

Lake Lyell Pumped Hydro Energy Storage Project

Scoping Report

Prepared for EnergyAustralia
July 2023



Lake Lyell PHES Project

Scoping Report

EnergyAustralia

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Executive summary

ES1 Introduction

EnergyAustralia NSW Pty Ltd (EnergyAustralia) is investigating the development of the Lake Lyell Pumped Hydro Energy Storage (PHES) Scheme (the Project). The Project is anticipated to provide between 300 and 350 megawatts (MW) of electricity generating capacity for up to 8 hours during peak demand. At a basic level, it will consist of upper and lower water reservoirs, a pipeline connecting them, and a hydro-electric power station connected to the national energy grid that is capable of generating or consuming electricity.

The Project will be located approximately 5 km west of Lithgow and 110 km west of the Sydney central business district, within the City of Lithgow Local Government Area. The Project is on land zoned as SP2 Electricity Generating Works, takes advantage of existing infrastructure (i.e. Lake Lyell) associated with Mt Piper power station which will be decommissioned in the coming decades, and allows Lake Lyell to continue to serve a specific purpose in electricity generation (consistent with its existing use).

EnergyAustralia owns and operates the land and water at Lake Lyell, including large parcels of the surrounding land. The existing 330 kV transmission line from Mt Piper passes through this land. The land is zoned and water is licenced for power generation purposes. The topography surrounding Lake Lyell ranges from low lying and rolling hills to the south, south east and west, to steep and very steep terrain to the north and north east associated with Mt Walker.

This landscape setting of an existing reservoir below areas of steep elevation, existing ownership of assets and land by EnergyAustralia, appropriate zoning, and close proximity to existing transmission infrastructure, make it a prime location for pumped hydro energy generation by EnergyAustralia. While there are other reservoirs within the Lithgow region (such as Lake Wallace and Thompsons Creek reservoirs), Lake Lyell is the only existing reservoir with surrounding suitable topography close enough to the reservoir that would allow for a technically and economically feasible PHES scheme.

The objectives of the Project are to develop a long-term energy storage facility that will improve energy security, support renewable energy developments in the nearby Central-West Orana Renewable Energy Zone (REZ) and facilitate the decarbonisation of the NSW electricity grid.

ES2 Strategic context

The role of the Lake Lyell PHES Project in relation to the transition to a decarbonised electricity network in NSW is crucial. Pumped hydro schemes, such as the Project, synergise effectively with renewable energy technologies which are characterised by an intermittent pattern of generation, such as wind and solar power. The energy storage provided by pumped hydro schemes smooths both the supply of and demand for electricity, while providing firming and other ancillary grid services necessary to ensure the reliability of the electricity network.

The critical role of pumped hydro in the future of the National Electricity Market (NEM) is recognised by the Australian Energy Market Operator (AEMO) in the 2022 Integrated System Plan (ISP). The 2022 ISP outlines that without coal-fired generation, the NEM will require 46 GW/640 GWh (gigawatt hours) of dispatchable storage, in all its forms, by 2050 and identifies the 'most pressing need in the next decade (beyond what is already committed) is for dispatchable batteries, pumped hydro or alternative storage to manage daily and seasonal variations in the output from fast-growing solar and wind generation (2022 ISP, AEMO).

The NSW Government is targeting a 50% cut in emissions by 2030 with a goal of Net Zero emissions by 2050 and as such the *State Infrastructure Strategy 2022–2042* outlines a key objective to ‘achieve an orderly and efficient transition to Net Zero’. Pumped hydro energy storage projects play a key role in the energy transition, with the State Infrastructure Strategy identifying that ‘...the continued rapid shift to renewables will create a need to accelerate investment in replacement firming capacity – generally gas peaking generators, batteries and pumped hydro facilities’. The Lake Lyell PHES is anticipated to provide between 300 and 350 MW of electricity generating capacity for up to 8 hours during peak demand and as such supports the need for firming capacity identified by the State Infrastructure Strategy.

The NSW Electricity Infrastructure Roadmap outlines an expected \$32 billion in private sector investment by 2030, 6,300 construction jobs and 2,800 ongoing jobs mostly in regional NSW in 2030 and specifically identifies that a ‘number of these jobs will be delivered through the development of energy storage infrastructure, such as pumped hydro projects which offer a significant boost to regional NSW...’. As a large infrastructure project, the Lake Lyell PHSE will support the NSW Electricity Infrastructure Roadmap by creating an anticipated 600 jobs during construction and providing long term employment for operation and maintenance team. The Roadmap also introduces the NSW Pumped hydro recoverable grants program, recognising the complexities and long lead times in developing pumped hydro projects.

On 2 September 2022, NSW Treasurer and Minister for Energy Matt Kean announced ‘NSW’s pumped hydro future is being fast tracked as five projects, with a combined capacity of almost 1.75 gigawatts (GW), have been awarded funding under the NSW Pumped Hydro Recoverable Grants Program’. This includes funding support of \$11 m for the Lake Lyell Pumped Hydro Energy Storage project.

At a local level, the Lake Lyell PHES also supports the Lithgow City Council strategic and economic strategies by providing significant investment in local infrastructure supporting the energy transition. EnergyAustralia is in the process of developing a road map for community benefit-sharing opportunities for the Lake Lyell PHES project. This road map will assist in the development of meaningful commitments to share the wider regional benefits of the project with the local community including offsetting of local impacts. EnergyAustralia is applying an approach to fair dealing with neighbours impacted by energy infrastructure development consistent with the observations and recommendations of the Australian Energy Infrastructure Commissioner.

ES3 Project overview

The Project will comprise an upper reservoir constructed adjacent to the southern shoulder of Mt Walker, connected to the Farmers Creek arm of Lake Lyell, which would act as the lower reservoir for the pumped hydro scheme. It is currently proposed that the two reservoirs will be connected via a series of tunnels and an underground power house. Once constructed, the operation of the Project will allow hydroelectricity to be generated as water is transferred from the upper reservoir to the lower reservoir via the connecting tunnels and pump-turbines located in the underground power house. The reversible pump-turbines will also be able to act as a pump, allowing water to be pumped to the top reservoir during periods of peak renewable energy availability.

The Project will operate as an open loop system, with Lake Lyell remaining largely unchanged although water levels will fluctuate by approximately two metres during each pumping and generating cycle. There is expected to be one pumping and generating cycle each day.

Energy generated by the Project will be distributed to the NEM via a new switchyard that will connect to the existing 330 kV transmission lines that pass through the Project area to the south of Mt Walker.

The design of the Project has been prepared with the goal of minimising the impacts associated with the development and operation of a pumped hydro scheme. The use of Lake Lyell as a lower reservoir will negate the need for a lower reservoir to be built. The proximity of the Project area to existing electricity infrastructure also lessens the need for additional transmission infrastructure. The iterative nature of the design process will also allow some Project elements to be optimised to ensure that adverse impacts are minimised.

The technical and economic feasibility of a PHES scheme is significantly driven by the relative arrangement of the upper and lower reservoirs, including height differential and distance between the reservoirs. Where the lower reservoir already exists such as at Lake Lyell, the considerations are reduced to options for positioning the upper reservoir. Alternative locations for the upper reservoir have been considered however ultimately Mt Walker provides the only suitable elevation in proximity to Lake Lyell to provide sufficient pumped hydro electric generation potential to make the Project feasible. Notwithstanding this, there is opportunity to refine the position of the upper reservoir on Mt Walker to minimise environmental and visual impacts, and this has been the focus of EnergyAustralia during the current design process.

