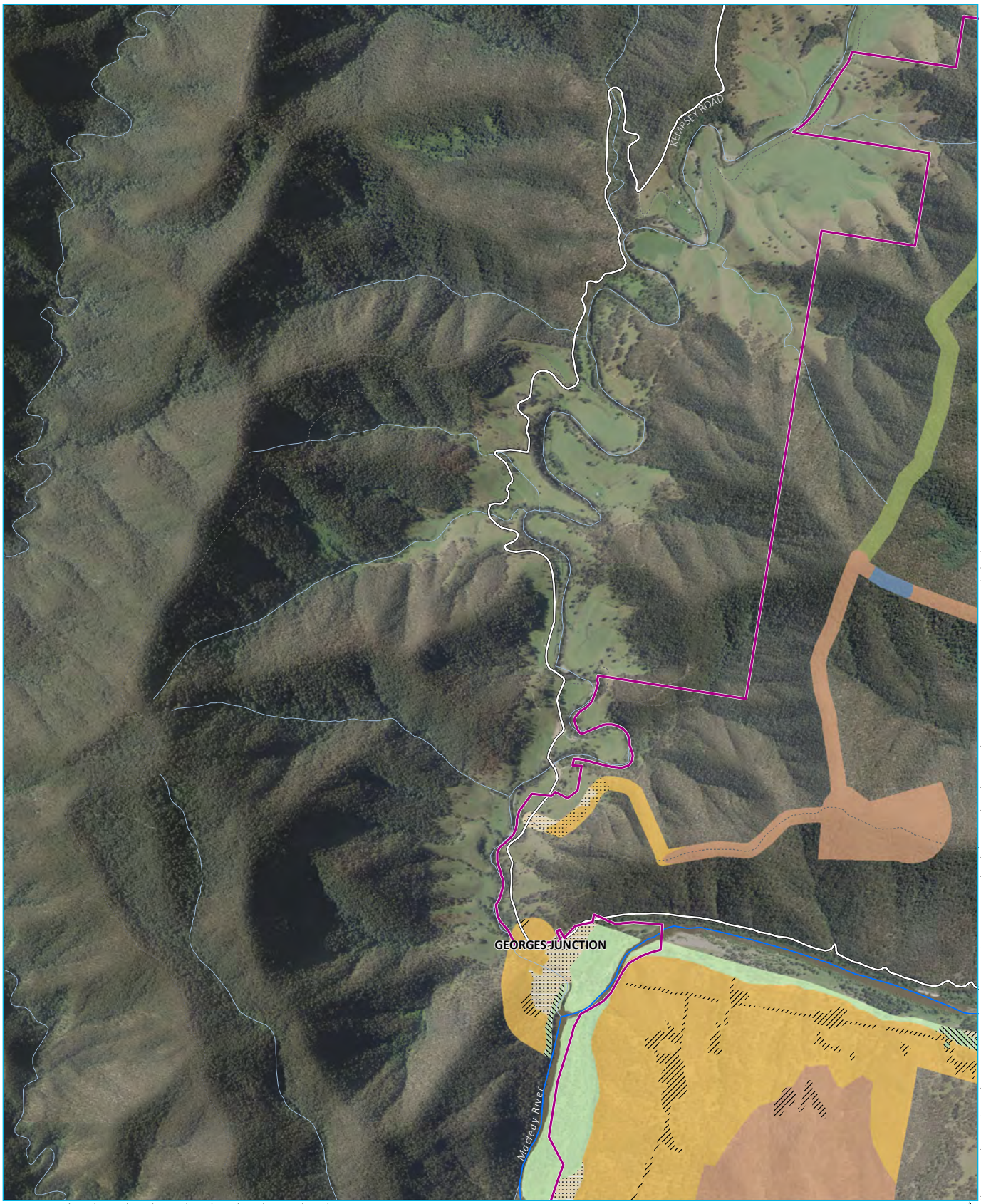
Project area plant community types
Map 2 of 7

Oven Mountain Pumped Hydro Energy Storage Project
Rehabilitation strategy
OMPS Pty Ltd
Figure 4.7

EMM
creating opportunities



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

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KEY

- Project area
- Existing environment
  - Macleay River
  - Watercourse/drainage line
  - Major road
  - Vehicular track

Plant community type
- 762
- 842
- 868
- 1106
- 1215
- 1268

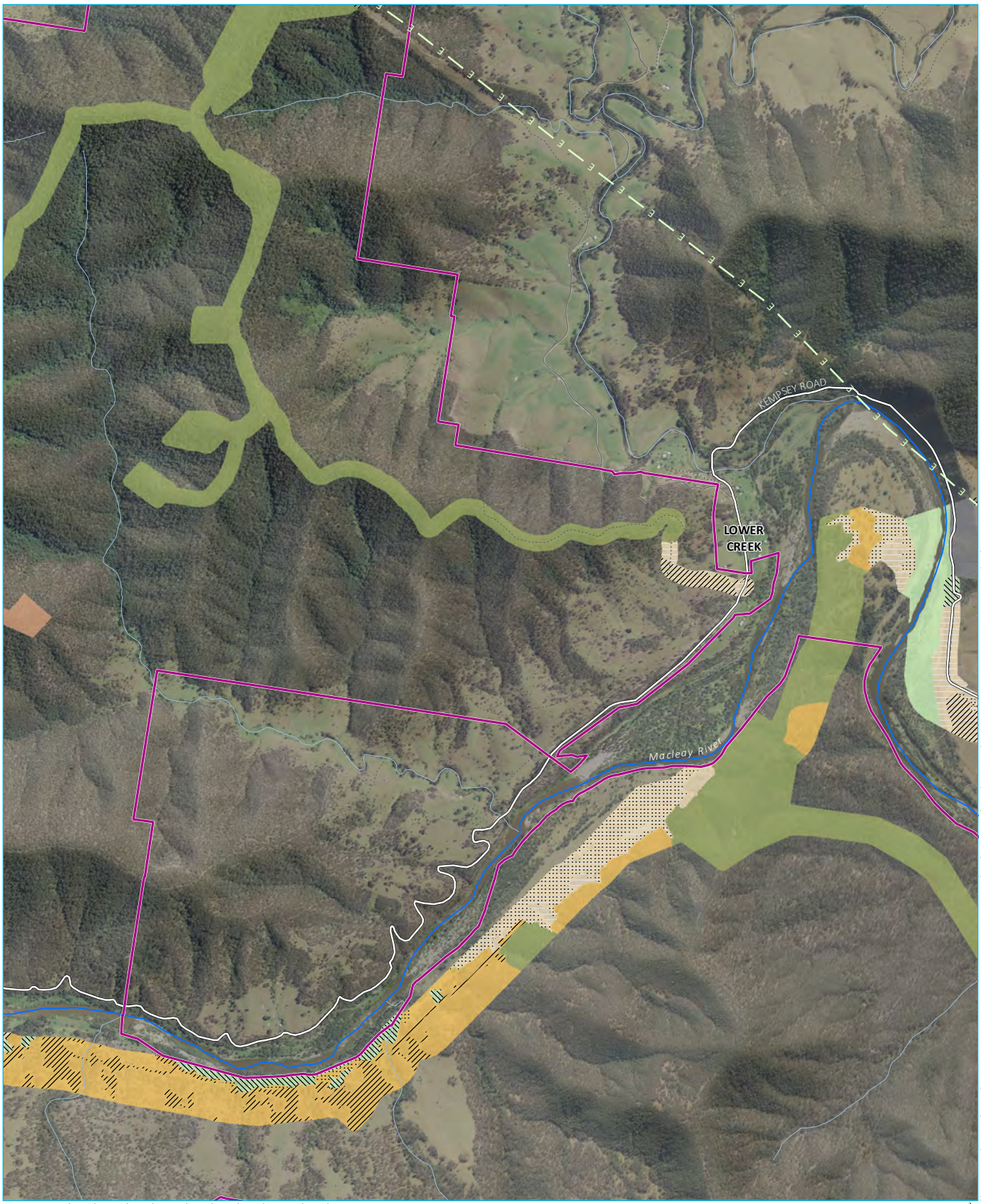
Threatened Ecological Communities (TEC)
- Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion
- Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion

Vegetation class
- Rainforest
- DNG
- Exotic grassland

Project area plant community types
Map 3 of 7

Oven Mountain Pumped Hydro Energy Storage Project
Rehabilitation strategy
OMPS Pty Ltd
Figure 4.7

EMM
creating opportunities



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

0 1 2 km

GDA 1994 MGA Zone 56

N

KEY

- Project area
- Existing environment
  - Macleay River
  - Watercourse/drainage line
  - Major road
  - Minor road
  - Vehicular track
  - Existing transmission line

Plant community type
- 762
- 842
- 868
- 1106
- 1215
- 1549

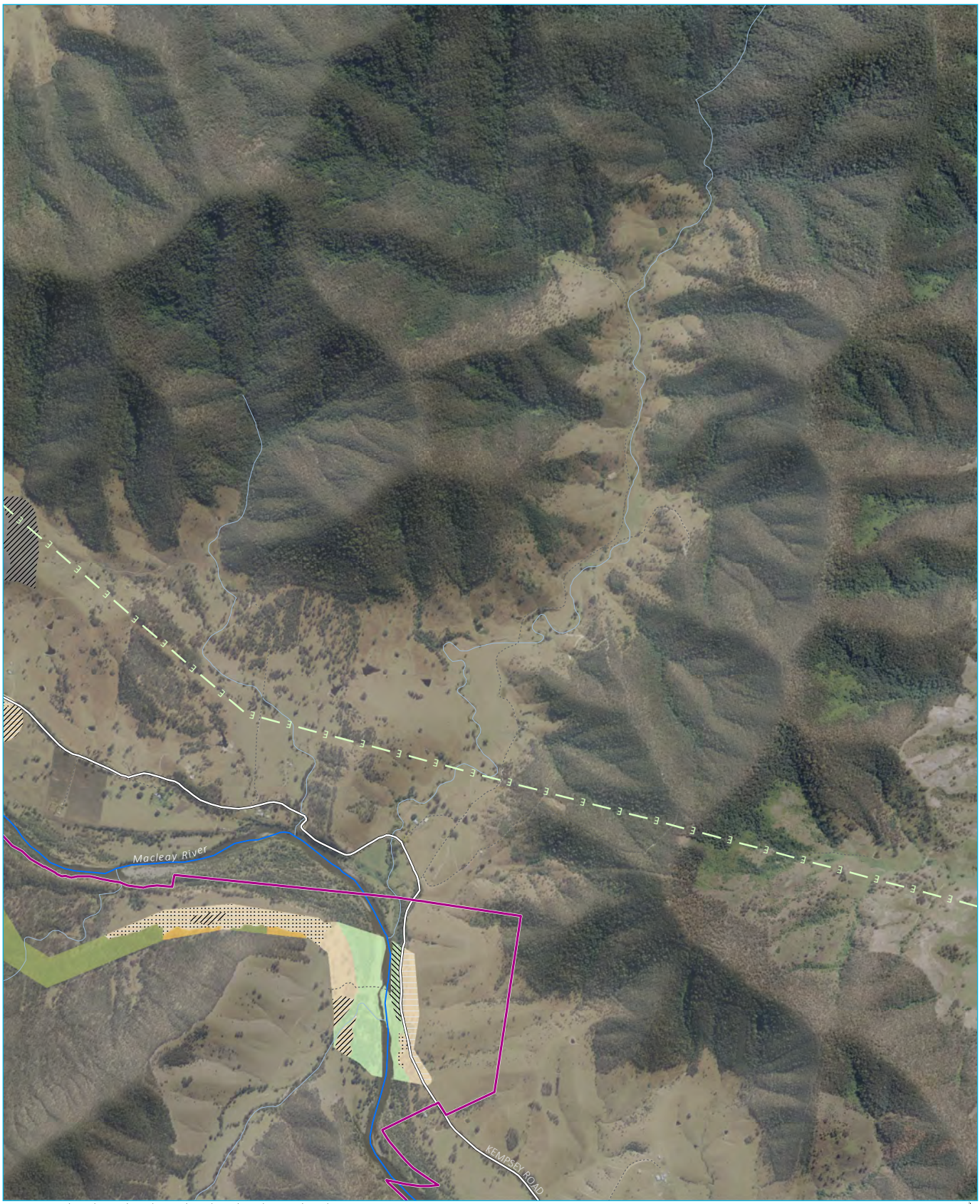
Threatened Ecological Communities (TEC)
- Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion
- Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion

Vegetation class
- Rainforest
- DNG
- Exotic grassland

Project area plant community types
Map 4 of 7

Oven Mountain Pumped Hydro Energy Storage Project
Rehabilitation strategy
OMPS Pty Ltd
Figure 4.7

EMM creating opportunities



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

0 1 2 km

GDA 1994 MGA Zone 56

N

KEY

- Project area
- Existing environment
- Macleay River
- Watercourse/drainage line
- Major road
- Vehicular track
- Existing transmission line

Plant community type
- 762
- 842
- 1106
- 1215
- 1549

Threatened Ecological Communities (TEC)
- Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion
- Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion

Vegetation class
- Rainforest
- DNG
- Exotic grassland

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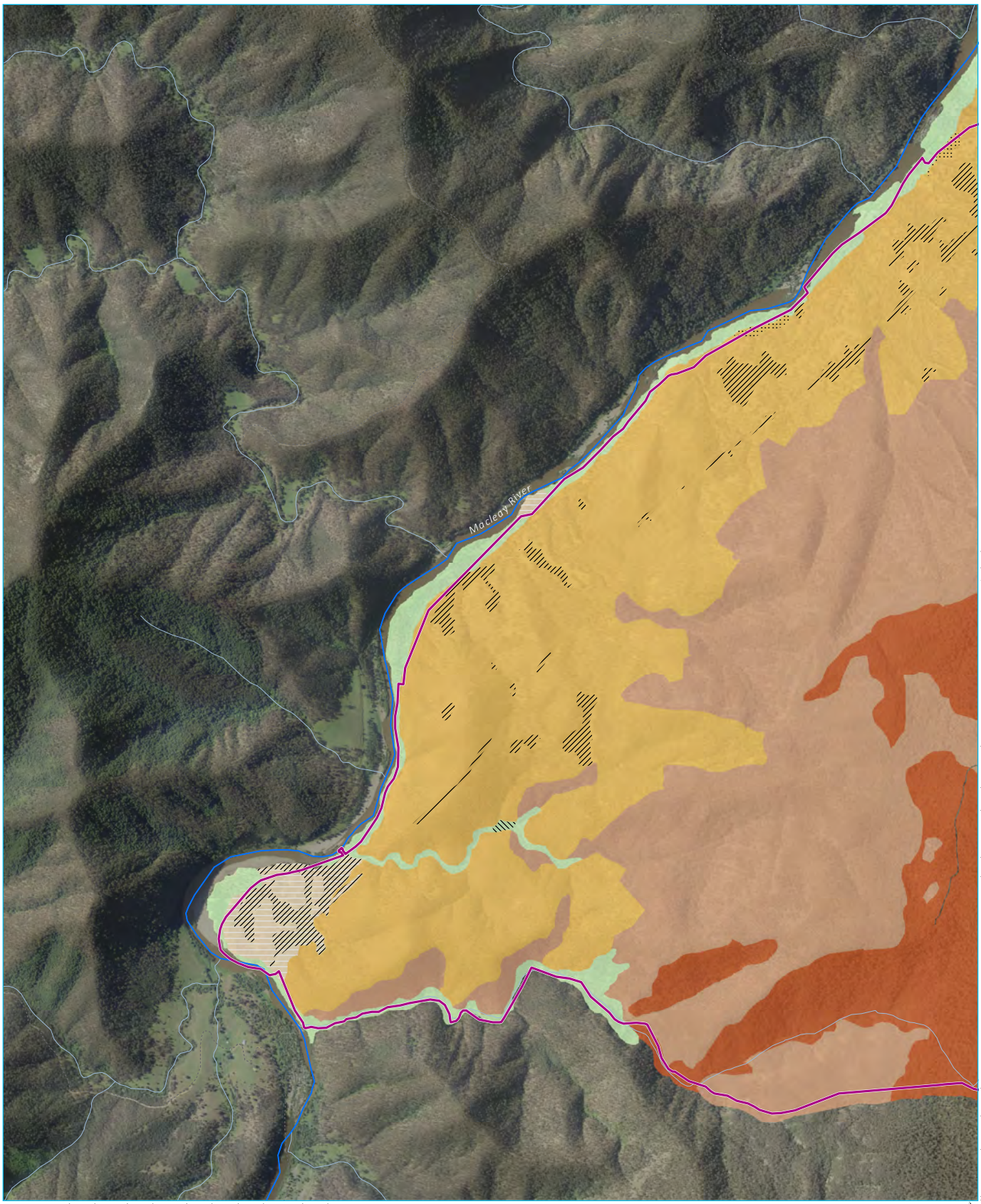
Project area plant community types
Map 5 of 7