EnergyAustralia is progressing an early contractor involvement (ECI) approach to the design, including an iterative design optioneering and environmental assessment process. The ECI approach has so far identified design and siting options and alternatives for critical infrastructure, including the upper reservoir and powerhouse. As a result of this process, and in addition to the feedback received from the community during the preparation of this Scoping Report, a preferred option for the upper reservoir has been selected. This preferred option is a change from the original concept presented by EnergyAustralia in 2021 and is still subject to further geotechnical and design investigations, and will be further assessed during the concept design phase. However, it is anticipated to greatly reduce the visibility of the project from key communities in Lithgow and Bowenfels. The design approach is expected to continue to allow for refinement and iteration of the project as environmental studies and ongoing engagement activities are completed as part of the Environmental Impact Statement (EIS) process.

ES4 Engagement

EnergyAustralia has been a longstanding operator in the local area due to its ownership of the nearby Mount Piper power station and has been actively undertaking community engagement since acquisition of both Mount Piper and Wallerawang power stations in July 2013. EnergyAustralia commenced stakeholder engagement and consultation with nearby residents, Lithgow community members, interested stakeholders, and Mount Piper community members on development of the Lake Lyell Project in 2021, including face to face meetings, several briefings, and a series of community drop-in sessions. Engagement activities have continued through 2022 and 2023, including directly with nearby residents, the Lake Lyell local community group, Traditional Owners, commercial operators, Lithgow City Council and the general public. These activities used a combination of door knocks, letter box drops of a Community Newsletter, community drop-in sessions, face-to-face and online meetings, phone calls and emails. A particular focus of the 2023 engagement activities was consulting with individuals and residents likely to experience some visibility of the project and/or direct construction impacts, with door knocking of over 100 residences and 1:1 meetings with residents

EnergyAustralia remains committed to continuing the stakeholder engagement process, and to using the insights gained in the assessment of environmental, social, and economic impacts. An EIS consultation plan has been prepared that sets out the stakeholder engagement procedures which are planned to be undertaken during the EIS preparation and exhibition period that is expected to occur between 2023 and 2025. During this period, the goals of EnergyAustralia's community engagement program are to:

- Inform communities and stakeholders about the project, the EIS process, and opportunities to participate.
- Actively involve communities and stakeholders in the project's development and planning to improve outcomes.
- Encourage participation and seek input during preparation of the EIS, to identify issues of potential concern, obtain local insights and gain feedback on measures to address concerns.
- Demonstrate how community and stakeholder issues and feedback are being captured and used to inform project development and assessment.

EnergyAustralia is also committed to fair dealing with neighbours and will apply an approach consistent with the observations and recommendations of the Australian Energy Infrastructure Commissioner.

ES5 Proposed assessment approach

The *Environmental Planning and Assessment Act 1979* (EP&A Act) defines the statutory framework for planning approval and environmental assessment in NSW. Part 4 of the EP&A Act relates to development assessment and Division 4.7 relates specifically to State Significant Development (SSD). The project is SSD as declared by the *State Environmental Planning Policy (Planning Systems) 2021* (Planning Systems SEPP). As SSD, an environment impact statement (EIS) will be prepared to comprehensively assess potential impacts and engage with the community throughout the process.

The project will be referred under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) due to uncertainty regarding impacts on threatened species. It is anticipated that the project will be deemed a controlled action and that the project can be determined via an accredited assessment using the bilateral agreement between the Commonwealth of Australia and the State of New South Wales relating to environmental assessment (the assessment bilateral agreement).

The identification and consideration of matters for assessment in the EIS have been guided by the *SSD guidelines – preparing a scoping report* (DPIE, 2021) (Scoping Report Guidelines), and informed by preliminary assessments completed for the project to date. The following factors have been considered in accordance with the Scoping Report Guidelines:

- the scale and nature of the likely impact of the project and the sensitivity of the receiving environment
- whether the project is likely to generate cumulative impacts with other relevant future projects in the area
- the ability to avoid, minimise and/or offset the impacts of the project, to the extent known at the scoping phase.

The environmental matters requiring further ‘detailed’ or ‘standard’ assessment in the EIS (in accordance with Section 3.6 and Appendix D of the Scoping Report Guidelines) are summarised in Table ES1.

Table ES1 Level of assessment

Assessment Level	Matter
Detailed	Water
	Amenity – Visual
	Biodiversity (Terrestrial and Aquatic)
	Heritage – Aboriginal
	Social
Standard	Hazards and risks
	Heritage – Historical
	Land
	Amenity – Noise and vibration
	Traffic
	Air quality
	Economic

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1 Introduction

This Scoping Report provides background information, rationale, and a preliminary assessment of a proposed new pumped hydro energy storage facility in the City of Lithgow Local Government Area (LGA).

1.1 The project

1.1.1 Overview

EnergyAustralia NSW Pty Ltd (EnergyAustralia) is investigating the development of the Lake Lyell Pumped Hydro Energy Storage Scheme (the Project), a Project that is anticipated to provide between 300 and 350 megawatts (MW) of electricity generating capacity for up to 8 hours during peak demand. At a basic level, it will consist of upper and lower water reservoirs, a pipeline connecting them, and a hydro-electric power station connected to the national energy grid that is capable of generating or consuming electricity.

Water will be pumped from the lower reservoir to the upper reservoir when intermittent renewable energy output is high, and later allowed to flow back into the lower reservoir via a turbine to produce electricity when energy production from other sources is low and demand is high. This utilisation of the natural terrain will effectively allow the Project to act as a large battery capable of storing energy from the main grid.

The Project's upper reservoir will be a reservoir constructed on Mount Walker, a location selected due to its relative closeness to Lake Lyell and high elevation. Lake Lyell itself will act as the lower reservoir, which at Full Supply Level (FSL) the lake has an active storage volume of approximately 32.1 GL. It is not anticipated Lilyvale Dam or Lake Lyell reservoir will require any significant modifications. The reservoirs will be connected via pipelines that will pass through a hydro-electric powerhouse, which will contain two pump-turbines and electrical transformers. The pipelines and powerhouse may be situated underground, in which case a series of permanent tunnels would also be required.

Other elements of the Project will include upgrades and extensions to roads in the Project area, a bridge crossing over the Farmers Creek arm of Lake Lyell, an electrical switchyard, a short transmission line to connect the powerhouse to the existing nearby electrical transmission lines, and an administration building. A comprehensive list of the elements of the Project is provided in Chapter 3.

The Project will be an open-loop system. It will involve no direct water consumption, and therefore impacts on downstream water users will be minimal.

To support the objectives of the NSW Government's Electricity Infrastructure Roadmap, EnergyAustralia has been awarded funding under the NSW Pumped Hydro Recoverable Grants Program to assist with the cost of early stage, detailed feasibility studies for the Project, which is currently underway.

1.1.2 Location and site suitability

The Project will be located approximately 5 km west of Lithgow and 110 km west of the Sydney central business district, as shown in Figure 1.1. The nearest street address for the Project is Sir Thomas Mitchell Drive, South Bowenfels NSW 2790.

The area was chosen due to already having the required attributes necessary for a feasible pumped hydro project due to its favourable topography, appropriate zoning, ease of water and land access, and proximity to existing high voltage (HV) electrical infrastructure. The Project takes advantage of existing infrastructure (i.e. Lake Lyell) associated with Mt Piper power station which will be decommissioned in the coming decades, and allows Lake Lyell to continue to serve a specific purpose in electricity generation (consistent with its existing use).

This landscape setting of an existing reservoir below areas of steep elevation, existing ownership of assets and land by EnergyAustralia, and close proximity to existing transmission infrastructure, make it a prime location for pumped hydro energy generation by EnergyAustralia. While there are other reservoirs within the Lithgow region (such as Lake Wallace and Thompsons Creek reservoirs), Lake Lyell is the only existing reservoir with surrounding suitable topography close enough to the reservoir that would allow for a technically and economically feasible PHES scheme.

The Project area, as shown in Figure 1.2, is primarily located on Lot 103 DP 751651. Project elements may also be constructed on Lot 3 DP 246233 and Lot 4 DP 246233. These lots, as well as large areas of the land surrounding Lake Lyell, are owned by EnergyAustralia.

The Project area is wholly situated within the City of Lithgow LGA. The *Lithgow Local Environmental Plan 2014* zones the Project area as SP2 Electricity Generating Works. The predominant land zoning around the Project area are RU1 Primary Production, RU2 Rural Landscape, and C1, as the Project area lies immediately to the south of Marrangaroo National Park. Some areas around the foreshore of Lake Lyell are classified as RE1 Public Recreation, which reflects that the Lake is a popular recreational area used for fishing, boating, water-skiing, kayaking, camping, and swimming. Figure 1.3 shows the land zoning of the Project area.

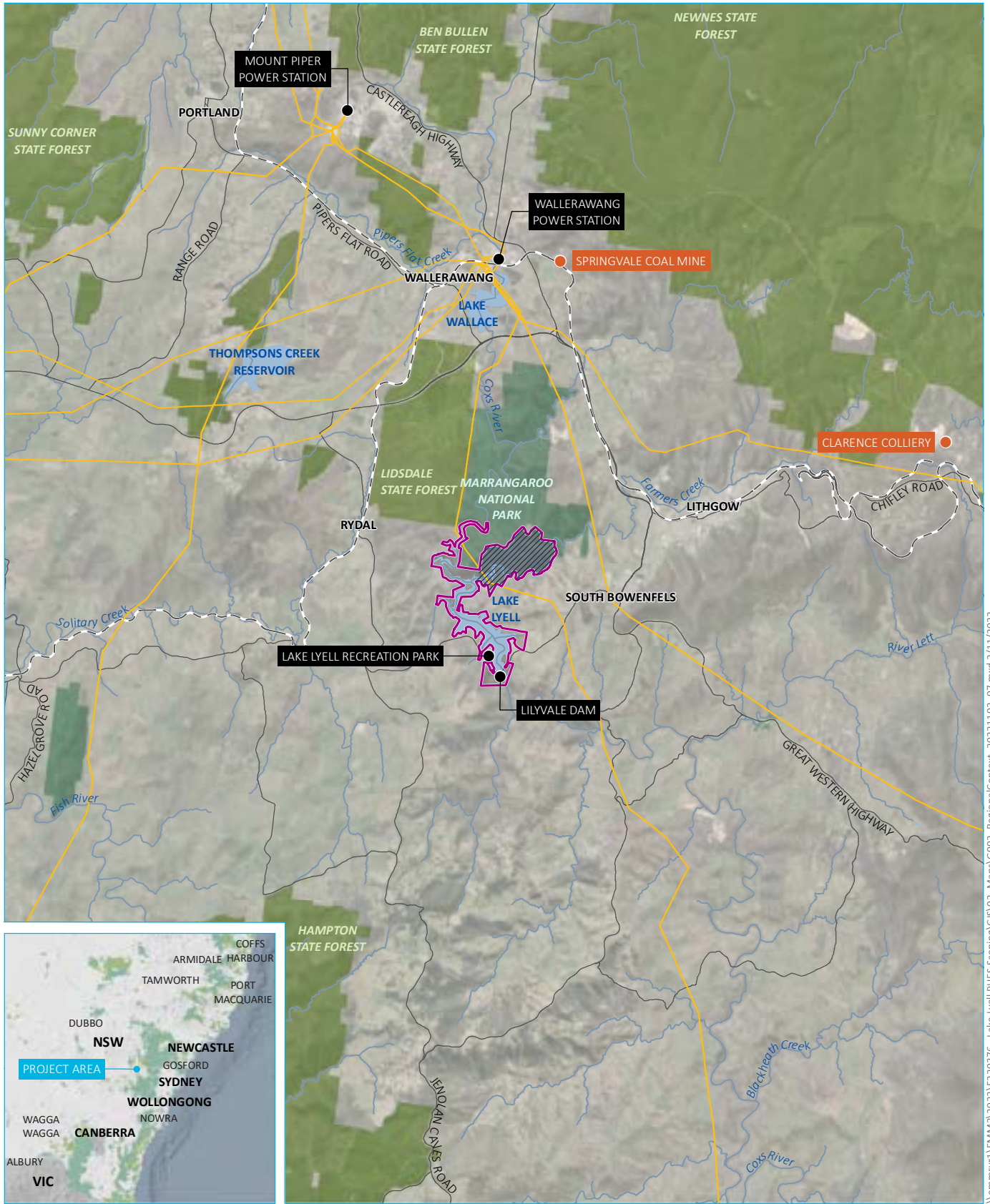
1.1.3 Objectives

The objectives of the Project are to develop a long-term energy storage facility that will improve energy security, support renewable energy developments in the nearby Central-West Orana Renewable Energy Zone (REZ) and facilitate the decarbonisation of the NSW electricity grid.

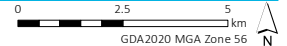
EnergyAustralia ceased electricity generation at the nearby Wallerawang power station in 2014 and the site was sold to a private company in September 2019. With Mt Piper coal-fired power station also due for closure in 2040, EnergyAustralia intends to take advantage of the unique opportunity to utilise existing infrastructure, water and transmission lines for the power station and transition to cleaner forms of energy.

The Project will contribute to supporting the energy needs of NSW by providing a range of benefits to consumers and assist in delivering the objectives of the NSW Electricity Infrastructure Roadmap. The large-scale energy storage provided by the Project will improve energy security for consumers in and around the Blue Mountains and broader NSW area. It will also facilitate the decarbonisation of the NSW electricity grid by supporting intermittent sources of renewable energy such as wind and solar and storing excess intermittent renewable energy for use during peak times such as early morning and evening.

In addition to these advantages, the operation of the Project will smooth both supply and demand for electricity and perform a range of other grid support and ancillary services, such as stabilising the electricity network through the provision of additional grid inertia.