Oven Mountain Pumped Hydro Energy Storage Project
Rehabilitation strategy
OMPS Pty Ltd
Figure 4.7

EMM creating opportunities



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

0 1 2 km

GDA 1994 MGA Zone 56

N

KEY

- Project area
- Existing environment
- Macleay River
- Watercourse/drainage line
- Vehicular track

Plant community type
- 762
- 842
- 868
- 983
- 1106

Threatened Ecological Communities (TEC)
- Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion

Vegetation class
- Rainforest
- DNG
- Exotic grassland

Project area plant community types
Map 6 of 7

Oven Mountain Pumped Hydro Energy Storage Project
Rehabilitation strategy
OMPS Pty Ltd
Figure 4.7

EMM creating opportunities

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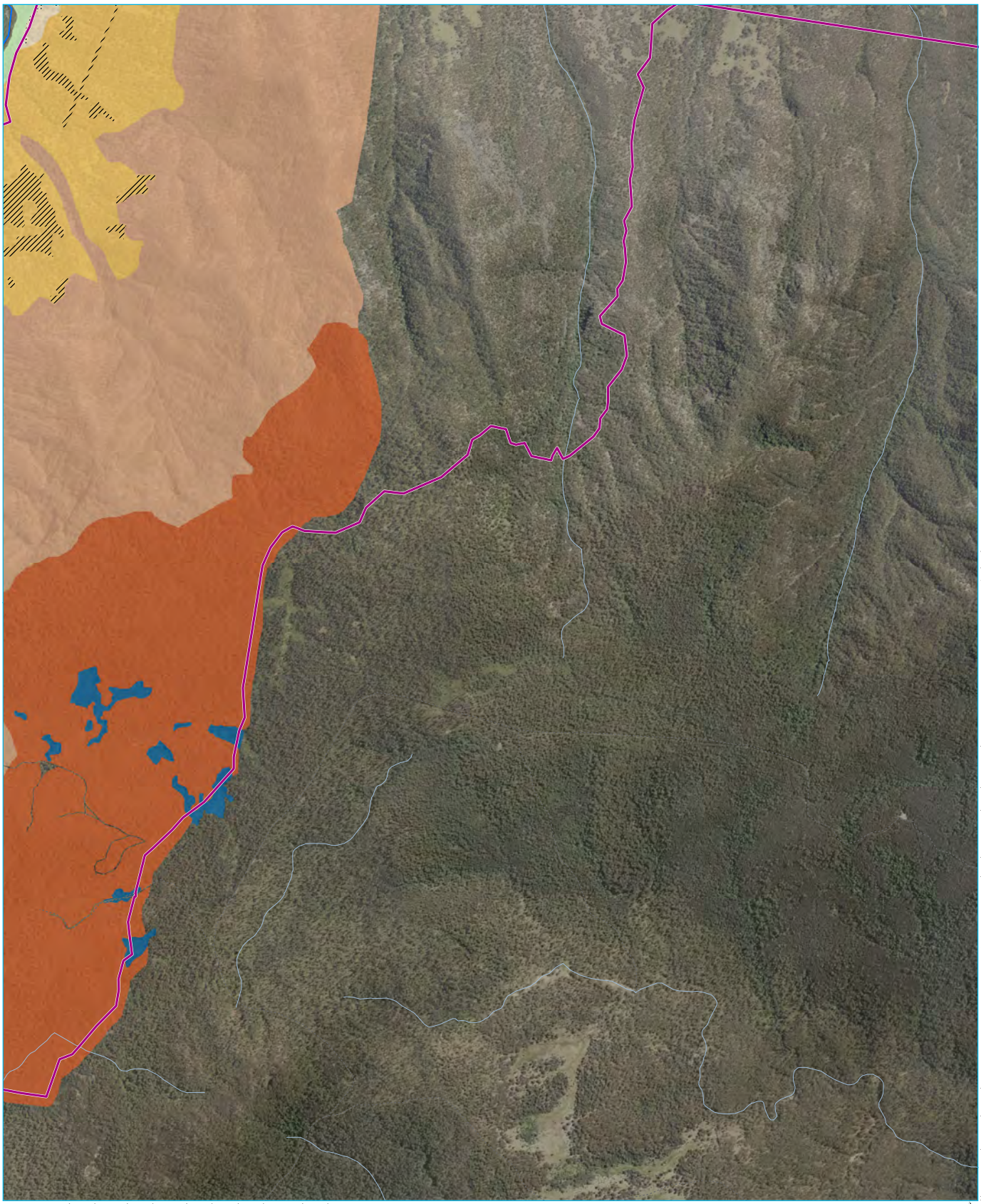

Source: EMM (2022); DFSI (2020); DPIE (2022); GA (2011); SMEC (2022)

0 1 2 km

GDA 1994 MGA Zone 56

N

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KEY

Project area

Existing environment

- Macleay River
- Watercourse/drainage line
- Vehicular track

Plant community type

- 762
- 842
- 868
- 983
- 1106
- 1287

Threatened Ecological Communities (TEC)

- Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion

Vegetation class

- DNG
- Exotic grassland

Project area plant community types
Map 7 of 7

Oven Mountain Pumped Hydro Energy Storage Project
Rehabilitation strategy
OMPS Pty Ltd
Figure 4.7

EMM
creating opportunities

4.8 Weeds

The majority of the Project area is relatively free of exotic weeds, with weeds primarily found in lower lying areas (e.g. floodplains and foothills) with incursions associated with grazing, use of existing access tracks and alluvial flows from the Macleay River introducing exotic species from upstream.

A total of 94 exotic species were recorded within the study area with 12 species identified as High Threat weeds, primarily herbaceous groundcover and grasses (EMM 2023d).

4.9 Heritage

4.9.1 Historical heritage

Project construction impacts on historical heritage will be limited primarily to impacts on the remnants of Long Flat Station, which is of local significance, associated with construction of the Project access road to the lower reservoir (EMM 2023e). Potential impacts to Long Flat Station were mitigated or avoided wherever possible during the design phase for the EIS.

As part of site rehabilitation, any historical heritage that is avoided and/or protected at the commencement of the Project will remain protected and incorporated into the rehabilitation design where practicable. Any heritage objects salvaged prior to Project construction may be reinstated based on consultation with relevant stakeholders.

4.9.2 Aboriginal cultural heritage

A number of identified Aboriginal heritage sites, objects and/or places are present within or near to the Project area (EMM 2023f). Several design changes have been made to avoid Aboriginal heritage sites. Broadly, the management of identified heritage during the Project construction phase will include:

- Active protection and avoidance of Aboriginal sites in close proximity to and within the disturbance footprint in accordance with the management measures and recommendations presented as part of this report.
- Passive avoidance of Aboriginal sites in the project area but not within the disturbance footprint (i.e. areas that will not be impacted by Project development).
- Relocation or salvage collection of Aboriginal sites within disturbance areas of the disturbance footprint.

As part of site rehabilitation, any Aboriginal cultural heritage that was avoided and/or protected will remain protected and incorporated into the rehabilitation design where practicable. Relocated or salvaged heritage may be reinstated subject to consultation with relevant stakeholders.

4.10 Existing land use

With reference to the NSW Landuse 2017 dataset (v1.2; DPE 2020), existing land uses in the Project area include the following Australian Land Use and Management (ALUM) classes:

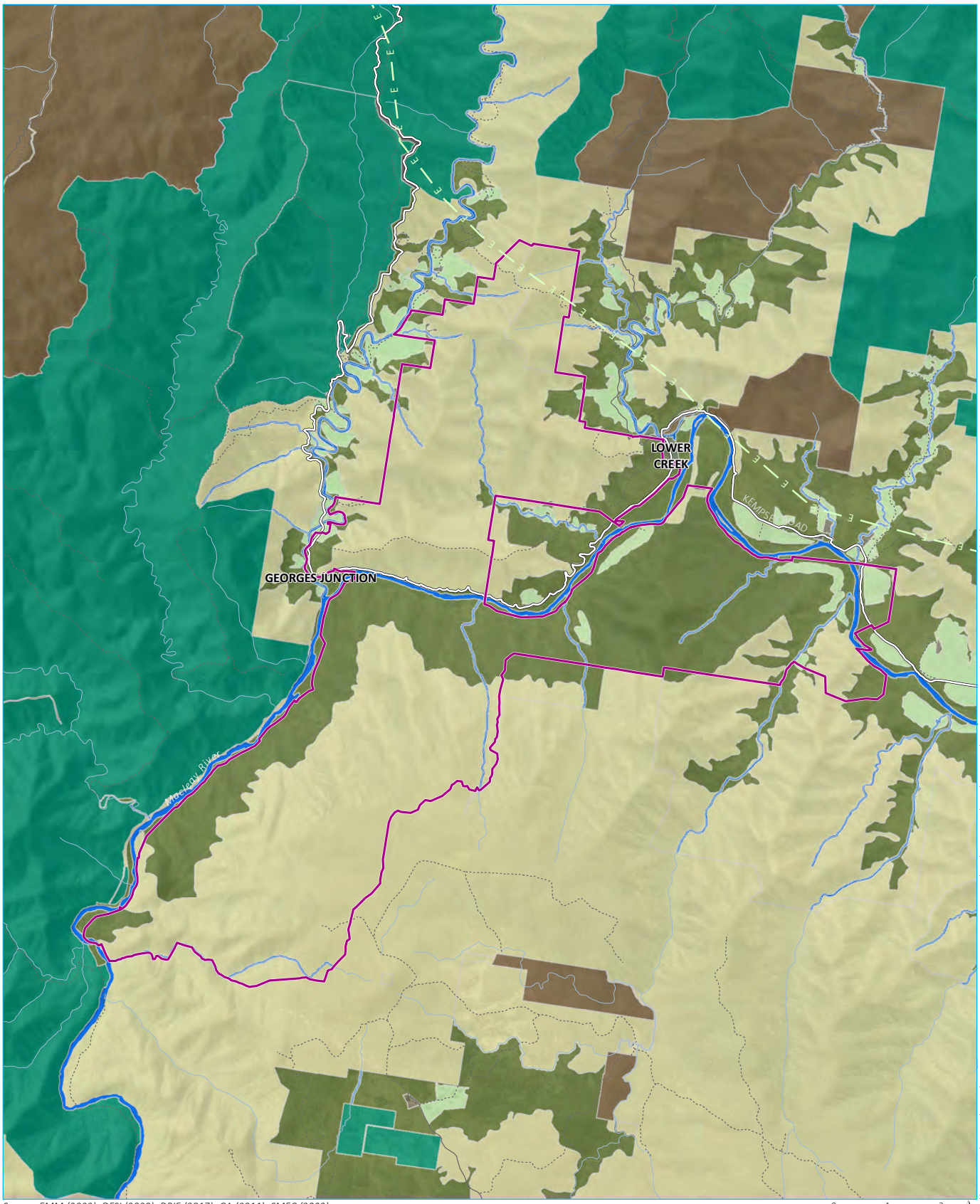
- ALUM 1.3.0: other minimal use
- ALUM 2.1.0: grazing – native vegetation
- ALUM 3.2.0: grazing modified pastures.

The majority of the Project area is mapped as other minimal use (ALUM 1.3.0) which generally coincides with steeper hillslopes, valleys and plateaus. These areas consist of native vegetation.

Areas mapped as native vegetation grazing (ALUM 2.1.0) generally coincide with lower lying areas (e.g. floodplains and foothills). Per the ALUM classification, these areas consist of native of native vegetation used for rangeland grazing.

A small portion of the Project area is mapped as modified pasture (ALUM 3.2.0) which occur as isolated pockets in lower lying areas and in proximity to the Macleay River and its tributaries.

Existing land use mapping (ALUM) for the Project area is shown in Figure 4.8.



Source: EMM (2022); DFSI (2020); DPIE (2017); GA (2011); SMEC (2022)

0 1 2 km

GDA 1994 MGA Zone 56

N

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KEY

Project area

NSW landuse (DPIE, 2017)

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

Existing environment

- Macleay River
- Watercourse/drainage line
- Major road
- Minor road
- Vehicular track
- Existing transmission line

Existing land uses (ALUM)

Oven Mountain Pumped Hydro Energy Storage Project
Rehabilitation strategy
OMPS Pty Ltd
Figure 4.8

EMM creating opportunities

5 Key rehabilitation risks and management

Key known and anticipated rehabilitation risks and controls are detailed below.

5.1 Landform stability

5.1.1 Geotechnical

Due to the steep nature of the terrain in sections of the Project area, current knowledge of geology and spoils and the nature of the proposed constructed landforms and structures, geotechnical instability is a key risk. Two phases of geotechnical investigations have been undertaken (SMEC 1997 and SMEC 2022).

SMEC (2022) has adopted geotechnical design parameters of 4(v):1(h), with a 3 m bench every 10 m vertically for rock excavation slopes and 1(v):1(h) slope, with a 3 m bench every 6 m vertically, for soil excavation slopes. With regard to the soil erosion hazard assessment undertaken for the Project (summarised in Section 5.2.1) it is recommended that erodibility material characterisation, erosion modelling and landform evolution modelling is undertaken to determine slope length and slope steepness rules during the detailed design phase to determine the optimal solution given the project terrain and soil types.

The 15% Project design incorporates 'Safety in Design' principles that incorporates risk management strategies systematically in the design process. It includes the following principal steps:

- identification of reasonably foreseeable hazards associated with design (including review of those identified in previous design stages)
- assess the risks arising from the hazards using a standard matrix process
- eliminate or minimise the risk by design controls
- reviewing the control measures and residual risks
- identifying the residual risks and high-level mitigation strategies for passing forward through the lifecycle.

Increasing geotechnical design detail will be provided during the detailed design stage, and subsequent stages, informed by further geotechnical investigations and testing.

Soil and spoil landform stability will require a combination of geotechnical and erosion modelling and design.

5.1.2 Erosion and sedimentation

Erosion can potentially impact constructed slopes and landforms planned and undergoing rehabilitation, resulting in re-work and generating sediment and turbid runoff. As described in the LSEA (EMM 2023a), the Project area soils have distinct constraints between the four SMUs, including unconsolidated sandy materials, sodic and dispersive clays and shallow stony clay loam soils. With slopes ranging from 0 to 6000% (0° to ~89° degrees), the erosion hazard assessment identified that slopes steeper than 12% have a high erosion hazard with soil loss classes ranging from very high to extremely high which results in all components of the Project having a high erosion hazard.