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



KEY

- | | | |
|-------------------------|-------------------|--------------|
| Project area | Named watercourse | NPWS reserve |
| Main works | Named waterbody | NPWS reserve |
| Mine | State forest | State forest |
| 330kV transmission line | Major road | State forest |
| Rail line | | |
| Major road | | |

INSET KEY

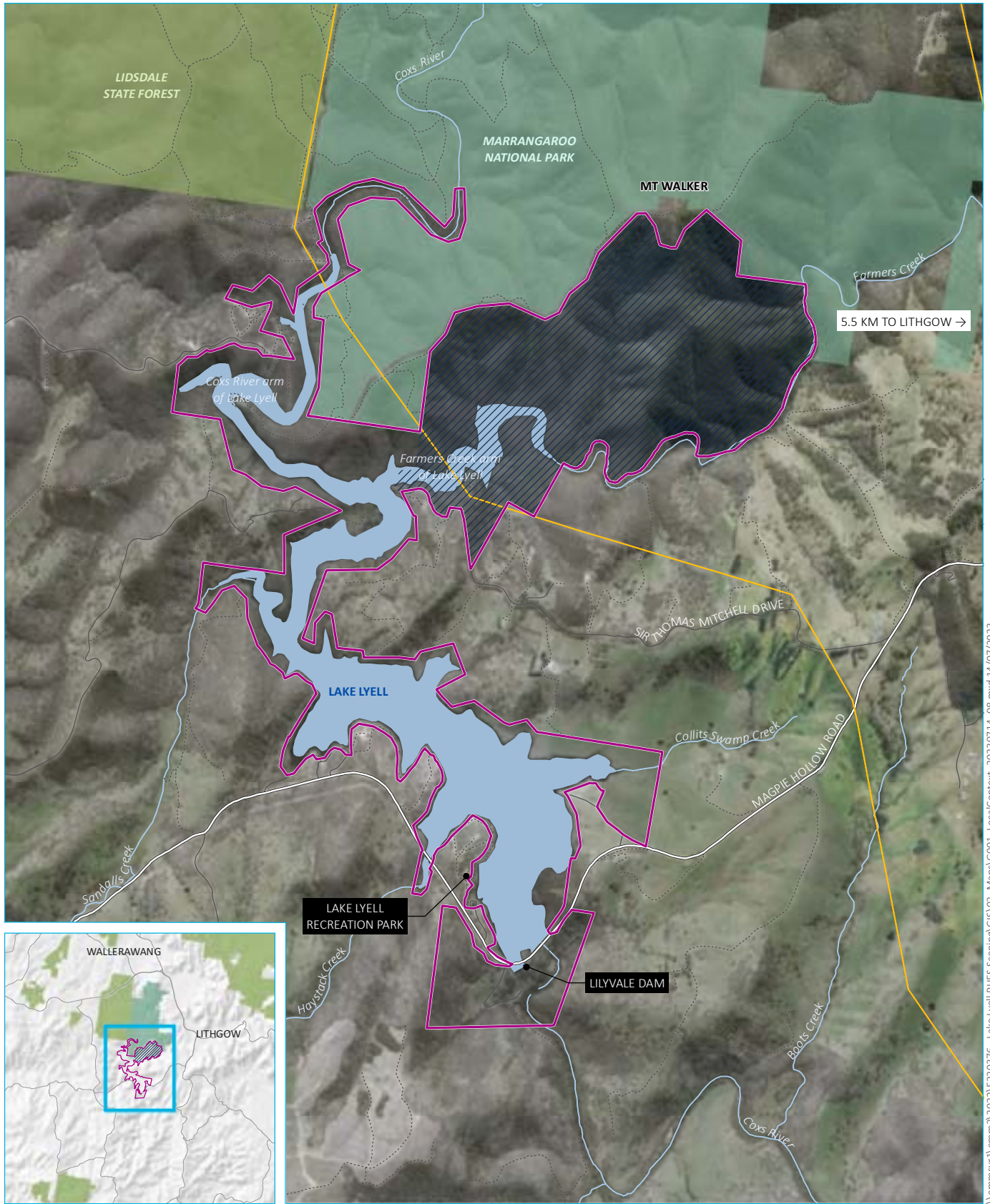
- | |
|--------------|
| Major road |
| NPWS reserve |
| State forest |

Regional context

Lake Lyell PHES Project
Scoping report
Figure 1.1



\\emmsvr1\EMM\2022\220376 - Lake Lyell PHES Scoping\GIS\02_Maps\G002_RegionalContext_20221102_07.mxd 2/11/2022



Source: EMM (2023); ABS (2021); DFSI (2020, 2021); GA (2011); Metromap (2022)

KEY

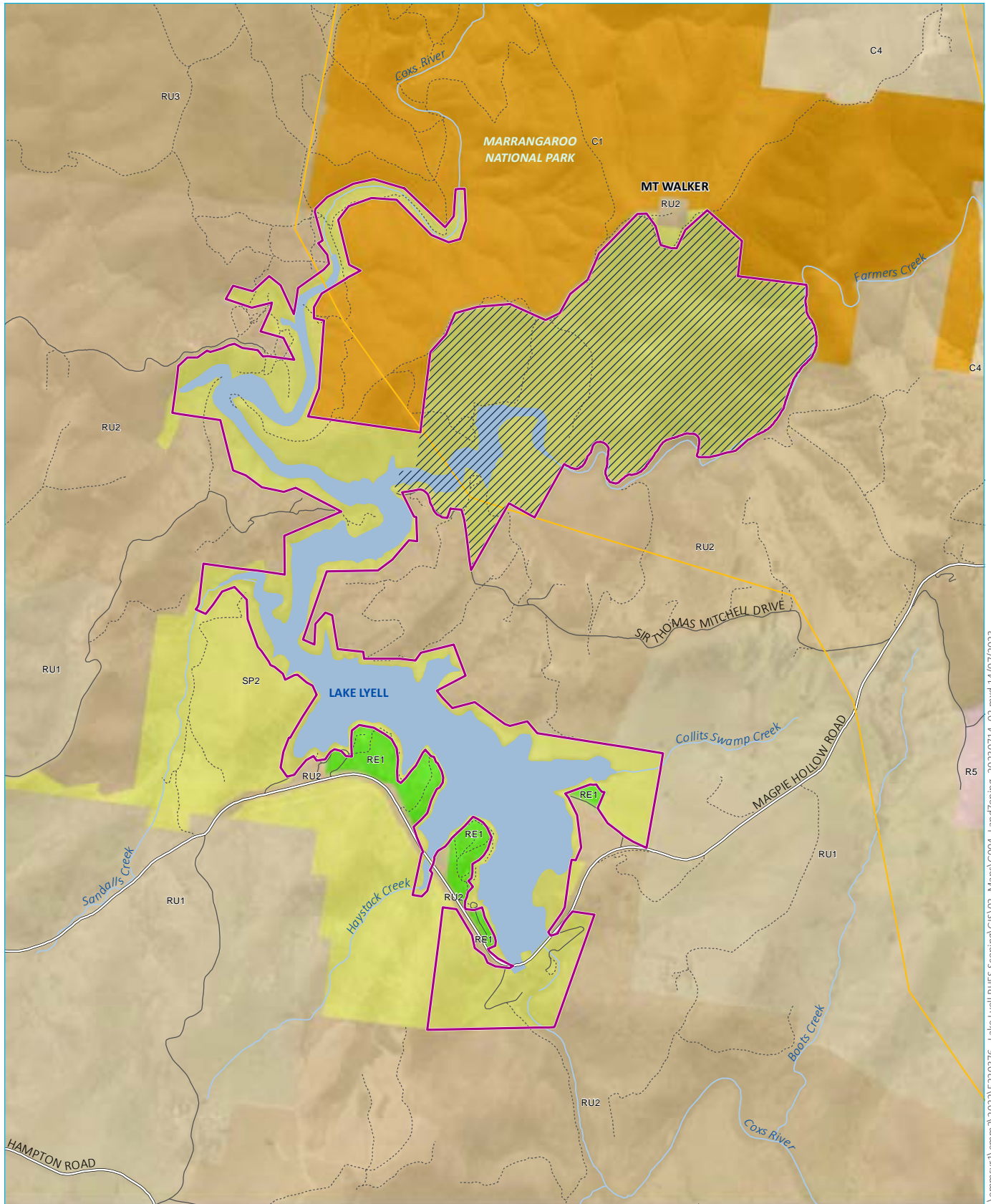
- | | | |
|-------------------------|-------------------|------------------|
| Project area | Named watercourse | INSET KEY |
| Main works | Named waterbody | Major road |
| 330kV transmission line | NPWS reserve | NPWS reserve |
| Major road | State forest | State forest |
| Minor road | | |
| Vehicular track | | |