Landform and drainage design will therefore need to be appropriate for dispersive and non-cohesive soils, as well as steep slopes. Final landforms will need to be designed and constructed to achieve tolerable rates of soil loss (a tolerable rate of soil erosion). Wischmeier and Smith (1978) defined tolerable soil loss for cropland as "*the maximum rate of soil erosion that will permit a high level of crop productivity to be sustained economically and indefinitely.*"

A value of 11”2 Tonnes per hectare per year (t/ha/yr) averaged over an area of interest is often cited as a tolerable soil loss rate, but that value was derived by US soil conservation agencies for deep, fertile cultivated soils, and has little relevance to the Project area with its steep slopes, thin skeletal soils and inability to repair erosion on rehabilitated lands post implementation. Using similar criteria to those applied for cropland, a lower soil loss tolerance value of 4.5 t/ha/yr was developed by US agencies for erosion of rangeland soils and shallow cultivated soils (Wight and Siddoway 1979).

These lower tolerance values for soil loss are relevant in rangeland areas (after Wight and Siddoway 1979) and applicable to the Project area given that:

- native soils in the Project area are also generally skeletal and susceptible to fertility decline
- the topography inherently limits the ability to regularly scarify or repair any rills or points of erosion that form
- rills are more likely to extend and develop into gullies over time.

A key priority in setting a tolerable erosion target is the prevention of significant rill or gully development. For slopes where long-term erosion risk (for a range of reasons) is considered low, then a mean average annual erosion rate for the whole slope of 5 t/ha/yr and a mean maximum annual rate at any one point on the slope of 10 t/ha/yr has commonly been applied by specialist landform designers in Australia (Howard and Loch 2019). Typically, the low-risk category includes slopes where:

- the material underlying the topsoil layer is not dispersive and unlikely to be more erodible than the surface layer if exposed
- establishment of vigorous and sustainable vegetation is considered to be readily achievable
- rainfall in the area and soil fertility/productivity are such that there is a reasonable probability of vegetation stabilising any rills that form during rehabilitation establishment
- the overall landform height is not great (≤50 m, for example).

Where the slopes would be considered higher risk due to any of the above factors, then a mean maximum erosion rate of 5 t/ha/yr at any point on a batter slope is appropriate, on the basis that – at that value – rilling is largely, if not completely absent. A design mean-maximum annual erosion rate of <5 t/ha/yr at any point on the slope is recommended for the Project landforms and slopes due to the high erosion risk.

Where dispersive subsoils are present (SMU B), Landcom (2004) recommends for the following maximum slope lengths based on gradient (see Table 5.1).

Table 5.1 Maximum recommended slope lengths

Slope gradient (h:v)	Maximum recommended slope length
2(h):1(v)	10 m
2.5:1	13 m
3:1	16 m
4:1	22 m
5:1	29 m

Source: Appendix A – Morse and Maxwell, 1993. K-Factor = 0.071 (t.ha.h)/(ha.MJ.mm), R-Factor = 1,937.8 Mjmmha^{-1}h^{-1}

Further guidance of maximum slope length due to grade, soil erodibility and rainfall erosivity for Project soils is provided in the Land, Soils and Erosion Assessment (EMM 2023a).

As discussed in Section 5.1.1 above, based on the soil erosion hazard assessment undertaken by EMM (2023a) the slope design must be refined and optimised in the detailed design:

- where they are too steep to stabilise with vegetation
- noting benches should never be used on dispersive or non-cohesive soils due to their inherently high risk of slumping and erosional failure (tunnel and gully erosion).

Soil and spoil slope gradient and steepness design rules need to be determined from material characterisation of erodibility and agronomic parameters – based on physical flume and simulated rainfall tests – to determine critical shear and erosion initiation and erosion and landform evolution modelling.

Drainage design will need to maintain sheet flow conditions as much as possible to avoid concentration of flow and exceedance the critical shear of the soils (the maximum shear stress that a soil can sustain, beyond which soil erosion of the soil occurs). Natural landform features should be used to control water where possible instead of structural drainage controls. Where it is necessary to manage flows, drainage techniques that avoid the excavation of channels should be used.

Project roads and tracks will be unsealed. In some instances, access tracks will traverse steep gradients (such as the access track to the upper dam and reservoir) and therefore have high erosion potential. Unsealed roads pavements will either need to be cement- or lime stabilised to minimise corrugations and concentration of surface water flows. Unsealed roads and tracks should have a minimum of 4% crossfall to minimise the formation of corrugations.

Rock lining used to protect soils from erosion should be well graded but poorly sorted to minimise the potential for flow underneath the lining and exceedance of the critical shear of the underlying soil.

Due to the steep slopes, high rainfall erosivity and erodible nature of the soils it will be necessary to use erosion control techniques that provide greater than 70% soil surface cover and have a high critical shear resistance such as hydraulically applied growth mediums, timber debris and rock/soil matrices.

All runoff from the Project area eventually drains to the Macleay River which is comprised predominantly of alluvial rock and gravel, and sections of small rapids and rock pools. Sediments within runoff from the Project area (including rehabilitation areas) have the potential, if not mitigated, to in-fill these rapids and pools, choking the water channel(s), diverting flows and reducing available micro-habitat for aquatic fauna. Successful, progressive stabilisation and rehabilitation during and following construction is a key component of reducing erosion and minimising the amount of coarse and fine sediment potentially entering the Macleay River.

It will be necessary to use sediment basins in circumstances where the disturbance areas upstream of receiving waters exceeds 2,500 m^2, where annual average soil loss exceed 150 cubic metres per year (m^3/yr), or where erosion hazard assessment otherwise identifies that turbidity control is required.

The use of Type B high-efficiency sediment basins with flow activated dosing systems are recommended over Type D/F batch basins as they offer greater treatment efficiency, allow more accurate use of coagulants/and or flocculants than batch dosing, do not require personnel to work during wet conditions to treat or dewater the basins and lower water treatment costs.

5.2 Vegetation establishment

5.2.1 Spoil emplacements

There will be three (3) permanent waste rock spoil emplacements, two (2) in the lower reservoir area and one (1) in the upper reservoir area (Figure 2.1). Waste rock will consist of large rock generated from drill and blast activities (e.g. tunnelling and quarrying) during Project construction.

When emplaced, the rock spoil will form a bulk rock matrix that cannot be readily capped with soils or other growing media to form a rooting zone due to the presence of open, free-draining cavities between the rock. Soils and growth media would be readily lost down/into this matrix due to gravity and water movement, and any soil or growth media retained would be of inadequate depth and water holding capacity to support and sustain larger vegetation.

It is anticipated that rock spoil emplacements will have angle of repose slopes (approximately 27 degrees) due to the expected geotechnical and erosional stability of the rocky material. If suitable soil resources are salvaged during stripping operations, the top of the spoil emplacements will be compacted via track walking to minimise the void space between the rock and then covered with stripped subsoil and topsoil and vegetated with cover crops and appropriate native species.

If there are insufficient soil resources to cap the surface of the spoil emplacements, then the entire emplacement will be a rocky landform with limited or no capacity for vegetation establishment.

Subject to other land use needs and bushfire requirements, timber debris from vegetation clearing may be retained and then positioned over the spoil emplacement batters on the contour for erosion protection and habitat enhancement.

Where suitable topsoil resources have been retained and appropriate batter grades have been provided (2:1 or flatter) the batters will be hydro-seeded, ameliorants applied, and then a heavy-duty bonded fibre matrix hydro-mulch (BFM hydromulch) applied over the newly seeded areas to protect them from raindrop splash erosion and overland flow until the cover vegetation can establish.

Where suitable topsoil does not exist, or the batter slopes are too steep for topsoil placement, the spoil emplacements will be seeded and protected from erosion using hydraulically applied growth mediums (HGM).

5.2.2 Cut and fill batters

The construction of the Project will require the excavation of numerous cuts and associated fills. The shallow and erodible nature of the soils will make cut batters challenging to stabilise, requiring the use of BFM hydro-mulches and HGMs.

Because of the drainage design and anticipated drainage conditions associated with the unsealed roads within the Project area, fill batters will be stabilised with rock/soil matrices, and where necessary, rock-filled wire basket (gabion) retaining walls.

Progressive stabilisation of cut and fill batters will be undertaken to minimise the extent and duration of soil disturbance.

5.2.3 Other disturbed areas

Progressive stabilisation of disturbed areas such as temporary hardstands and access tracks will be undertaken progressively to minimise the extent and duration of disturbance. The required revegetation technique will be dependent on slope, availability of suitable growing media and prevailing climatic conditions.

5.3 Availability of rehabilitation resources

5.3.1 Soil availability and quality

Soil availability and quality across the Project area are highly variable due to a combination of terrain (topography) and soil physical and chemical constraints.

In some areas, steep terrain is likely to prohibit the safe access and operation of preferred surface mobile equipment (SME) (e.g. bulldozers) to undertake soil stripping and future soil reinstatement works. Soils in steeper areas are also generally variable in depth, which impedes accurate stripping and separation of the topsoil and subsoil horizons and result in the undesirable mixing of soil layers.

The physical and chemical properties of soils also influence their suitability for recovery and re-use in rehabilitation. With reference to the LSEA (EMM 2023a) and Table 5.2 the following are noted:

- SMU A, found across most the Project area (typically in lower lying areas), offers the greatest potential for recovery and re-use in rehabilitation given their generally greater depth and limited constraints within the topsoil and subsoil horizons. SMU A topsoils are comparatively poor growing media due to their sandy nature and subsequent low nutrient and water holding capacity, with organic matter, and the associated micro-flora and micro-fauna, likely largely responsible for their chemical and physical fertility. The SMU A subsoils have no apparent chemical constraints and could be utilised as supplementary topsoils if necessary if organic matter content could be improved.

- SMU B has more valuable topsoils, however recovery of these SMUs on steeper terrain is likely to be difficult. SMU B subsoils also have high chemical constraints (salinity, sodicity and aluminium). Attempts to strip and recover SMU B soil on steep terrain is likely to mix subsoils with the topsoils, resulting in reduced topsoil quality, increased sodicity and dispersive erosion potential. If machine access is possible, the topsoil and subsoil layers must be stripped and stored separately. Overall, however, the recovery and re-use of SMU B soils should be avoided where terrain impedes stripping/recovery, and alternative growth media substituted for rehabilitation.

- SMU C has more valuable topsoils, however these SMUs are commonly associated with steeper terrain and recovery is likely to be difficult. SMU C subsoils also have high chemical constraints (sodicity and aluminium toxicity potential). As with SMU B, topsoil and subsoils should be stripped and stored separately or avoided altogether and alternative growth media substituted for rehabilitation.

- SMU D offer potential for recovery and rehabilitation re-use having limited constraints and moderate to high fertility topsoils.

Table 5.2 Soil management layers – rehabilitation potential

SMU	Stripping depth (mBGL)[1]		Growth media overview (rehabilitation potential)	
	Topsoil	Subsoil	Topsoil	Subsoil
A	0–0.30	0.30–1.0	Low potential; low to moderate fertility, low nutrient holding capacity.	Low to moderate potential; no chemical constraints, low nutrient holding capacity.
B	0–0.10	0.10–1.0	Moderate to high potential; moderate to high fertility and nutrient holding capacity.	Low potential; high subsoil constraints, moderate to high nutrient holding capacity.
C	0–0.10	0.10–0.70	Low to moderate potential; moderate fertility but shallow and rocky with variable topsoil depth.	Low potential; high subsoil constraints, moderate to high nutrient holding capacity.

Table 5.2 Soil management layers – rehabilitation potential

SMU	Stripping depth (mBGL)[1]		Growth media overview (rehabilitation potential)	
	Topsoil	Subsoil	Topsoil	Subsoil
D	0–0.30	0.30–1.0	Moderate potential; moderate to high fertility and likely variable nutrient holding capacity.	Low to moderate potential; no chemical constraints, low (but variable) nutrient holding capacity.

Source: EMM (2023a)

1. mBGL = metres below ground level

The assessment of growth media potential is based on the chemical fertility and soil textures of the SPCs described in EMM (2023a) based on conventional growing potential. Given the predominantly undisturbed and well-established native vegetation of the Project area, rehabilitation and re-establishment of native vegetation should be possible in most of the SMU topsoils, as well as potentially the subsoils of SMU A and D, though the timeframes for suitable establishment of vegetation is uncertain.

Due to the natural variability between soil type boundaries and variability of topsoil depth within the soil types, stripping depths should be adjusted as necessary depending on actual topsoil depths encountered. The assessment of actual topsoil and subsoil resources available for recovery can only be determined through detailed soil assessments prior to ground clearing works and where soils/cover vegetation to be cleared is assessed as having low or no weed load.

Where a deficit of soil exists, alternative growth media – such as commercial HGMs and pneumatically applied growing media such as straw mulches and compost blankets – will be required to provide suitable growing medium as well as erosion protection while the vegetation establishes. Vegetation debris and other organic material (such as putrescible, green wastes) can also be successfully treated via processes such as the Groundswell Continuous Fermentation™ process or composting to create suitable growing media. Such techniques will be investigated if required.

5.3.2 Woody debris

Vegetation clearing generates vegetative debris (logs, large branches, mulch and seeds) that potentially serves as an important rehabilitation resource when spread on reinstated landforms. This includes but is not limited to the creation of micro-climates and micro-habitat, erosion protection and the addition of organic matter and native seed (the latter dependent on the age of the material and seed viability).

The ability to salvage and re-use vegetative material is largely dependent on the presence of exotic weeds within the vegetation to be cleared. Where existing vegetation is assessed as having significant weed incursion, or hosts High Threat weeds, vegetative debris will not be stockpiled as a rehabilitation resource and will be either deep buried or processed biologically for re-use as an organic soil.

Native vegetation in the upper reservoir area (and other areas of steep terrain) are likely to exhibit low weed incursion, with cleared vegetative debris likely suitable for stockpiling as a rehabilitation resource. Weeds are most likely to occur in lower-lying areas (e.g. foothills and floodplains) and pre-clearing assessment of weed load will therefore be more important in these areas.

The ability to preserve cleared vegetative debris associated with construction of the eastern access road and transmission line corridor is expected to follow a similar pattern (i.e. lower weed risk in elevated terrain, higher weed risk in lower terrain).

In all cases a pre-clearing weed assessment will be undertaken to identify how cleared vegetation will be managed (disposed or retained as a rehabilitation resource).

5.4 Pest species

5.4.1 Weeds

Weeds have the potential to exclude and out-compete native vegetation and desirable pasture species.

As noted in Section 4.8, the presence of exotic weed species is most likely in lower lying areas (e.g. foothills and floodplain areas) and less likely in upper/elevated areas.

Weed survey and control will be undertaken through the construction, operations and rehabilitation phases of the Project. This includes, but is not limited to:

- weed control in construction areas prior to clearing of vegetation and stripping of soils
- weed control in/around infrastructure areas and peripheral areas throughout the construction and operations phases to minimise the potential for weed ingress to future rehabilitation areas
- weed control in/around stockpiled rehabilitation materials (e.g. soils, vegetative debris, other)
- weed control prior to and during landform reinstatement and revegetation works
- routine weed survey and control post-rehabilitation.

5.4.2 Pest fauna

Pest species can damage establishing vegetation through grazing pressure and damage to soils/growth media (digging and burrowing), compete with native fauna for resources (food, water and habitat) and prey on native fauna and livestock.

Pest species threats to rehabilitation will be managed through:

- routine inspection for pest fauna activity (e.g. sightings, prints and scat)
- mandatory pest control for declared pests (i.e. rabbits, feral pigs, wild dogs and foxes) in accordance with Pest Control Orders under the *Local Land Services Act 2013*
- inspections to assess the effectiveness of control measures.

5.5 Fauna

Fauna use of rehabilitated native ecosystem lands can be delayed due to lack of suitable habitat features.

Subject to weed risk (Section 5.3.2), woody debris from vegetation clearance will be salvaged and spread on the contour on rehabilitation areas to provide habitat and protection. The provision of nest boxes for birds and other species may be provided in adjacent uncleared areas to offset any loss of nesting hollows.

5.6 Public safety

Retained infrastructure may result in harm to members of the public, livestock and native fauna.

Controls will be implemented to minimise the potential for impacts on public and fauna safety, such as fencing and warning signs (for example, at access points to reservoir embankments and open water).

5.7 Bushfire

Uncontrolled bushfires can impact rehabilitating systems (both establishing and mature revegetation) and destroy, or substantially delay, rehabilitation trajectory.

Fire management controls to be implemented include:

- fire awareness and training
- fuel reduction burning planning
- fire breaks and fire-fighting access trails
- fire detection and emergency response
- communication and reporting protocols.

The implementation of fire management controls would be coordinated with the NSW Rural Fire Service and other authorities, as relevant.

6 Rehabilitation objectives and criteria

The overarching rehabilitation objective is to achieve final landforms that are:

- safe, stable and non-polluting
- sympathetic with the surrounding landscape
- appropriate to the nominated final land uses.

Conceptual rehabilitation objectives and completion criteria for specific environmental aspects, and phases of rehabilitation, are provided in Table 6.1. The objectives describe what is to be achieved, and the completion criteria are the principles or standards (either qualitative or quantitative) that will be used to demonstrate that objectives have been met.

The objectives and criteria provided in Table 6.1 are based on:

- the current available knowledge of site and Project design
- an assessment of rehabilitation risks (documented in Chapter 5 and Attachment A)
- author experience and knowledge of rehabilitation best-practice, including reference to similar projects and operating environments.

Formal rehabilitation objectives and completion criteria for the Project, including associated rehabilitation performance indicators and measurement methods, will be addressed within the post-approval rehabilitation management plan for the Project.

Consistent with rehabilitation planning principles it is expected that rehabilitation objectives, criteria, performance indicators and measurement methods will be refined over time as the state of knowledge of the environment and site-specific rehabilitation techniques evolves.

Table 6.1 Concept rehabilitation objectives and completion criteria

Aspect	Objective(s)	Domain(s)	Risks to achieving objective	Completion criteria
Final landforms				
Final landform design	The reconstructed landform is capable of supporting the nominated end land use.	All domains	The design of the final landform prevents or constrains the intended end land use(s).	The construction of the proposed final landform is in general accordance with the design.
		Domain 1A Domain 2 Domain 3	Final landform design does not integrate (is incompatible) with surrounding topography.	Final landform integrates and is generally compatible with the surrounding landscape. ***Note – this is <u>not</u> applicable to spoil emplacements (Domain 1B), upper and lower reservoirs (Domain 2) and access roads and tracks (Domain 3) which will exist as novel final landforms and represent a change in land use.***
Final landform stability	Final landforms are safe, stable and non-polluting.	All domains	Unacceptable rates of erosion (landform surface creates ongoing erosion/drainage issues).	Rates of erosion (rills, gullies and tunnel erosion) are within acceptable erosion limits for the given landform and/or consistent with local reference sites.
			Geotechnically instability of final landform.	Final landforms assessed as geotechnically stable.
			Final landforms present a risk of harm to members of the public, livestock and native fauna.	Risks to public safety, livestock and native fauna are assessed and appropriate controls applied.
Decommissioning				
Infrastructure	Retained buildings, infrastructure and other assets: • are compatible with the nominated end land use • do not pose an unacceptable risk to public safety.	All domains	Project infrastructure not relevant or desirable for the end land use remains on site.	All redundant above- ground buildings, infrastructure and other plant and equipment is removed from site.
			Project infrastructure relevant and desirable for the end land use are unsafe.	Retained buildings, roads, infrastructure and other assets have been issued any necessary safety compliance certificates or permits.
			No agreement with third parties for the retention of infrastructure and/or acceptance of any associated liability (if applicable).	Agreements are in place with relevant third parties for the retention of infrastructure, including any associated liabilities (if applicable).
			Nil	Redundant groundwater bores are decommissioned in accordance with relevant statutory or best-practice guidelines.
			Adits and shafts are not sealed or the seals are ineffective.	Adits and shafts are sealed.
Land contamination	There is no residual soil contamination on site that prevents the nominated end land use or poses a risk of environmental harm.	All domains	Residual site contamination is not identified, assessed and addressed.	Contamination is appropriately remediated, in accordance with relevant guidelines, to a condition that consistent with the nominated end land use.
Hazardous materials	All hazardous materials are removed from site.	All domains	Hazardous materials are not identified and removed from site.	All hazardous materials are identified and removed from site.
Ecosystem/final land use establishment				
Revegetation – native vegetation	Native vegetation communities are established that are self-sustaining, resemble target PCTs and can be maintained through standard management practices.	Domain 1A	Inadequate revegetation (including extent or complexity).	Reinstated soil profile and function are comparable with pre-disturbance condition or local reference sites.
				Available woody debris is reinstated for soil protection and provision of micro-habitat.
				Floristic diversity and ecosystem function are comparable with, or are on trajectory toward, local reference sites.
Weeds	Weed diversity and abundance within rehabilitation areas is comparable with local reference sites.	All domains	Weed control programs not implemented – weed competition with re-establishing vegetation.	Weed control programs are implemented, with emphasis on the management of High Threat weeds.
Pest animals	Abundance of priority pest animals within rehabilitation areas and immediate surrounding areas is comparable with local reference sites.	All domains	Pest animal control programs not implemented – grazing and other disturbance pressure on rehabilitation.	Pest animal control programs implemented for priority species.
				Abundance of priority pest animals within rehabilitation areas and immediate surrounding areas is comparable with local reference sites.
Bushfire	The risk of bushfire and impacts to the community, environment and retained infrastructure has been addressed as part of rehabilitation	All domains	Bushfire risks not assessed, and controls not implemented.	Bushfire controls implemented are appropriate to the end land use(s).

Table 6.1 Concept rehabilitation objectives and completion criteria

Aspect	Objective(s)	Domain(s)	Risks to achieving objective	Completion criteria
Water quality	Water quality in retained reservoirs is suitable for the nominated end land uses and associated beneficial uses.	Domain 2	Quality of water in retained water storages is inconsistent with the end land uses and associated beneficial uses.	The quality of water in retained reservoirs is within statutory and/or other guideline limits relevant to the beneficial use(s) of that water.
	The quality of passive surface water runoff from rehabilitation areas does not pose an unacceptable risk to receiving waters and associated beneficial uses.	All domains	Quality of passive surface water runoff from partially or fully rehabilitated ground exceeds background conditions.	The quality of passive surface water runoff from rehabilitation areas is consistent with local reference sites with the same or similar land uses.
	The quality of drainage runoff from emplaced waste rock does not pose an unacceptable risk to receiving waters and associated beneficial uses.	Domain 1B Domain 2	Quality of rock drainage water exceeds background conditions.	The quality of rock drainage water is within the statutory and/or other guideline limits relevant to receiving waters and associated beneficial uses.
Water licensing	Retained water holding structures that take water are appropriately licensed.	Domain 2	Retained water reservoirs are not licensed for the passive take of water (entitlements not in place to support nominated beneficial uses – e.g. environmental, recreational, livestock and other general use).	Water entitlements are held for retained reservoirs and permit the passive take of water (passive surface water and groundwater inflows).

1. Dry sheep equivalent per hectare (DSE/ha)

7 Final land uses, landforms and rehabilitation domains

7.1 Final land use options assessment

No detailed assessment of alternative final land uses options has been undertaken on the basis that final uses will be generally consistent with pre-disturbance land uses, except for the following features which will be retained:

- EAR, main access road and access tracks to the lower and upper reservoirs (subject to agreement with relevant landowners/land managers)
- waste rock spoil emplacements
- upper and lower dams and reservoirs.

The retention of the upper and lower dams and reservoirs and spoil emplacements in perpetuity is proposed on the basis that their removal would:

- involve significant cost
- result in re-disturbance of rehabilitated terrain and the requirement for new rehabilitation effort
- result in environmental impacts similar to those associated with Project construction.

The retention of the upper and lower dams and reservoirs in perpetuity assumes that existing surface water and groundwater entitlements secured for the Project (to permit water take for operation of the hydro-electric system) would be retained, and the purpose of these entitlements are amended in the future to reflect the incidental/passive take of water for future environmental, recreational, livestock water and other general use.

It is also possible that refurbishment or repowering of the Project infrastructure may be undertaken such that it is used for power generation beyond the current 100-year design lifespan.

7.2 Consultation

Community views, issues and expectations related to the Project were documented as part of the social impact assessment (SIA) (EMM 2023g). No matters were identified that specifically related to rehabilitation of Project-related disturbance however several matters were raised that overlap with rehabilitation risks, proposed final land uses and rehabilitation methodology outlined in this strategy (Table 7.1).

Table 7.1 Community views relevant to rehabilitation

Relevant community views[1]	Relevance considerations
Potential for the EAR to serve as a public road.	Rehabilitation strategy proposes permanent retention of the EAR, and roads to lower and upper reservoirs, as beneficial assets (subject to agreement with relevant landowners/land managers).
Concerns about impacts to natural features (e.g. flora and fauna, soil, and geological landscape) associated with the building and flooding of reservoirs.	Rehabilitation strategy proposes final land uses that are generally consistent with existing land use types and extent, i.e: • native vegetation • modified pasture.
Concerns about project impacts to native vegetation.	
Concerns about project impacts to native fauna.	

Table 7.1 Community views relevant to rehabilitation

Relevant community views[1]	Relevance considerations
Concerns about the impact of project activity on livestock.	Native vegetation rehabilitation includes native vegetation used for livestock grazing (rangeland grazing). Native vegetation rehabilitation methodology considers provision of habitat features for fauna.
Questions regarding tunnelling work, including scope and spoil use and management.	Rehabilitation strategy proposes permanent retention of waste rock spoil emplacements. This includes consideration of associated risks, including: • landform stability • rehabilitation methodology.

1. Source: EMM (2023g)

7.3 Final landforms

Available final landform designs are limited to general arrangement plans and cross-sections for the lower and upper dams and reservoirs as provided in the 15% design report (SMEC 2022) which have not been reproduced herein.

Detailed landform designs and cross-sections for the waste rock spoil emplacements did not form part of the 15% Project design. As per Section 5.2.1, the general design for spoil emplacements is likely to comprise dumping to natural angle of repose (~27 degrees), with track-rolling of the surfacer to form a 'tabletop' design to enable reinstatement of recovered soils or application of alternate growing media. Waste rock generated in some areas of the Project (e.g. from tunnelling) has the potential to be re-used in other areas (e.g. reservoir walls).

7.4 Final land use domains

A domain-based rehabilitation approach has been adopted where the Project area has been divided into a series of physically discrete rehabilitation domains that have similar rehabilitation requirements, consistent with the RMP Guidelines for mining projects (NSW Resources Regulator 2021).

Conceptual final land use domains are shown in Figure 7.1.

Although the Project is not a mining project it will involve several comparable activities (e.g. land clearing, excavation, generation of waste rock spoil and spoil emplacement, construction of large water storages etc.) and the RMP Guidelines provide a logical framework for differentiating between the different rehabilitation requirements of each of the various Project components.

7.4.1 Domain 1 – Native ecosystems

i Sub-Domain 1A – Native vegetation

Approximately 183 ha of the Project area will be rehabilitated to native vegetation consistent with the pre-disturbance PCTs mapped for the area.

Areas to be rehabilitated to native ecosystems broadly encompasses pre-disturbance areas mapped with the following ALUM land use classes:

- ALUM 1.3.0: other minimal use
- ALUM 2.1.0: grazing – native vegetation.

PCTs targeted for rehabilitation based on pre-disturbance ecological mapping (EMM 2023c) – corresponding to key Project features – are listed in Table 7.2 and shown in Figure 4.7

Table 7.2 Native vegetation rehabilitation – target PCTs

Project feature/area	Target PCTs
Upper reservoir area (Including spoil emplacement, excluding dam and reservoir)	• PCT 868 – Grey gum – stringybark open forest of the gorges of the NSW North Coast Bioregion and New England Tableland Bioregion
Lower reservoir area (Including spoil emplacements, excluding dam and reservoir)	• PCT 842 – Forest Redgum – Broad-leaved Apple dry open forest of the gorges of NSW North Coast Bioregion
Operations precinct	• PCT 842 – Forest Redgum – Broad-leaved Apple dry open forest of the gorges of NSW North Coast Bioregion
EAR	• PCT 762 – Cabbage Gum open forest or woodland on flats of the North Coast • PCT 842 – Forest Redgum – Broad-leaved Apple dry open forest of the gorges of NSW North Coast Bioregion • PCT 1106 – River Oak riparian woodland of the NSW North Coast Bioregion and northern Sydney Basin Bioregion • PCT 1215 – Spotted Gum – Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion
Transmission corridor (South of Macleay River, including access roads and tower pads)	• PCT 842 – Forest Redgum – Broad-leaved Apple dry open forest of the gorges of NSW North Coast Bioregion
Transmission corridor (North of Macleay River, including access roads and tower pads)	• PCT 762 – Cabbage Gum open forest or woodland on flats of the North Coast • PCT 868 – Grey gum – stringybark open forest of the gorges of the NSW North Coast Bioregion and New England Tableland Bioregion • PCT 1215 – Spotted Gum – Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion • PCT 1268 – Tallowwood open forest of the coastal ranges of the NSW North Coast Bioregion

ii Sub-Domain 1B – Rock landscape

Approximately 9 ha of the Project area will be rehabilitated as rock landscape, which will be limited to the outer batters of waste rock spoil emplacements (Figure 7.1).

The slopes of the waste rock emplacements will not be revegetated and will be for purposes of general fauna habitat.

7.4.2 Domain 2 – Water storage

The upper and lower reservoirs will be retained as water storages, totalling approximately 47 ha. This domain area encompasses the full supply level (FSL) of the reservoirs, embankments and spillways which are required for ongoing safe operation/passive bypass of water in perpetuity.

The beneficial uses of the upper and lower reservoirs may include environmental, recreational, livestock water and other general use.