Local context

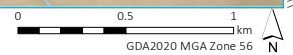
Lake Lyell PHES Project Scoping report
Figure 1.2



\\emmsvr1\emmsr2\2022\220376 - Lake Lyell PHES Scoping\GIS\02_Maps\G001_LocalContext_20230714_08.mxd:14/07/2023



Source: EMM (2023); BBSI (2021); ZPSI (2021); GDA (2021); GDA (2021); GDA (2021); GDA (2021)



KEY

- | | | |
|-------------------------|---------------------------------------|------------------------|
| Project area | Named waterbody | RE1 Public Recreation |
| Main works | Land zone | RU1 Primary Production |
| 330kV transmission line | C1 National Parks and Nature Reserves | RU2 Rural Landscape |
| Major road | C4 Environmental Living | RU3 Forestry |
| Minor road | R5 Large Lot Residential | SP2 Infrastructure |
| Vehicular track | | |
| Named watercourse | | |

Land zoning

Lake Lyell PHES Project
Scoping report
Figure 1.3



\\emmsvr1\emmsv2\2022\E220376 - Lake Lyell PHES Scoping\GIS\02_Maps\G004_LandZoning_20230714_02.mxd 14/07/2023

1.2 Background

1.2.1 History of Lake Lyell

Lake Lyell lies within the Coxs River system, which is a crucial river system for the provision of drinking water to Sydney. The lake was formed, for the purpose of supplying water to nearby coal-fired power stations, following the construction of the Lilyvale Dam in 1981/82. Constructed as a part of the Coxs River Water Supply Scheme, the dam itself is a 46 m high concrete-face rockfill dam situated on the Coxs River approximately 7 km southwest of Lithgow. Water from the Lake is used to supply water to the Mt Piper Coal-fired Power Station via the Lilyvale Pumping Station located to the south of the Lilyvale Dam wall. Water from the lake was also supplied to the Wallerawang Coal-fired Power Station until it was decommissioned in 2014.

The Lilyvale Dam underwent a series of upgrades in the 1990s and early 2000s to increase the capacity of Lake Lyell and to improve the durability and safety of the dam. Ownership of the dam was transferred to EnergyAustralia in September of 2013. Today Lake Lyell provides a vital water supply for nearby electricity generation purposes and is also a popular area for recreation, with the lake supporting activities such as boating, kayaking, water-skiing, swimming, camping, and fishing.

EnergyAustralia's ongoing use of water from Lake Lyell is regulated by the NSW Government in accordance with the *Greater Metropolitan Region Unregulated River Water Sources Water Sharing Plan (2011)* as per the *Water Management Act 2000* and EnergyAustralia's water access licence.

1.2.2 Key steps to minimise the impacts of the Project

The design of the Project has been prepared with the goal of minimising the impacts associated with the development and operation of a pumped hydro scheme. The location of the Project area presents an opportunity for this to be achieved, through the use of Lake Lyell as a lower reservoir, which will negate the need for a lower reservoir to be built. The proximity of the Project area to existing electricity infrastructure also lessens the need for additional transmission infrastructure to be constructed. No other technically or economically feasible sites have been identified for a PHES within the Lithgow region that provide the same opportunity to re-purpose existing assets (i.e. Lake Lyell).

In addition to the location of the Project, the iterative nature of the design process will allow the Project elements to be optimised to ensure that adverse impacts are minimised. With the exception of certain key elements of the Project, such as Lake Lyell as the lower reservoir, the design and positioning of Project components can be further refined subsequent to the receipt of information from environmental and social investigations. For this reason, broad Project areas have been identified to provide flexibility for the ongoing design and environmental assessment iteration process. This will allow the Project to proceed in a manner which minimises the adverse impacts associated with its development and operation.

Other steps that will be taken to lessen the Project's impacts will include the use of avoidance principles to mitigate ecological harm, and the implementation of a waste hierarchy that will prioritise the avoidance, reduction and re-use of waste generated throughout the construction and operation of the Project.

1.3 Related developments

A development application for geotechnical investigation works on EnergyAustralia's land (DA070/22) received consent from Lithgow City Council on 25 July 2022. The works involved drilling an initial set of boreholes and low-impact seismic refraction survey, and were completed in March 2023. A DA modification has also been submitted to seek consent for a further drilling for the installation of ground water monitoring and geotechnical bore holes, allowing the establishment of a regional groundwater monitoring network.

There is no significant development currently required for the project subject to a separate assessment.

Significant developments in the region (<25 km from the Project area) are predominantly mining and quarrying operations, particularly targeting black coal. Examples of such operations include Springvale coal mine, Clarence colliery, and Wallerawang quarry. These operations are located approximately 10 km north, 15 km west, and 7 km north of the Project area respectively. The established nature of these operations along with their distance from the Project area suggest that cumulative impacts will be minimal.

The single, existing development most directly related to the Project is the Mount Piper Power Station, located approximately 16 km to the north of the Project area. Lilyvale Dam, along with the nearby Thompsons Creek Dam, was built specifically for the purpose of providing the (now retired) Wallerawang Power Station and Mount Piper Power Station with water. The Mount Piper Power Station is set to be retired by 2040.

The role of the Lake Lyell PHES Project in relation to the transition to a decarbonised electricity network in NSW is also crucial. Pumped hydro schemes, such as the Project, synergise effectively with renewable energy technologies which are characterised by an intermittent pattern of generation, such as wind and solar power. The energy storage provided by pumped hydro schemes smooths both the supply of and demand for electricity, while providing firming and other ancillary grid services necessary to ensure the reliability of the electricity network. For these reasons, the nearest Renewable Energy Zones (REZs) announced in NSW and the renewable energy generation projects planned within them are related developments, as well as other renewable energy projects in the Lithgow region not currently within a REZ. Future projects that may be related to the Project were also identified as part of an initial scoping for cumulative impact assessment (see Section 6.13 and Appendix C).

1.4 The proponent

EnergyAustralia NSW Pty Ltd (ABN: 75163935635) is a wholly owned subsidiary of EnergyAustralia Holdings Pty Ltd which is an Australian private company specialising in the generation and supply of electricity and gas. EnergyAustralia Holdings Pty Ltd has been operating since 1995 and has been a wholly owned subsidiary of China Light and Power (CLP) Group since 2011. The company's headquarters are located in Melbourne at Level 19, 697 Collins Street Docklands Victoria 3008.

2 Strategic context

2.1 National Electricity Market transition

2.1.1 2022 Integrated System Plan

The 2022 Integrated System Plan (ISP), published by the Australian Energy Market Operator (AEMO) is a 30 year strategy for investment in the National Electricity Market (NEM) and “supports Australia’s highly complex and rapid energy transformation, switching from higher-cost, high-emission energy to lower-cost renewable energy, doubling capacity to power transport and industry, and at all times providing consumers with reliable, secure and affordable power” (2022 ISP, AEMO).

The 2022 ISP outlines that without coal-fired generation, the NEM will require 46 GW/640 GWh (gigawatt hours) of dispatchable storage, in all its forms, by 2050 and identifies the “most pressing need in the next decade (beyond what is already committed) is for dispatchable batteries, pumped hydro or alternative storage to manage daily and seasonal variations in the output from fast-growing solar and wind generation” (2022 ISP, AEMO).

The Lake Lyell PHES supports the 2022 ISP by providing firming and other ancillary grid services necessary to ensure the reliability of the electricity network.

2.1.2 State Infrastructure Strategy 2022–2042

Developed by Infrastructure NSW, the 20 year State Infrastructure Strategy is a plan to guide NSW Government investment decisions. The ‘Staying Ahead’ strategy for 2022–2042 “assesses infrastructure problems and solutions, and provides recommendations to best grow the State’s economy, enhance productivity and improve living standards for [the] NSW community”.

The NSW Government is targeting a 50% cut in emissions by 2030 with a goal of Net Zero emissions by 2050 and as such the State Infrastructure Strategy outlines a key objective to “achieve an orderly and efficient transition to Net Zero”. This objective is supported by a series of recommendations, including the “Steadfast implementation of the NSW Electricity Infrastructure Roadmap in support of reliability and affordability”.

Pumped hydro energy storage projects play a key role in the energy transition, with the State Infrastructure Strategy identifying that “...the continued rapid shift to renewables will create a need to accelerate investment in replacement firming capacity – generally gas peaking generators, batteries and pumped hydro facilities”.

The Lake Lyell PHES is anticipated to provide between 300 and 350 megawatts (MW) of electricity generating capacity for up to 8 hours during peak demand and as such supports the need for firming capacity identified by the State Infrastructure Strategy.

2.1.3 NSW Electricity Infrastructure Roadmap

The NSW Electricity Infrastructure Roadmap (NSW Department of Planning, Industry and Environment, November 2020) recognises that NSW has “some of the best renewable energy resources in the world” and provides a framework to deliver energy “infrastructure and secure NSW’s future as an energy superpower”. The Roadmap outlines an expected \$32 billion in private sector investment by 2030, 6,300 construction jobs and 2,800 ongoing jobs mostly in regional NSW in 2030 and specifically identified that a “number of these jobs will be delivered through the development of energy storage infrastructure, such as pumped hydro projects which offer a significant boost to regional NSW...”.

The Roadmap also introduces the NSW Pumped hydro recoverable grants program, recognising the complexities and long lead times in developing pumped hydro projects. On 2 September 2022, NSW Treasurer and Minister for Energy Matt Kean announced “NSW’s pumped hydro future is being fast tracked as five projects, with a combined capacity of almost 1.75 gigawatts (GW), have been awarded funding under the NSW Pumped Hydro Recoverable Grants Program”. This includes funding support of \$11 m for the Lake Lyell Pumped Hydro Energy Storage project.

As a large infrastructure project, the Lake Lyell PHES will support the NSW Electricity Infrastructure Roadmap by creating an anticipated 600 jobs during construction and would need a team of people to operate and maintain the asset over its long life.

2.2 Local strategic plans

Our Place Our Future, the *Lithgow City Council Community Strategic Plan 2035* provides a “vision for future growth and development and for the long-term sustainability of the Lithgow local government area”, presented as five key themes comprising:

1. caring for our community
2. strengthening our economy
3. developing our built environment
4. enhancing our natural environment
5. responsible governance and civic leadership.

Under the theme of 'Strengthening our economy', the “shift to energy efficiency/alternative energy” was “identified as a priority issue for the next 10 years by the community”, with investigation of renewable energy opportunities identified as an area of focus. “Transitioning from a coal based economy to renewable energy” was also identified as a key challenge under the theme of “Enhancing our natural environment”.

The importance of the transition to renewable energy is also recognised in the *Lithgow Regional Economic Development Strategy 2018–2022*, with an early stage priority action identified to “investigate business development opportunities in the energy sector, including renewables, to capitalise on existing infrastructure and location advantages”.

The Lake Lyell PHES supports the local Lithgow City Council strategic and economic strategies by providing significant investment in local infrastructure supporting the energy transition.

2.3 Natural and built features of the local area

Key features in and around the Project area are shown in Figure 1.2 and include the following:

- Lake Lyell, which has a capacity of approximately 32.1 GL and a catchment area of 380 km².
- Mount Walker, a mountain located approximately 1.2 kilometres (km) north of Lake Lyell. With a peak of approximately 1,190 metres (m), there is about a 350 m elevation gain from the Lake Lyell shoreline to the Mount Walker peak.
- Farmers Creek, a tributary of Lake Lyell which conjoins with the Lake within the bounds of the Project area.
- Coxs River, the main tributary of Lake Lyell, located to the west of the Project area.
- Line 76/77 Sydney South – Wallerawang – Ingleburn, a 330 kilovolt (kV) electricity transmission line that passes through the Project area.

- Marrangaroo National Park, located to the north of the Project area.
- Lithgow, with the closest residential area being Bowenfels which is located approximately 2.5 km east of the Project area.

Other residential areas relevant to the project include South Bowenfels, Lithgow, and Littleton located east of the project area, and Rydal to the west. Several residential properties are located more sparsely in the rural areas surrounding the project as well as tourism operators and agricultural properties. These receptors near to the project are generally shown in Figure 2.1. Not all receptors are expected to experience impacts from the project however this would be determined and assessed as part of the EIS, including continued targeted engagement with potentially affected receptors (see Section 5.5 for proposed engagement approach).