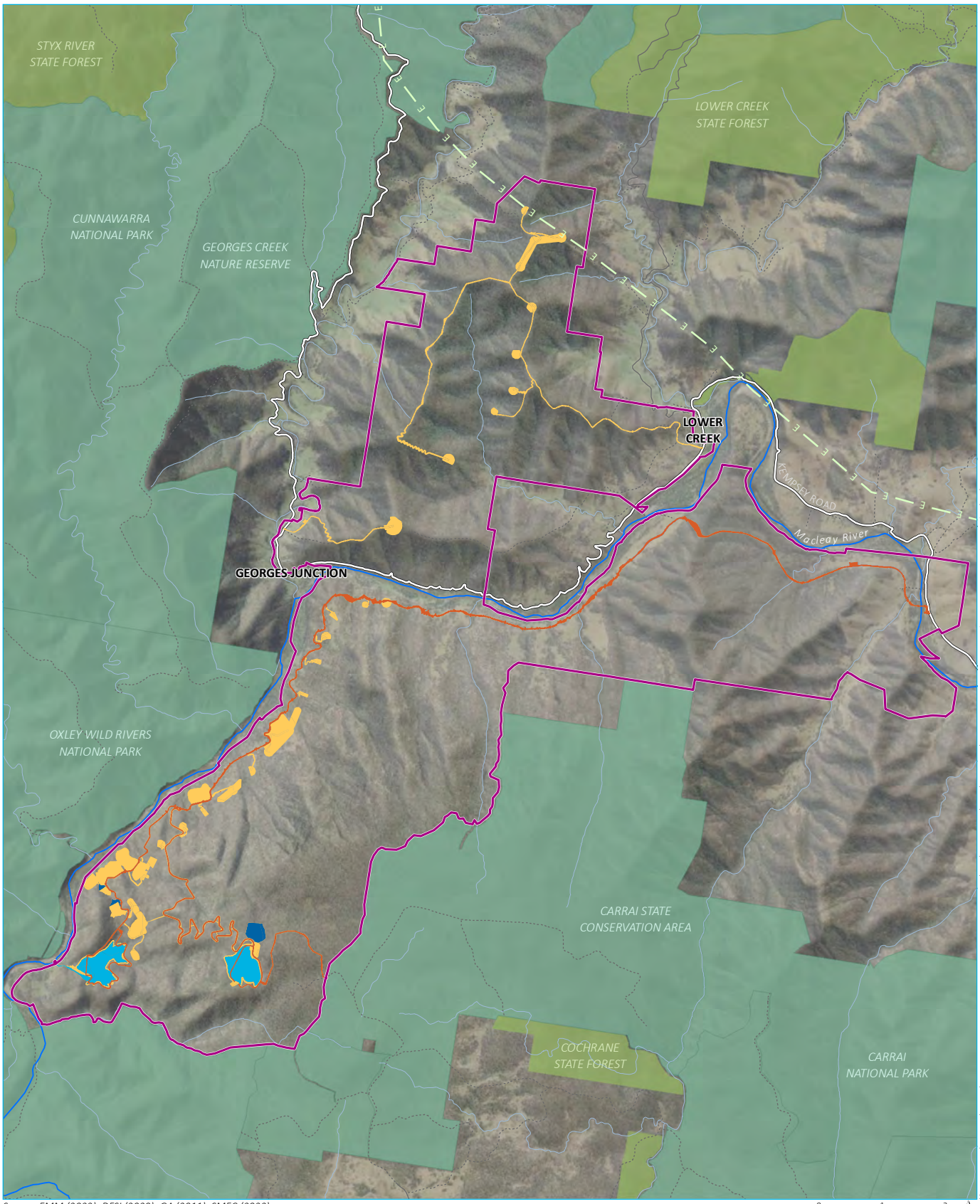
Proposed Domain 2 areas are shown in Figure 7.1.

7.4.3 Domain 3 – Access roads and tracks

Subject to agreement with relevant landowners/land managers the EAR, main access road and access tracks to the upper and lower reservoirs will be retained as permanent access roads and tracks for the following purposes:

- access to rehabilitation areas for rehabilitation monitoring and maintenance
- access to the reservoirs for purposes of ongoing geotechnical surveillance or environmental monitoring
- access to the reservoirs by members of the public for recreational, livestock watering or other miscellaneous purposes
- access to the reservoirs and surrounding lands by government authorities and agencies for general land management and emergency purposes.

The total area of access roads and tracks to be retained totals approximately 92 ha of the Project area.



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

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KEY

Project area

Final land use domains

- Domain 1A (Native vegetation)
- Domain 1B (Rock landscape)
- Domain 2 (Water storage)
- Domain 3 (Access roads and tracks)

Existing environment

- Macleay River
- Watercourse/drainage line
- Major road
- Minor road
- Vehicular track
- Existing transmission line

NPWS reserve

Final land use domains

Oven Mountain Pumped Hydro Energy Storage Project
Rehabilitation strategy
OMPS Pty Ltd
Figure 7.1

EMM creating opportunities

8 Rehabilitation methodology

8.1 Vegetation clearing

8.1.1 Ecological pre-clearance survey

Cleared areas will be subject to a pre-clearance ecological assessment to identify and assess:

- the presence of key habitat features (including hollow trees) to be avoided or preserved, if possible. These habitat features are to be clearly marked or delineated using paint, flagging tape or other means
- the presence of any threatened flora or fauna species to be avoided or preserved, if possible
- the presence and extent of any exotic weed infestations with emphasis given to populations of High Threat weeds
- evident or suspected infections by pathogens or other biological organisms (e.g. Phytophthora) that may require specific in-situ treatment, specific clearing procedures and priority treatment and disposal.

The coordinates of all identified features, and weed and pathogen infestations, are to be captured for GIS mapping.

8.1.2 Pre-clearing weed and pathogen management

Prior to vegetation clearance, those areas identified as having a high weed load and/or hosting high-risk weeds will be subject to weed control to reduce the potential for weed propagation on cleared ground and within wood stockpiles.

Priority weeds for control and eradication are as listed in Appendix A of the Northern Tablelands Regional Strategic Weed Management Plan 2017–2022 (Local Land Services 2017) which aligns with the *Biosecurity Act 2015.*

Weed control methods include, but are not necessarily limited to:

- mechanical application of herbicide using boom spray or high-volume power applicator
- manual application of herbicide from knapsack or similar applicator, or
- manual methods, including pulling and disposal of weeds.

Where spraying is undertaken this will include use of a biodegradable dye marker to identify sprayed areas.

Areas sprayed with herbicide will remain undisturbed for a minimum period of two weeks or such longer period recommended by the herbicide manufacturer.

8.1.3 Vegetation clearing and stockpiling of woody debris

Selected woody debris from vegetation clearing (e.g. logs and large branches) will be preserved and retained for potential future rehabilitation re-use. The general protocol for management of woody debris will include:

- locating stockpiles in designated stockpile/laydown areas
- signposting of stockpiles with the date of placement and vegetation/plant community type
- recording details of all stockpiles on a site database which includes the location, approximate volume and the records of stockpile maintenance (e.g. weed and pest control).

Some woody debris will be retained for erosion control purposes (soil surface cover and rill interruption on soil slopes). The woody debris will be sheared into 1.5 to 2 m lengths and stockpiles as detailed previously. During rehabilitation works they will be placed on appropriate slopes on the contour and track rolled to ensure intimate soil contact and to minimise flow concentration through and under the woody debris.

8.2 Soil management

Soils of sufficient depth, low/no weed contamination and with limited physical or chemical constraints will be stripped and retained for rehabilitation purposes.

As noted in Section 5.3, soil reclamation for rehabilitation re-use will generally not occur in the upper reservoir area or in other steep terrain given the skeletal nature of these soils and difficulty stripping soil profile layers without mixing.

The protocol for soil management includes:

- detailed survey and characterisation of the suitability of material for rehabilitation works is conducted prior to stripping
- stripping and stockpiling soil resources selectively and managed according to their suitability for rehabilitation purposes
- stripping sufficient volumes of subsoil and stable topsoil for rehabilitation purposes
- where possible, the preferential direct placement of stripped soils directly onto target rehabilitation areas and if not possible, stockpiled for future use
- progressive rehabilitation of final landforms as soon as practical after completion of landforms or when areas are no longer required
- stripping and storing soil resources in such a manner that their long-term viability is maintained.

Key soil management activities are described below.

8.2.1 Pre-stripping soil amelioration

Where soil survey and assessment has identified physio-chemical constraints requiring amelioration (e.g. application of gypsum or lime) this will be conducted prior to soil stripping to optimise mixing and incorporation with soils.

The application of ameliorants may also be required to soils that will be subject to development but not stripped, for example to mitigate erosion potential.

Recommended soil amelioration rates for identified SMUs and SPCs are provided in EMM (2023a).

8.2.2 Soil stripping

Soil stripping will be undertaken in a manner that minimises the mixing of subsoils with topsoils and limits, as far as reasonably practicable, the number of passes by plant and equipment movements to minimise potential soil profile mixing and compaction.

Stripping will be avoided, where practical, during and following wet weather, when soils are wet or damp, in order to minimise risks of soil compaction and sediment runoff.

Recommended soil stripping depths (soil management layers) for identified SMUs and SPCs are provided in Section 5.3.1 (Table 5.2).

8.2.3 Stockpile placement and management

The general protocol for management of stockpiled soil includes soil handling measures that optimise the retention of soil characteristics (in terms of nutrients and micro-organisms) favourable to plant growth. The protocol includes:

- locating stockpiles in designated stockpile/laydown areas, and importantly outside of floodplains and areas of concentrated surface water flow
- leaving the surface of the completed soil stockpiles in a roughened condition to help promote water infiltration and minimise erosion prior to vegetation establishment
- deep ripping soil stockpiles with gypsum (or other relevant ameliorants) and seeding to maintain soil organic matter levels, soil structure and microbial activity
- signposting of stockpiles with the date of construction, soil layer (topsoil or subsoil) and mapped soil type
- recording details of all soil stockpiles on a site database which includes the location and volume of each stockpile, and stockpile maintenance records (e.g. ameliorative treatment, weed control, seeding).

Long-term topsoil stockpiles will be constructed up to maximum height of 2 m with a 3(h):1(v) slope. Subsoil stockpile heights will vary as determined by material volume and available space within the footprint of approved disturbance areas.

A site soil database will be maintained to track soil resource accounting (rehabilitation material balance), including the creation of new stockpiles, and drawdown/re-use of stockpiled material in rehabilitation.

If required by soil testing, the application and incorporation of ameliorants into stockpiled soils may be required periodically after placement to maintain soil condition and function.

Where fertilisers are used to address nutrient deficiencies in reinstated soils, preference will be given to the use of mineral based biologically activated fertilisers over water soluble chemical fertilisers to minimise the potential for nutrient runoff into waterways and to encourage beneficial microbial activity in the soil. Fertilisers will be applied following respreading to compensate for nutrients lost from the soil when stored in the extraction area bunds.

Topsoil stockpiles will require amelioration and/or good mixing of the anaerobic and aerobic layers when returned to rehabilitated areas.

8.3 Decommissioning

An indicative plan for decommissioning of Project infrastructure at the end of its expected 100-year operating life is provided in Table 8.1.

This strategy assumes that the majority of above ground operations-phase infrastructure would be decommissioned, although certain infrastructure with an ongoing asset value post-project, such as overhead transmission and communications infrastructure, may be retained and transferred to third parties.

Detail on the fate of Project infrastructure will be documented within the post-approval rehabilitation management plan. This will include the assessment of options to retain and transfer any key infrastructure to third parties.

Table 8.1 Infrastructure decommissioning – indicative plan

Project element	Infrastructure	Fate	Decommissioning method
PHGW			
Underground power station complex	An underground pumped hydro-electric power station complex, including: • main caverns • machine hall • transformer hall • interconnecting tunnels, transformer hall tunnel and IPB tunnels.	Decommissioned	• Assets removed off-site where practical and possible. • Caverns, hall and tunnels/sealed.
Dams and reservoirs	• Upper dam and reservoir • Lower dam and reservoir.	Retained (Domain 2 – water storages)	• Not applicable.
Water intake structures	Reservoir intake structures: • morning glory, vertical-type intake structure (upper dam and reservoir) • lateral intake structure, with head gates and stoplog slots, and an intake channel (lower dam and reservoir).	Decommissioned	• Intakes sealed.
Spillways	• Upper dam and reservoir – concrete spillway chute • Upper dam and reservoir – concrete spillway chut.	Retained (Domain 2 – water storages) Retained as key operating infrastructure for reservoir operation (passive release of water)	• Not applicable.
Macleay River pump facility	A pump station and pumps.	Decommissioned	• Above ground assets removed off-site. • Ground rehabilitated.
Tunnels	Main tunnels: • main access tunnels (MAT1 and MAT2) • emergency, cable, ventilation tunnel.	Decommissioned	• Intakes sealed.
Power waterway	The power waterway infrastructure: • vertical pressure shaft • high-pressure headrace tunnel • penstock tunnels • draft tube tunnels • tailrace tunnel.	Decommissioned	• Adits, shafts and portals sealed.
Transmission connection works			
Connection works	• 330 kV towers and overhead lines • 132 kV towers and overhead lines • access roads to towers.	Decommissioned if not retained by owner of the electricity grid.	• Towers and lines removed. • Access roads rehabilitated.
Sub-station	Substation and associated connection infrastructure.	Decommissioned if not retained by owner of the electricity grid.	• Above-ground assets removed off-site. • Ground rehabilitated.

Table 8.1 Infrastructure decommissioning – indicative plan

Project element	Infrastructure	Fate	Decommissioning method
Switchyard	Outdoor air insulated switchyard.	Decommissioned if not retained by owner of the electricity grid.	• Above-ground assets removed off-site. • Ground rehabilitated.
Ancillary development (construction and operation)			
Access roads, access tracks and bridge	• EAR (including bridge)	Retained (Domain 3 – access roads and tracks)	• Not applicable.
	• Upper dam and reservoir – access road		
	• Lower dam and reservoir – access road		
	• Access tracks to transmission towers • Transmission easement access/inspection tracks • Other general access tracks	Decommissioned	• Ground rehabilitated.
Surface works pads and facilities	Construction phase facilities: • CBPs • accommodation camp • site offices • mechanical and electrical workshops • laboratory • water treatment and wash areas • staging areas • material stockpiling areas.	Decommissioned	• Above-ground assets removed off-site. • Ground rehabilitated.
	Spoil emplacement areas.	Retained (Domain 1B – rock landscape)	• Not applicable.
Communications	Fibre optic communications cable – buried in road corridors.	Retained Retained as ongoing communication asset for reservoir monitoring and/or other general-purpose telecommunications use	• Not applicable.
	Fibre optic communications cable – overhead line between upper and lower dams and reservoirs (in conjunction with overhead electrical line.	Decommissioned	• Removed as part of decommissioning of power transmission infrastructure.
	Communications tower (upper reservoir area).	Retained Retained as ongoing communication asset for reservoir monitoring and/or other general-purpose telecommunications use	• Not applicable.
Utilities during construction	Construction extraction bores (construction water supply bores).	Decommissioned	• Bores grouted and capped below natural ground level. • Ground rehabilitated.

Table 8.1 Infrastructure decommissioning – indicative plan

Project element	Infrastructure	Fate	Decommissioning method
Utilities for operation	Permanent water supply pipelines (within utility corridor).	Decommissioned	• Above-ground assets removed off-site. • Ground rehabilitated.
Water diversion and water treatment facilities	Site drainage, e.g: • cross drainage culverts • drainage pits and pipe • open channels/open drains (vegetated, rock-lined or concrete) • levees/bunds • detention basins.	Decommissioned, unless incorporated/integrated into final landform design	• Above-ground assets and wastes removed off-site. • Ground rehabilitated.
Stockpile areas	Temporary stockpile areas.	Decommissioned	• Above-ground assets removed off-site. • Ground rehabilitated.
Ancillary operational facilities	Operational facilities, including: • maintenance housing • work area • car parking • workshop and storage • control room and switchgear • water treatment plant • office area • HVAC • backup generators • Macleay River Pump Facility.	Decommissioned	• Above-ground assets and wastes removed off-site. • Ground rehabilitated.

8.4 Landform establishment

The general protocol for final landform construction and establishment includes:

- Pre-earthworks activities prior to subsoil and topsoil reinstatement / application of alternative growth media, including:
  - inspection of target rehabilitation areas to identify weed infestation and weed control as required
  - sampling, analysis and amelioration (if required) of stockpiled soils to address physical, chemical or nutrient deficiencies
  - sampling, analysis and amelioration (if required) of the target ground area to address physical, chemical or nutrient deficiencies
  - contour-ripping (to 0.3 m depth) or scarification (to 0.1 m depth) to alleviate compaction (subject to terrain and safe machine access).
- Where soils are to be reinstated, placement of subsoils and topsoils to original surveyed depths.

- Where alternative growth media is used, application at rates recommended by the manufacturer appropriate for the slope length and steepness.
- Implementation of erosion and sediment controls, per Soil and Water Management Plans (SWMPs) and Erosion and Sediment Control Plans (ESCPs).
- Installation of any controls to manage public safety, including harm to fauna and livestock.

Topsoil reinstatement will be undertaken in a manner that limits the need for repetitive trafficking by earthmoving plant and equipment in order to minimise risks of compaction and inadvertent mixing of topsoils and subsoils.

Access tracks may be required to facilitate revegetation implementation and ongoing maintenance. These tracks will be kept to a practical minimum and rehabilitated consistent with the surrounding rehabilitation area when no longer required.

8.5 Ecosystem and final land use establishment

8.5.1 Modified pasture

Revegetation of modified pasture will be undertaken via direct seeding.

Species composition will reflect the pre-disturbance pasture type, which is expected to be a mix of native and exotic pasture species as well as cover crops and legumes.

8.5.2 Native vegetation

Revegetation will involve direct seeding via hydro-mulching. Tubestock planting will only be undertaken for landscaping purposes, or where target species fail to establish, and in-fill planting is required.

Native seed will be collected prior to and during vegetation clearance activities from local native vegetation areas throughout the construction and operations phase. Seed collection planning (target species, timing, collection volumes, treatment and storage) will be documented within a post-approval rehabilitation management plan.

Native provenance seed will also be sourced periodically from local native vegetation areas to maintain required volumes of viable bank, where it is reasonable and feasible to do so. Seed collection campaigns will be based on a rehabilitation schedule (i.e. when disturbed areas are no longer required and are available for rehabilitation) as well as the seeding times of target species. A rehabilitation schedule will be developed and documented within the post-approval rehabilitation management plan.

Seed will be stored for direct seeding or used for tubestock propagation, with a seed bank and tubestock nursery established either on-site or off-site. Native seed and tubestock may also be sourced through reputable local nurseries or other suppliers.

8.5.3 Fauna and habitat enhancement measures

Salvaged vegetative debris will be spread on rehabilitation areas to provide micro-habitat and erosion protection.

8.6 Rehabilitation phase monitoring, maintenance and research

8.6.1 Native vegetation monitoring

i Landscape function analysis

Monitoring of native vegetation rehabilitation will be undertaken to monitor the trajectory of rehabilitating systems, which will be undertaken using the Landscape Function Analysis (LFA) methodology (Tongway and Hindley 2004), recognised pasture productivity measures, and comparison with local analogue reference sites.

LFA is one of three components of the Ecosystem Function Analysis (EFA) tool developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) that aims to measure the progression of revegetation/rehabilitation towards a self-sustaining ecosystem. LFA indices can be used to demonstrate that an area is on a trajectory towards a self-sustaining landscape, that is, the landscape contains processes operating to maintain the biogeochemical 'engine-room' of a landscape (Tongway and Hindley 2004). The EFA methodology is described in detail in Tongway and Hindley (2004), Tongway (2001) and Tongway (2008).

Data obtained from the analogue (reference) sites will provide a range of values from replicated examples of similar vegetation communities. Rehabilitation areas will be compared to reference sites that best represent the applicable final land use, vegetation community and conditions they will be subjected to (e.g. grazing pressure, climatic conditions and natural stochastic events).

This approach allows the recognition of the dynamic nature of ecosystems therefore rehabilitation sites are monitored simultaneously to the reference sites over time to account for changes in:

- seasonal variations
- climatic conditions
- management practices and land uses (e.g. grazing)
- unexpected disturbance events such bushfire and flooding.

Rehabilitation monitoring will identify undesirable deviation from the desired rehabilitation condition (or trajectory toward the desired condition) – measured against performance indices – and triggers for maintenance/intervention if required.

Rehabilitation performance indicators will be used to assess:

- success of initial establishment cover (for both native vegetation and modified pasture rehabilitation)
- weed infestation (with emphasis on High Threat weeds, and also where general weed load is excessive)
- pest species and livestock activity and impacts
- stability of the rehabilitation areas and evidence of erosion
- integrity of structural drainage and erosion control measures (if required).

Where management and intervention are required, this will be in accordance with the conceptual Trigger, Action and Response Plan (TARP) provided in Attachment B. A formal, detailed TARP will be developed and included within the post-approval rehabilitation management plan.

ii Soil analyses

Soil samples are taken using a core sampler within a monitoring quadrat at each rehabilitation monitoring site. At least 12 cores are taken at each site and soil samples sent to a National Association of Testing Authorities (NATA) accredited laboratory for analysis.

Soil samples are analysed for the following parameters: pH, electrical conductivity, available calcium, magnesium, potassium, ammonia, sulphur, organic matter, exchangeable sodium, calcium, magnesium, potassium, hydrogen, aluminium, cation exchange capacity, available and extractable phosphorus, micronutrients (zinc, manganese, iron, copper, boron) and total carbon and nitrogen.

Exchangeable sodium percentages are also calculated as a measure of sodicity or dispersion (erosion hazard).

iii Ecological assessment

In addition to LFA, various biodiversity components are assessed to monitor the successional phases/changes of plant development and to identify the requirements for ameliorative measures and guide adaptive management. Rapid ecological assessment will be used to provide quantitative data that measures changes in:

- floristic diversity including species area curves and growth forms (using full floristic sampling)
- ground cover diversity and abundance
- vegetation structure and habitat characteristics (including ground cover, cryptogams, logs, rocks, litter, projected foliage cover at various height increments)
- understorey density and growth (including established shrubs, direct seeding and tubestock plantings and tree regeneration)
- overstorey characteristics including tree density, health and survival
- other habitat attributes such as the presence of hollows, mistletoe and the production of buds, flowers and fruit.

Permanent transects and photo-points will be established to record changes in these attributes over time.

These ecological assessment components will be described in detail in the post-approval rehabilitation management plan for the Project.

The monitoring methodology described above may be revised to an alternative method required to adequately assess rehabilitation performance.

iv Monitoring quadrats

The monitoring methodology components described in Sections 8.6.1i – 8.6.1iii above will be undertaken within 20 m x 50 m monitoring quadrats established at each rehabilitation monitoring site and reference site. An LFA transect is established along the 20 m downslope boundary of the quadrat. Vegetation monitoring is undertaken within 1 m x 1 m sub-quadrats at 5 m intervals along the 50 m transect which runs perpendicular to the LFA transect.

The transect and quadrat boundary points are marked with pegs (and flagging tape) and global positioning system details recorded at each peg to ensure the location of the quadrat and transects is consistent over time.

Permanent photo-points will be established at the monitoring quadrats to monitor the changes that occur over time. The methodology for photographic monitoring is consistent with the NSW National Parks and Wildlife Service (2003) *Conservation Management Note 9 – Photographic Monitoring*. Photos are taken annually during spring and during a similar time of day (for consistence of light conditions).

After each photographic monitoring event, the photographs are compared to the photographs from the previous monitoring periods. The following elements will be noted:

- plant establishment
- the status of weeds
- natural regeneration of species
- presence of habitat features (e.g. logs, litter, rocks).

A review of aerial photography may also be used to show enhancement of vegetation connectivity.

8.6.2 Pasture monitoring

Monitoring of agricultural productivity for modified pasture rehabilitation will include measurement of soil quality and fertility, pasture yield (tonnes per hectare), crude protein levels and livestock carrying capacity measured in dry sheep equivalent per hectare (DSE/ha).

8.6.3 Analogue sites

Analogue (reference) sites may be identified and detailed within the post-approval rehabilitation management plan for the Project.

Analogue sites will be established to support and inform monitoring and performance of both native vegetation and modified pasture rehabilitation.

8.6.4 Rehabilitation trials and research

Rehabilitation trials may be used to refine and improve the rehabilitation program. Example rehabilitation trials may include:

- Spoil rehabilitation – trials to test methods for the installation of growth media to enable vegetation establishment and ongoing viability.
- Material amelioration – investigation into the chemical and physical properties of soil resources and the optimum rates of gypsum application to minimise erosion and improve suitability for plant growth and use on rehabilitation areas.
- Temporary erosion control – trial temporary slope stabilisation techniques for topsoil and/or growth media placement on steep slopes prior to and during periods of high rainfall erosivity, and to support vegetation re-establishment.

9 Intervention and adaptive management

A conceptual rehabilitation trigger, action and response plan (TARP) is provided in Attachment B, and outlines proposed responses to potential threats to rehabilitation outcomes. This will be refined during the development of the SWMP and post-approval rehabilitation management plan for the Project.

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Attachment A

Rehabilitation risk assessment

EMM
creating opportunities

Rehabilitation Risk Assessment

Date: 16/09/2022
Participants: Nick Travers, Michael Frankcombe, Jason O'brien, Henry Noakes

Project No: J210465
Project Name: Oven Mountain Pumped Storage - Generation Component EIS - Rehabilitation Strategy
Client: Oven Mountain Pumped Storage Pty Ltd (OMPS)
Site: Oven Mountain Pumped Storage