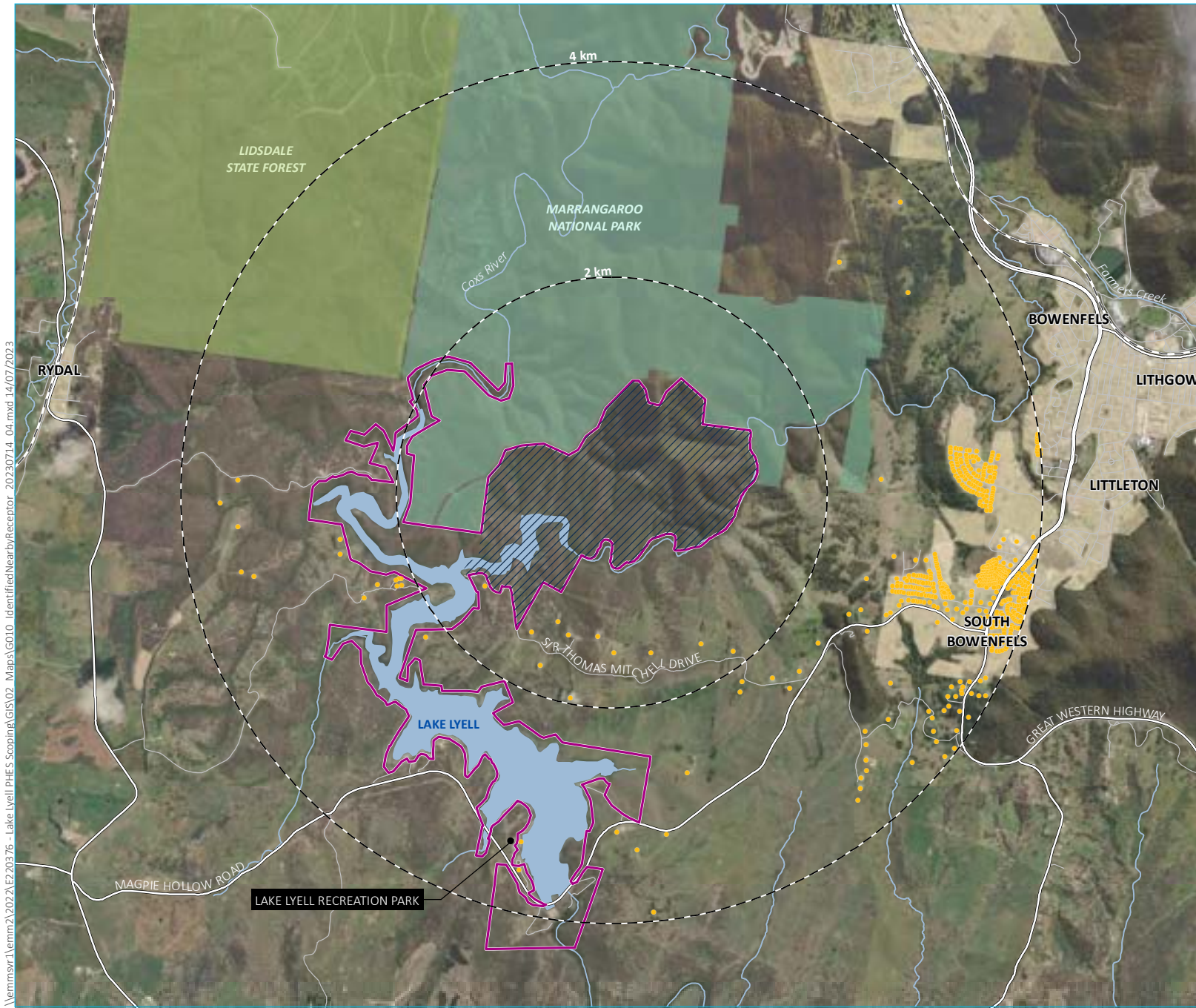
The values of the Marrangaroo National Park as listed by the statement of management intent (Office of Environment and Heritage 2014) include the water catchment of Marrangaroo Creek, Farmers Creek and the Coxs River, potential for native plants and animals (though there have been limited or no native plant or animal surveys conducted), scenic quality of Mt Walker and recreation activities, and Aboriginal heritage (though limited or no archaeological surveys have been conducted). These relevant values as they may pertain to the Project area are discussed in Chapter 6.

2.4 Future projects and cumulative impacts

In accordance with *Cumulative Impact Assessment Guidelines for State Significant Projects* (DPIE 2021c), a cumulative impact assessment (CIA) scoping summary has been completed to identify future relevant projects and the assessment matters that may result in cumulative impacts with the Lake Lyell PHES. The CIA scoping summary table is provided at Appendix C.

The project may generate cumulative impacts in conjunction with surrounding mines, energy developments or projects, including future projects in planning, during both construction and operation. These impacts may include cumulative amenity, social (including workforce and accommodation capacity), and biodiversity and Aboriginal heritage impacts at a regional context. However, there may also be a cumulative benefit to local communities from the project and other developments in the region through the generation of jobs.

The EIS will carry out a cumulative assessment in accordance with the CIA Guideline.



- KEY**
- Project area
 - Main works
 - Sensitive receptor
 - Urban/residential areas
- Existing environment
- Rail line
 - Major road
 - Minor road
 - Named watercourse
 - Named waterbody
 - NPWS reserve
 - State forest
 - Buffer around centre of Main Works area

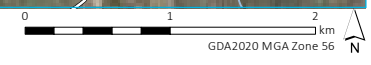
Identified nearby receptors

Lake Lyell PHES Project
 Scoping report
 Figure 2.1



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Source: EMM (2023); DFSI (2020, 2021); ESRI (2022); GA (2011)



2.5 Project justification and benefits

The AEMO 2022 ISP, *State Infrastructure Strategy 2022–2042* and NSW Electricity Infrastructure Roadmap all outline the urgent need for an increase in dispatchable energy storage to support the NEM transition and support the NSW Government goal of a Net Zero future. The project directly supports this need and the objectives of these strategies by providing between 300 and 350 megawatts (MW) of electricity generating capacity for up to 8 hours during peak demand. The NSW Government has recognised the importance of the project role in providing a critical investment in energy storage capacity and as such has committed funding under the NSW Pumped hydro energy grants program to facilitate development of the project.

The project is based on a preferred development option and a preferred upper reservoir location, based on consideration of technical, environmental and economic feasibility.

The benefits of the project also include:

- It's reliable – pumped hydro doesn't rely on seasonal water flows like traditional hydroelectricity. In fact, adding an upper dam increases water security by adding more water storage to the system.
- It supports renewable energy – storing large volumes of energy provides cover when renewables aren't available (e.g. when it's dark and still). When demand for power rises, pumped hydro storage plants can begin producing in minutes but keep running for many hours, keeping the lights on.
- It's a natural fit – the project can help progress the energy transition by leveraging existing infrastructure at Lake Lyell and nearby power lines.
- It can help stabilise the grid – the project can provide much-needed grid and system stability for NSW and will connect to the electricity grid in a strong part of the network.
- It's long-life – pumped hydro facilities can operate for decades with no reduction in storage capacity.
- It creates jobs – pumped hydro is a large infrastructure project that will create jobs during construction and needs a team of people to operate and maintain the asset over its long life.
- It is highly sustainable, with very long life equipment maintaining its performance without the need for expensive degraded battery cell replacements.

EnergyAustralia is currently exploring ways in which benefit sharing can be used within project communities to better progress large-scale renewable energy projects and investments. Benefit sharing initiatives are intended to sit alongside the organisation's existing broadscale social investment framework and project specific community engagement activities.

EnergyAustralia is in the process of developing a road map for community benefit-sharing opportunities for the Lake Lyell PHES project. This road map will assist in the development of meaningful commitments to share the wider regional benefits of the project with the local community including offsetting of local impacts. This will complement the investigation into impacts and mitigation measures for the project and will be further explored and detailed during the EIS, including as part of community and stakeholder consultation, including with Lithgow City Council. This will include feedback for how benefits could be structured as well as direct and indirect benefits implementation for the Lake Lyell project.

EnergyAustralia is cognisant of the impacts on neighbours caused by new energy infrastructure developments and is taking an approach to ensure fair dealing with neighbours through application to the extent practicable of the observations and recommendations of the Australian Energy Infrastructure Commissioner Annual Report 2022 Appendix A Section 2.

3 Project

3.1 Overview

The Project will comprise an upper reservoir constructed adjacent to the southern shoulder of Mt Walker, connected to the Farmers Creek arm of Lake Lyell, which would act as the lower reservoir for the pumped hydro scheme. The two reservoirs will likely be connected via a series of tunnels and an underground power house.

Once constructed, the operation of the Project will allow hydroelectricity to be generated as water is transferred from the upper reservoir to the lower reservoir via the connecting tunnels and turbine located in the power house. The reversible turbine will also be able to act as a pump, allowing water to be pumped to the top reservoir during periods of peak renewable energy availability. A generalised image of the process is shown in Figure 3.1.