RISK LEVEL IS BASED ON THE HIGHEST SEVERITY LEVEL

RISK LEVEL IS BASED ON THE HIGHEST SEVERITY LEVEL

					INHERENT RISK - WITHOUT CONTROLS												RESIDUAL RISK - AFTER CONTROLS														
						Impacted Area												Impacted Area														
CLOSURE RISK DESCRIPTION (Unwanted Event)	**POTENTIAL IMPACTS (Consequence)**	**POTENTIAL CAUSES / REASONS (Risk Pathway - Root Causes)**	**RISK #**	**RELEVANT? (Yes / No)**	**Likelihood (L)**	Financial	Health & Safety	Environmental	Community Relations	Company Reputation	Security	Legal Compliance	**Inherent Risk Level (IRL)**	**Controls**	**Comments**	**Likelihood (L)**	Financial	Health & Safety	Environmental	Community Relations	Company Reputation	Security	Legal Compliance	**Residual Risk Level (RRL)**	**Knowledge gaps**	**Actions to address knowledge gaps**	**Path Forward (Rehabilitation strategy)**
FINAL LANDFORM STABILITY																														
Waste rock spoil emplacements (final landforms) - erosional instability/failure	* Failure of establishing rehabilitation (revegetation); * Major costs for landform re-design/re-work; * Inability to handover/relinquish site to other parties;	* Landform design not sympathetic to the base material characteristics (eg erodibility and geochemistry) and local climatic conditions; * Landform subject to unacceptable rates of erosion; * Landform design not integrated with surrounding hydrology (design does not account for surface water flows onto and off the landform); * Not constructed to design; * Revegetation failure due to fire, grazing disturbance etc exposes underlying material to water and erosive processes; * Lack of suitable covering material/growth media (local soils skeletal and cannot be reclaimed); * Landform design based on common geotechnical practices and not considerate of material erodibility and geochemistry; * Revegetation with inappropriate plant community types (PCTs) (eg vegetation with deep rooting species and/or not suitable for rock)	1	Yes	D - Unlikely	2 - Minor	1 - Insignificant	1 - Insignificant	N/A	2 - Minor	N/A	2 - Minor	Low	Spoil will consist of moderate-to-large rock generated by drill-and-blast activity - will be geotechnically stable when emplaced in a spoil landform. * Spoil emplacement batters will be stable at natural angle of repose due to the angular nature and weight of rock debris. * Upper reservoir spoil emplacement will on a flat pad/plateau in the landscape with negligible risk to receptors in the unlikely event of geotechnical or erosional failure. * Upper reservoir spoil emplacement at top of catchment with no run-on water, and runoff will not alter downstream hydrologic regimes. * Portion of generated rock spoil to be disposed underwater within the reservoirs. Erodibility characterisation of spoil, WEPP erosion modelling and landform evolution modelling (SIBERIA) not warranted or required		D - Unlikely	2 - Minor	1 - Insignificant	1 - Insignificant	N/A	2 - Minor	N/A	2 - Minor	Low	n/a	n/a	Rehabilitation strategy includes methodology for rehabilitation of spoil emplacements. Rehabilitation strategy nominates spoil emplacements to remain as novel landforms in perpetuity, designated as 'rock landscape' final land use domain
Upper and lower resoirvoirs are retained in perpetuity (not removed) (Closure base case)	* Ongoing liability for management as declared dams; * Ongoing liability and costs for water licensing (water harvesting); * Ongoing liability and costs for water monitoring; * Inability to handover/relinquish reservoirs to other parties; * No 3rd-parties willing to take on liability	* Significant costs to remove reservoirs at end of life; * Other options (partial removal) have greater cost and risk	2	Yes	A - Almost Certain	1 - Insignificant	N/A	1 - Insignificant	N/A	N/A	N/A	N/A	Moderate	* Identify beneficial future uses (ie environmental, recreation); * Identify options for transfer of liability to 3rd-party	Recommended (base case) closure scenario - significant cost and impacts associated with future removal	A - Almost Certain	2 - Minor	N/A	1 - Insignificant	N/A	N/A	N/A	N/A	High	n/a	n/a	Rehabilitation strategy to assume reservoirs to remain in perpetuity (post-project) as a 'water storage' final land use domain
Erosion/failure of rehabilitation - other areas	* Failure of establishing rehabilitation (revegetation); * Sediment runoff into receiving waterways; * Significant costs to repair	* Erodibility (erosion hazard) of topsoils/subsoils not undertaken; * Rehabilitation method does not consider: - soil erosion hazard; - re-direction or control of run-on water (eg cut-outs); * Access tracks not ripped/scarified or this not done on contour	3	Yes	C - Possible	2 - Minor	1 - Insignificant	3 - Moderate	N/A	2 - Minor	N/A	2 - Minor	High	* Erosion hazard assessment (EHA) of topsoils/subsoils; * ESCPs/PESCPs with site-specific erosion controls as part of landform reinstatement works; * Use of alternative growth media given limited available topsoil resources and difficulty to reclaim; * Revegetation with appropriate plant community types (PCTs)		D - Unlikely	3 - Moderate	1 - Insignificant	3 - Moderate	N/A	2 - Minor	N/A	2 - Minor	Moderate	n/a	n/a	Rehabilitation strategy includes recommended landform design criteria based on site-specific erosion hazard assessment, and methodologies for management of erosion risk
GEOTECHNICAL STABILITY																														
Slumping and failure of reservoir embankments	* Harm to /loss of persons and property downstream; * Reputational impacts; * Major costs for landform re-design/re-work; * Inability to achieve relinquishment.	* No geotechnical stability assessments (ANCOLD) to confirm long-term stability and hazard classification * Erosion of embankment; * No geotech reports undertaken for long term closure plan only for current use	4	Yes	E - Rare	4 - Major	3 - Moderate	3 - Moderate	N/A	2 - Minor	N/A	2 - Minor	Moderate	* Embankments geotechnically engineered and certified; * Erosion hazard assessment of reservoir embankments; * Erosion controls applied to embankment; * Ongoing monitoring and remediation of erosion (assumes embank	Geotechnical assessment and sign-off required at end-of-life to demonstrate no long-term instability risk	E - Rare	3 - Moderate	3 - Moderate	3 - Moderate	3 - Moderate	N/A	3 - Moderate	3 - Moderate	Moderate	n/a	n/a	Rehabilitation strategy considers geotechnical integrity and surveillance of reservoir embankments
MATERIAL BALANCE - WASTE ROCK AND OVERBURDEN																														
Insufficient volume of benign waste rock and/or overburden to use for encapsulation of deleterious wastes and/or construct target landform design	* Inability to construct adequate depth of cover above problematic mining or other wastes; * Inability to construct nominated post-mining landform design; * Unplanned cost for landform re-design or substitute materials;	* Inadequate geochemical characterisation of waste rock to inform material brehab material balance/landform design options;	5	Yes	D - Unlikely	1 - Insignificant	N/A	2 - Minor	1 - Insignificant	N/A	N/A	N/A	Low	Geochemical assessment indicates no acid-rock drainage (ARD) and metalliferous drainage potential - encapsulation and/or other treatment of waste rock unlikely to be required (classified as VENM)		D - Unlikely	1 - Insignificant	N/A	2 - Minor	1 - Insignificant	N/A	N/A	N/A	Low	n/a	n/a	n/a
MATERIAL BALANCE - SOIL AND GROWING MEDIA																														
Insufficient volume of native soil resource (subsoil and topsoil) to use as final cover material	* Inability to support proposed final land uses (eg native vegetation, cropping or pasture)	* Subsoil and topsoil resources not stripped and stockpiled; * Subsoil and topsoil resources are limited due to topography - cannot be easily stripped, or stipping is too expensive; * Existing stockpiled soil resources contaminated with weeds; * Existing stockpiled soil resources lost through erosion; * Existing stockpiled soil resources inter-mixed and now constrained; * Subsoil and topsoil resources contaminated (eg hydrocarbons & other).	6	Yes	B - Likely	2 - Minor	N/A	3 - Moderate	1 - Insignificant	3 - Moderate	N/A	N/A	High	* Use of alternative growth media given limited available topsoil resources and difficulty to reclaim; * Revegetation using appropriate PCTs with an affinity for rocky landforms		D - Unlikely	2 - Minor	N/A	3 - Moderate	1 - Insignificant	3 - Moderate	N/A	N/A	Moderate	n/a	n/a	Rehabilitation strategy assumes use of alternative growth media where soil availability and quality is limited
Quality of native soil resource inadequate to support vegetation final land uses	* Inability to support proposed final land uses (eg native vegetation, cropping or pasture); * Unplanned costs to import/apply alternative growing media; * Extended closure time and cost to achieve performance targets.	* Inadequate characterisation of subsoil and topsoil resources (across the site (both geochemical and volume); * No trials undertaken into alternative growth media and techniques.	7	Yes	C - Possible	2 - Minor	N/A	3 - Moderate	1 - Insignificant	3 - Moderate	N/A	N/A	High	* Soil assessment (land and soil capability) to assess soil depth, quality and constraints; * Use of biological and chemical ameliorants to address inherent soil constraints; * Use of alternative growth media	Biological and chemical amelioration of waste rock spoil, and soils (where these are recoverable) likely to be required.	D - Unlikely	2 - Minor	N/A	3 - Moderate	1 - Insignificant	3 - Moderate	N/A	N/A	Moderate	n/a	n/a	Rehabilitation strategy assumes use of alternative growth media where soil availability and quality is limited
REVEGETATION																														
Waste rock spoil emplacements (final landforms) - inability to support and sustain native vegetation	* Inability to satisfy approval conditions; * Inability to achieve relinquishment; * Visual and aesthetic impacts (landscape character); * Net loss of native vegetation area	* Nature of rocky debris (large, angular) precludes capping with soils, growth media and thus establishment of a suitable rooting zone for vegetation	8	Yes	A - Almost Certain	2 - Minor	2 - Minor	2 - Minor	2 - Minor	2 - Minor	N/A	2 - Minor	High	* Spoil emplacements nominated as native vegetation final land use (scree slope habitat); * native vegetation establishment likelety to occur but over significant time period	Spoil emplacements expected to provide extensive habitat/harbour for small fauna and invertebrates.	A - Almost Certain	2 - Minor	2 - Minor	2 - Minor	2 - Minor	2 - Minor	N/A	2 - Minor	High	Alternate methods to establish vegetation given limitations in capping with soil/growth media	Future rehabilitation trials (vegetation establishment in spoil)	Rehabilitation strategy nominates spoil emplacements to remain as novel landforms in perpetuity, designated as 'rock landscape' final land use domain
Inability to re-establish target plant community types (PCTs) - other revegetation areas	* Inability to satisfy approval conditions; * Inability to achieve relinquishment; * Unplanned rehabilitation/closure liability; * Unplanned, undesired change of end land use;	* Drought/climate change; * Inadequate final landform design, and final landform instability; * Saline capillary rise into root zone (no or inadequate capillary break); * Fire/bushfire; * Grazing pressure (livestock and native fauna); * Soil or growth media insufficient or not suitable for target PCT and key species; * Lack of suitable seed resources	9	Yes	C - Possible	2 - Minor	N/A	2 - Minor	1 - Insignificant	2 - Minor	N/A	1 - Insignificant	Moderate	* Post-approval rehabilitation management plan; * Seed collection, seedbank and tubestock nursery established; * Rehabilitation monitoring (LFA) and TARP * Use of alternative growth media to mitigate issues with native soil availability and quality, and to provide rapid vegetation establishment	Seed collection program will be required from start of project construction phase in readiness for early progressive rehabilitation	D - Unlikely	2 - Minor	N/A	2 - Minor	1 - Insignificant	2 - Minor	N/A	1 - Insignificant	Low	n/a	n/a	Rehabilitation strategy includes methodology for landform reinstatement and native vegetation rehabilitation
NATIVE FAUNA																														
Delayed recolonisation of rehabilitation areas by native fauna	* Delayed recolonisation of rehabilitation areas by native fauna; * Delayed reinstatement of ecosystem function; * Reduced fauna diversity post-closure.	* Loss of original habitat and nesting due to vegetation clearance; * No provision of alternate habitat features (eg trees, hollows etc);	10	Yes	C - Possible	2 - Minor	N/A	3 - Moderate	N/A	2 - Minor	N/A	N/A	High	* Reinstatement of timber debris for micro-habitat; * Provision of alternate nest boxes/hollows in adjacent vegetation		C - Possible	2 - Minor	N/A	2 - Minor	N/A	2 - Minor	N/A	N/A	Moderate	n/a	n/a	Rehabilitation strategy references key controls (re-use of debris, provision of alternate habitat)
PEST SPECIES																														
Weeds - high threat weeds or excessive weed load - competition with establishing vegetation	* Weeds out-compete establishig revegetation; * Delayed rehab progress; * Inabaility to achieve rehab outcomes; * Inability to achieve relinquishment; * Inability to preserve vegetative debris and soils for rehabilitation use	* Existing weeds in native vegetation - weed seeds retained in cleared vegetative debris; * Lack of weed inseption and control prior to vegetation clearing; * Lack of weed inseption and control prior to soil stripping; * Lack of weed inseption and control during and post-rehabilitation.	11	Yes	B - Likely	2 - Minor	N/A	3 - Moderate	N/A	N/A	N/A	N/A	High	* weed inspection and control prior to vegetation clearance; * weed inspection and control of timber and soil stockpiles; * weed inspection and control as part of rehab monitoring program; * use of alternative growth media to address soil defecit/manage weed risk;		C - Possible	2 - Minor	N/A	3 - Moderate	N/A	N/A	N/A	N/A	Moderate	n/a	n/a	Rehabilitation strategy includes methodology for assessment and control of weeds
Pest fauna - grazing pressure and other disturbance of establishing vegetation	* Grazing, digging and burrowing impacts (delayed rehab progess)	* Existing pest species in greater Project area	12	Yes	C - Possible	2 - Minor	N/A	2 - Minor	N/A	N/A	N/A	N/A	Moderate	* Baiting and control programs during Project operations and rehabilitation phases		D - Unlikely	2 - Minor	N/A	2 - Minor	N/A	N/A	N/A	N/A	Low	n/a	n/a	Rehabilitation strategy includes methodology for assessment and control of pest animals
LIVESTOCK																														
Livestock - grazing and trampling of establishing vegetation	* Grazing and trampling of establishing vegetation; * Delayed rehab progress; * Erosion of underlying rehab landform	* Existing pastoral uses in Project area (rangeland grazing)	13	Yes	B - Likely	2 - Minor	N/A	2 - Minor	N/A	N/A	N/A	N/A	Moderate	* Exclusion fencing of progressive rehab areas (particularly in lower-lying areas nearer to river where grazing is predominant)		D - Unlikely	2 - Minor	N/A	2 - Minor	N/A	N/A	N/A	N/A	Low	n/a	n/a	Rehabilitation strategy includes methodology for assessment and control of livestock
PUBLIC SAFETY																														
Slumping and failure of reservoir embankments	* Harm/Fatality to member of public (flooding, engufment, flow impacts to dwellings, other)	* No geotechnical stability assessments (ANCOLD) to confirm long-term stability and hazard classification * Erosion of embankment; * No geotech reports undertaken for long term closure plan only for current use	14	Yes	E - Rare	4 - Major	3 - Moderate	3 - Moderate	N/A	2 - Minor	N/A	2 - Minor	Moderate	* Engineered emabankments; * Erosion hazard assessment of reservoir embankments; * Erosion controls applied to embankment; * Ongoing monitoring and remediation of erosion (assumes embank		E - Rare	3 - Moderate	3 - Moderate	3 - Moderate	3 - Moderate	3 - Moderate	N/A	3 - Moderate	Moderate	n/a	n/a	Rehabilitation strategy includes indicative controls to manage public safety risks, and risks to fauna and livestock
Access to reservoir embankments and infrastructure by members of public, livestock etc - harm/fatality	* Loss of life (eg falls, entrapment) or injury * Livestock harm/fatality	* Falls from embankment crests	15	Yes	C - Possible	N/A	3 - Moderate	N/A	3 - Moderate	3 - Moderate	3 - Moderate	3 - Moderate	High	Fencing and signage to prevent access by public, livestock to embankment crests;		D - Unlikely	N/A	3 - Moderate	N/A	3 - Moderate	3 - Moderate	3 - Moderate	3 - Moderate	Moderate	n/a	n/a	Rehabilitation strategy includes indicative controls to manage public safety risks, and risks to fauna and livestock
SURFACE WATER																														
Permanent retention of upper and lower dams and reservoirs post-closure - pre-project catchment hydrology cannot be reinstated	* Catchment and sub-catchment flows are permanently altered as a result of final landform changes; affecting downstream users and sensitive receptors; * Inability to satisfy approval conditions; * Inability to achieve relinquishment; * Final landforms permanently alter catchment and sub-catchment flows (e. final landform designs do not consider pre-mining catchment hydrology); * Final landforms deliberately alter original catchments in order to manage other risks (eg final voids, permanent flood levees etc); * Adjoining land use changes not considered (cumulative impacts); * Inadequate staging plans - final hydrology not realised.	* Final landform design(s) do not, or do not adequately, integrate with site- and/or local hydrology (eg drainage lines, creeks etc) * Deliberate decision to retain reservoirs (ie preferred closure option)	16	Yes	A - Almost Certain	2 - Minor	N/A	2 - Minor	N/A	N/A	N/A	N/A	High	* GW and SW entitlements (licenses) to cover water take post-rehab; * Identify beneficial future uses (ie environmental, recreation); * Identify options for transfer of liability to 3rd-party Surface water (hydrology) assessment indicates that the reservoirs, and permanent off-take of water, has negligible impact on the Macleay River at the catchent scale.	Recommended (base case) closure scenario to retain reservoirs at closure (favoured on basis of cost and risk compared with other closure options)	A - Almost Certain	2 - Minor	N/A	2 - Minor	N/A	N/A	N/A	N/A	High	n/a	n/a	Rehabilitation strategy to assume reservoirs to remain in perpetuity (post-project) as a 'water storage' final land use domain
Waste rock spoil emplacements (final landforms) - landforms adversely effect downstream hydrology and flooding risk	* Altered surface water flow regimes; * Increased flows in streams/gullies resulting in erosion;	* Spoil landforms not considered in hydrologic and flood modelling	17	Yes	D - Unlikely	N/A	N/A	2 - Minor	N/A	N/A	N/A	N/A	Low	SW modelling indicates spoil landforms will have negligbe effect on downstream hydrology (flow regimes) and flooding risk		D - Unlikely	N/A	N/A	2 - Minor	N/A	N/A	N/A	N/A	Low	n/a	n/a	Rehabilitation strategy nominates spoil emplacements to remain as novel landforms in perpetuity, designated as 'rock landscape' final land use domain Rehabilitation strategy references findings of project hydrology assessment re: impacts on downstream hydrology (flows and water quality)
Waste rock spoil emplacements (final landforms) - acid and/or metalliferous drainage	* Adverse impacts on waterways; * Ongoing, statutory non-compliance (penalties/infringements); * Ongoing costs for control and remediation; * Major costs for landform re-design/re-work;	* Geochemistry of waste rock and associated risks not assessed; * Final landform design does not consider geochemical issues/risk;	18	Yes	D - Unlikely	N/A	N/A	2 - Minor	N/A	2 - Minor	N/A	N/A	Low	* Geochemical characterisation of waste rock to determine geochemical risks (eg acid and metalliferous drainage potential) - critical to informing appropriate spoil landform design to provide long-term encapsulation - material assessed as low acid generating potential with low-to-moderate metalliferous drainage potential (Aluminium and Iron) * Modelling of runoff water quality impacts on receiving waters	Geochemical assessment indicates no acid-rock drainage (ARD) and metalliferous drainage potential	D - Unlikely	3 - Moderate	N/A	N/A	N/A	N/A	N/A	2 - Minor	Moderate	n/a	n/a	Rehabilitation strategy references findings of projeect geochemical assessment re: acid and metalliferous drainage risk

Ongoing impact on water quality in creeks and drainage lines downstream of rehabilitated areas	* Erosion and sediment runoff from rehabilitated areas; * Erosion of reconstructed drainage lines and waterways; * Adverse impacts to downstream users and sensitive receptors (cumulative impacts); * Inability to satisfy approval conditions; * Inability to achieve relinquishment;	* Instability and erosion of rehabilitated landforms; * acid and/or metalliferous drainage;	19	Yes	D - Unlikely	3 - Moderate	N/A	3 - Moderate	3 - Moderate	N/A	3 - Moderate	Moderate	* ESCPs/PESCPs with site-specific erosion controls as part of landform reinstatement works; * Rehabilitation monitoring and maintenance programs (inc. TARP). Surface water (hydrology) assessment indicates that spoil emplacement runoff will have negligible impact on the Macleay River (flows and quality)	Recommended (base case) closure scenario to retain waste rock spoil emplacements as permanent final landforms	D - Unlikely	3 - Moderate	N/A	3 - Moderate	3 - Moderate	N/A	3 - Moderate	Moderate	n/a	n/a	Rehabilitation strategy references findings of project hydrology assessment re: impacts on downstream hydrology (flows and water quality)
Flood events result in damage to or loss of rehabilitated ground	* Unplanned rehabilitation/closure liability; * Inability to achieve relinquishment, or delays to relinquishment.	* Inadequate or no flood modelling;	20	Yes	D - Unlikely	2 - Minor	N/A	2 - Minor	N/A	N/A	N/A	Low	* EIS surface water impact assessment (inc. flood modelling); * Project design considers flood levels re: siting of infrastructure and disturbance areas - flood risks likely limited to access roads in proximity of Mcleay River. * Upper reservoir and surrounds at elevated location with small catchment; * Lower reservour and surrounds above flood level	Assumed that: * upper resoirvoir areas, access roads etc would be at lower flood risk; * lower reservoir areas near river at higher risk from flooding	E - Rare	2 - Minor	N/A	2 - Minor	N/A	N/A	N/A	Low	n/a	n/a	Rehabilitation strategy references findings of project hydrology assessment re: impacts on downstream hydrology (flows and water quality)
Water quality in retained reservoirs not suitable to support final land uses (eg environmental or recreational uses)	* Unplanned rehabilitation/closure liability (ongoing costs for treatment)	* Inflow of PAF/hostile waste rock leachate from upstream sources; * Excessive inflows of sediment; * Stagnant, standing water (low O2, high nutrient load)	21	Yes	D - Unlikely	3 - Moderate	2 - Minor	3 - Moderate	2 - Minor	N/A	3 - Moderate	Moderate	* EIS surface water impact assessment (inc. flood modelling); * Disturbance areas upstream of reservoirs fully rehabilitated; * Reservoirs filled with fresh water harvested from Macleay River		D - Unlikely	3 - Moderate	2 - Minor	3 - Moderate	2 - Minor	2 - Minor	3 - Moderate	Moderate	n/a	n/a	Rehabilitation strategy to include rehabilitation objective and completion (success) criteria for quality of receiving waters based on applicable beneficial uses
FIRE AND BUSHFIRE																															
Bushfire impacts native revegetation (rehabilitation)	* Loss of native revegetation; * Unplanned rehabilitation/closure liability; * Inability to achieve, or delays to, mine relinquishment.	* Revegetation is not mature / resilient to fire; * Lack of bushfire protection and mitigation measures; * Bushfire risk not assessed or modelled; * Retained infrastructure causes spark/ignition of vegetation; * Arson.	22	Yes	C - Possible	3 - Moderate	2 - Minor	3 - Moderate	N/A	N/A	1 - Insignificant	High	* Progressive rehabilitation to establish revegetation ASAP (commence rehabilitation trajectory and bushfire resilience ASAP); * Use of local PCTs and key veg species for rapid veg establishment; * Use of alternative growth media to support rapid veg establishment;		C - Possible	3 - Moderate	2 - Minor	3 - Moderate	N/A	N/A	1 - Insignificant	High	n/a	n/a	Rehabilitation strategy to include concept controls and post-fire corrective actions for bushfire impacts of rehabilitation
HERITAGE																															
Cultural heritage (sites, relics, artefacts and other) not reinstated and protected at closure	* Non-compliance with cultural heritage agreements/approvals; * Non-compliance with statutory obligations; * Reputational impact.	* Reinstatement of cultural heritage not accounted for in landform design and rehabilitation plans;	23	Yes	D - Unlikely	2 - Minor	N/A	N/A	3 - Moderate	3 - Moderate	3 - Moderate	Moderate	EIS cultural heritage assessment (ACHA) - sites/artefacts to reinstated are considered in final landform design and rehabilitation methodology		E - Rare	3 - Moderate	N/A	3 - Moderate	3 - Moderate	3 - Moderate	3 - Moderate	Moderate	n/a	n/a	Rehabilitation strategy considers protection of cultural heritage and reinstatement of cultural heritage as part of rehabilitation, subject to engagement with relevant stakeholders
Historic heritage (sites, relics, artefacts and other) not reinstated and protected at closure	* Non-compliance with cultural heritage agreements/approvals; * Non-compliance with statutory obligations; * Reputational impact.	* Reinstatement of cultural heritage not accounted for in landform design and rehabilitation plans;	24	Yes	D - Unlikely	2 - Minor	N/A	N/A	2 - Minor	2 - Minor	3 - Moderate	Moderate	EIS historic heritage assessment (CHMP) - sites/artefacts to reinstated are considered in final landform design and rehabilitation methodology		E - Rare	2 - Minor	N/A	N/A	2 - Minor	2 - Minor	3 - Moderate	Moderate	n/a	n/a	Rehabilitation strategy considers protection of historical heritage and reinstatement of historical heritage as part of rehabilitation, subject to engagement with relevant stakeholders
INFRASTRUCTURE																															
Retained infrastructure is inconsistent/incompatible with the intended final land use	* Unplanned cost to remove; * Unplanned rehabilitation/closure liability; * Inability to achieve relinquishment.	* Landform designs do not consider retained infrastructure; * Mine plans and closure plans do not consider retained infrastructure and land use compatibility; * Landowner/land manager agreement not obtained on infrastructure to be retained; * Formal landowner agreement not obtained regarding infrastructure to be retained; * Landowner does not accept the final condition of retained infrastructure at point of closure.	25	Yes	C - Possible	2 - Minor	2 - Minor	2 - Minor	2 - Minor	N/A	N/A	Moderate	* Identify beneficial future uses (ie environmental, recreation, stock water); * Identify options for transfer of liability to 3rd-party	Long-term water entitlements likely requried for the reservours to cover their passive take of water - assumed that GW and SE entitlements obtained for shceme operation would be held and amended to cover this change in use (change in take).	E - Rare	2 - Minor	2 - Minor	2 - Minor	2 - Minor	2 - Minor	N/A	N/A	Low	n/a	n/a	Rehabilitation strategy to include concept plan for fate of project infrastructure with regard to the nominated final land uses
SITE CONTAMINATION																															
Residual site contamination not removed/remediated prior to mine closure	* Contamination prevents or limits the intended final land use; * Non-compliance with environmental protection legislation, policies and NEPM for site contamination; * Residual contamination results in surface water or groundwater contamination; * Unexpected cost to manage/treat contaminated material; * Delays to closure and relinquishment; * Unplanned rehabilitation/closure liability.	* Types and locations of known and potential site contamination not identified, tested and removed/remediated prior to mine closure; * Hostile tailings material, PAF, rejects material etc not appropriately disposed at depth/capped as part of mine planning and landform construction/reinstatement; * No or inadequate remediation;	26	Yes	D - Unlikely	2 - Minor	2 - Minor	2 - Minor	2 - Minor	2 - Minor	2 - Minor	Low	Contamination assessments and remediation (if required) prior to closure	Post-excavation and removal sampling to verify success	E - Rare	1 - Insignificant	N/A	1 - Insignificant	1 - Insignificant	1 - Insignificant	2 - Minor	Low	n/a	n/a	Rehabilitation strategy to include rehabilitation objective and completion (success) criteria for land contamination
CLIMATE CHANGE																															
Droughts and climate change	* Delays to rehabilitation establishment; * Loss of establishing rehabilitation (native vegetation, crops and pasture); * Unplanned rehabilitation/closure liability; * Inability to achieve, or delays to, mine relinquishment.	* Revegetation is not mature / resilient to extended dry conditions; * Lack of watering/irrigation programs (rehabilitaion maintenance) during establishment phase resulting; * over-watering impedes hardening of reveg; * Inadequate soil/growth media preparation.	27	Yes	D - Unlikely	N/A	N/A	3 - Moderate	N/A	N/A	N/A	Moderate	* Progressive rehabilitation to establish revegetation ASAP (commence rehabilitation trajectory and bushfire resilience ASAP); * Use of local PCTs and key veg species for rapid veg establishment; * Use of alternative growth media to support rapid veg establishment;		E - Rare	N/A	N/A	2 - Minor	N/A	N/A	N/A	N/A	Low	n/a	n/a	Rehabilitation strategy proposes progressive rehabilitation and rehabilitation implementation methods to optimise rehabilitation establishment and success.

Attachment B

Rehabilitation Trigger, Action and Response Plan (TARP)

EMM
creating opportunities

Table B.1 Conceptual rehabilitation trigger, action and response plan (TARP)

Rehabilitation aspect	Item	Indicator	Trigger/response				
			Monitoring method(s)	Trigger / response	Condition Green	Condition Amber	Condition Red
Landform stability	1	Slope gradient	• Construction inspection test point (ITP), hold and witness points. • Annual walkover. • Annual rehabilitation monitoring.	Trigger	Constructed landform has been constructed to no steeper than 3° of design slope gradient.	Constructed landform has been constructed steeper than 3° but less than 5° of design slope gradient.	Constructed landform has been constructed steeper than 5° of design slope gradient.
				Response	No response required provided the slopes are stable. Continue monitoring program.	Undertake re-grading and revegetation of the area. If unable to re-grade, implement more intensive erosion control such as rock/soil matrix.	Undertake a review of the landform design, including survey if required. Undertake re-grading and revegetation of the area, if required.
	2	Erosion control	• Inspections following rainfall. • Annual walkover. • Annual rehabilitation monitoring.	Trigger	No gully or tunnel erosion. No rilling present.	Minor gully or tunnel erosion present and/or rilling <300 mm deep.	Significant gully or tunnel erosion present and/or rilling >300 mm deep.
				Response	No response required. Continue monitoring program.	An inspection of the site will be undertaken by a suitably-trained person. Investigate opportunities to install water management infrastructure or other controls to address erosion. Remediate as appropriate.	Undertake a review of the drainage of the area and provide recommendations to appropriately remediate the erosion. Remediate as soon as practicable.
	3	Drainage condition	• Inspections following rainfall. • Annual walkover. • Annual rehabilitation monitoring.	Trigger	Drainage condition is in accordance with the design criteria established within this document.	Landforms exhibit minor drainage issues, but issues unlikely to result in rehabilitation failure.	Landforms exhibit significant drainage issues resulting in, or are likely result in, rehabilitation failure.
				Response	No response required. Continue monitoring program.	An inspection of the site will be undertaken by a suitably trained person. Investigate opportunities to address issues. Remediate as appropriate.	Undertake a review of the drainage design and provide recommendations to appropriately remediate the area. Remediate as soon as practicable.
Water quality Includes quality of: • downstream receiving waters (eg Macleay River) • water in reservoirs	4	Water quality parameters	• Routine water quality monitoring.	Trigger	Surface water quality of runoff from rehabilitation areas is within criteria.	Water quality exceeds performance criteria but does not indicate a long-term rehabilitation issue.	Water quality exceeds criteria, indicating a long- term rehabilitation liability.
				Response	No response required. Continue monitoring program.	Review and investigation of water quality monitoring and management where appropriate. Implement relevant remedial measures where required.	Reporting as per relevant statutory reporting requirements. Implement relevant responses and undertake immediate review to determine source of issues and implement remediation measures identified as soon as practicable.
Soil/spoil quality	5	Soil parameters	• Annual rehabilitation monitoring.	Trigger	Soil properties meet criteria and no indication of not being able to support vegetation establishment.	Soil properties are not meeting criteria and indication of not being able to support vegetation establishment.	Soil properties have not met criteria and are not supporting vegetation establishment.
				Response	No response required. Continue monitoring program.	Conduct investigation and take samples of soil/spoil to determine the need for ameliorants or other management options.	Engage a consultant to assist with recommendations to appropriately remediate soil/spoil quality and depth. Remediate as soon as practicable.

Table B.1 Conceptual rehabilitation trigger, action and response plan (TARP)

Rehabilitation aspect	Item	Indicator	Trigger/response				
			Monitoring method(s)	Trigger / response	Condition Green	Condition Amber	Condition Red
Revegetation – Native vegetation	6	Surface cover	• Annual rehabilitation monitoring.	Trigger	Five years following revegetation to woodland, a minimum of 70% total ground cover (vegetation, leaf litter, mulch) is present within rehabilitated areas.	Five years following revegetation to woodland, total ground cover (vegetation, leaf litter, mulch) is a minimum of 60% in rehabilitated areas.	Five years following revegetation to woodland, total ground cover (vegetation, leaf litter, mulch) is a minimum of 50% within rehabilitated areas.
				Response	No response required. Continue monitoring program.	Review rehabilitation procedures where required to increase vegetation cover. Assess opportunities for corrective actions as appropriate.	A suitably trained person to inspect the site. Investigate use of appropriate management options to remediate. Remediate as appropriate.
	7	Species composition	• Annual rehabilitation monitoring.	Trigger	Five years following revegetation to woodland, species composition comprises native tree and shrub species consistent with reference sites.	Five years following revegetation, native tree and shrub species composition comprises <75% species diversity of reference sites.	Five years following revegetation, native tree and shrub species composition comprises <50% species diversity of reference sites
				Response	No response required. Continue monitoring program.	Review rehabilitation records to identify possible causal factors. Review native seed mix and amend if necessary. Consider remedial actions such as in-fill tubestock planting or re-seeding to achieve required species composition.	An inspection of the site will be undertaken by a suitably trained person. Investigate remedial options to achieve required species composition.
Revegetation – Modified pasture	8	Surface cover	• Annual rehabilitation monitoring.	Trigger	Following revegetation, vegetative cover (vegetation, leaf litter, mulch) is within 10–20% of analogue sites.	Following revegetation, total ground cover (vegetation, leaf litter, mulch) is within 20–40% of analogue sites.	Following rehabilitation to pasture or native grassland, total ground cover (vegetation, leaf litter, mulch) is more than 40% of the range of analogue sites.
				Response	No response required. Continue monitoring program.	Review procedures where required to increase vegetation cover.	An inspection of the site will be undertaken by a suitably trained person. Investigate use of appropriate management options to remediate. Remediate as appropriate.
	9	Species composition	• Annual rehabilitation monitoring.	Trigger	Two years following revegetation, modified pasture species composition is consistent with analogue sites in the local area.	Two years following revegetation, <75% of modified pasture species are present as compared to local analogue sites.	Two years following revegetation, <50% of modified pasture species are present as compared to local analogue sites.
				Response	No response required. Continue monitoring program.	Investigate additional weeding and re-seeding where required and ensure seed mix utilised is consistent with desired species composition.	An inspection of the site will be undertaken by a suitably trained person. Investigate remedial options to achieve required species composition.
Bushfire	10	Fuel load	• Annual walkover. • Annual rehabilitation monitoring.	Trigger	Fuel loads are assessed and managed as required (including maintaining fire breaks) and there is firefighting access across rehabilitation areas and water resources available for fighting fires.	Monitoring indicates elevated fuel loads.	Bushfire has damaged, or is likely to damage, rehabilitation areas.
				Response	No response required. Continue monitoring program.	Assess fuel load reduction options. Reduce fuel loads and ensure access tracks are cleared. Inspect water sources and ensure sufficient water is available.	Investigate remedial options to achieve required species composition (e.g. in-fill tubestock planting and/or direct seeding). Review bushfire management controls to ensure monitoring and maintenance is completed for fuel loads and access tracks.

Table B.1 Conceptual rehabilitation trigger, action and response plan (TARP)

Rehabilitation aspect	Item	Indicator	Trigger/response				
			Monitoring method(s)	Trigger / response	Condition Green	Condition Amber	Condition Red
Weeds	11	Weed diversity and abundance	• Inspections following rainfall. • Annual walkover. • Annual rehabilitation monitoring.	Trigger	Following revegetation, weed abundance is within 10–20% of analogue sites and no High-Threat weeds are present.	Following revegetation, weed abundance is 20–40% higher than analogue sites and/or High-Threat weeds are present.	Following revegetation, weed abundance is >40% higher than analogue sites and/or High-Threat weeds are present.
				Response	Continue routine weed control programs. Continue monitoring program.	Assess opportunities to augment existing controls or implement supplementary controls. Implement additional measures.	Engage with external stakeholders on opportunities to coordinate control programs (type and intensity) within the Project area and surrounding areas. Implement additional/coordinate targeted control programs. Review ongoing control strategy. Investigate remedial options to mitigate continued incursion of High-Threat weeds and general weed abundance.
Pest animals	12	Pest animal abundance (vertebrates)	• Inspections following rainfall. • Annual walkover. • Annual rehabilitation monitoring. • Routine pest animal inspection program.	Trigger	Pest animal abundance is stable/consistent with local analogue sites. Impacts on rehabilitation areas is limited or absent.	Pest animal abundance and/or evidence of impacts on rehabilitation areas (eg grazing, burrowing) are increasing	Pest animal abundance and/or evidence of impacts on rehabilitation areas (eg grazing, burrowing) are significant and threaten rehabilitation success.
				Response	No response required. Maintain with existing controls.	Assess opportunities to augment existing controls or implement supplementary controls. Implement additional measures.	Engage with external stakeholders on opportunities to coordinate control programs (type and intensity) within the Project area and surrounding areas. Implement additional/coordinate targeted control programs. Review ongoing control strategy. Investigate remedial options to mitigate pest-related damage and achieve required species composition.

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