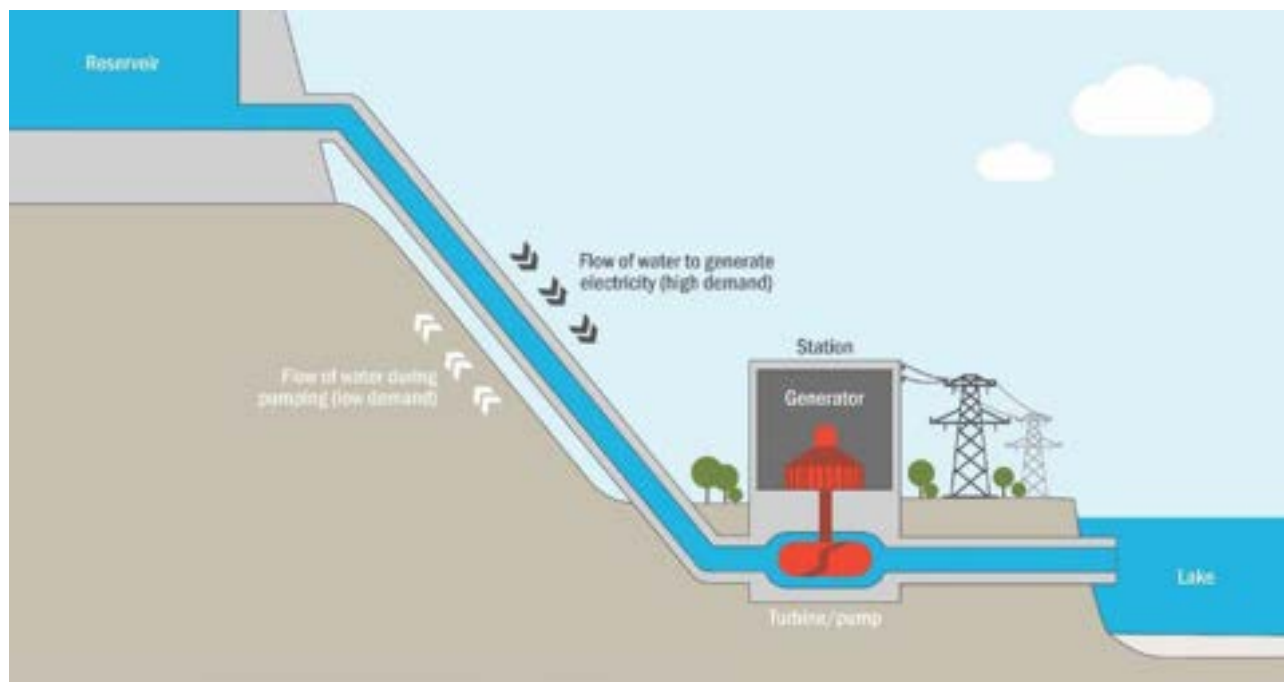


Figure 3.1 Pumped hydro process

The Project will operate as an open loop system, with Lake Lyell remaining largely unchanged although water levels will fluctuate by approximately two metres during each pumping and generating cycle. There is expected to be one pumping and generating cycle each day.

Energy generated by the Project will be distributed to the NEM via a new switchyard that will connect to the existing 330 kV transmission lines that pass through the Project area to the south of Mt Walker.

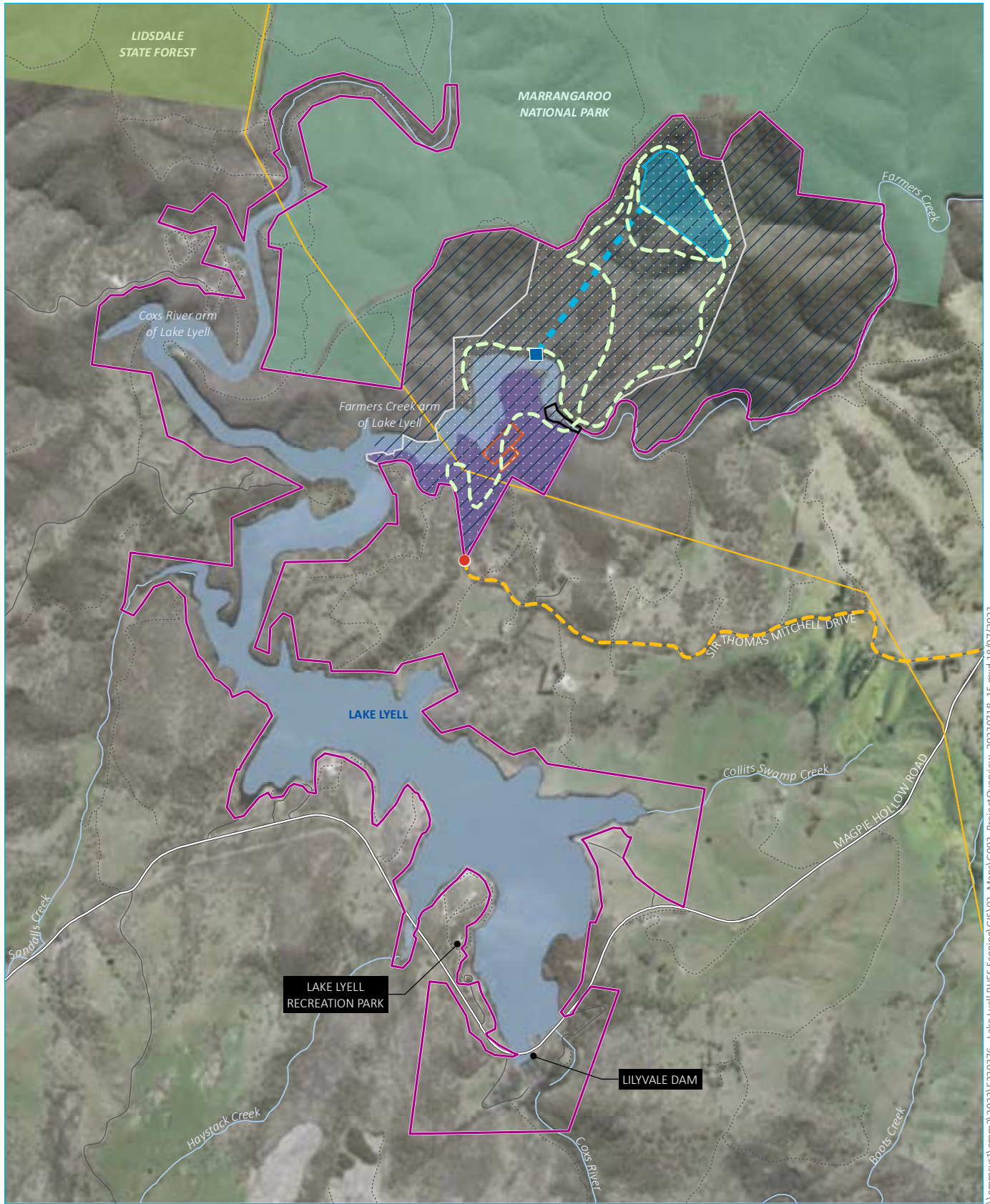
The Project is intended to operate with a round trip efficiency of approximately 77%. Current estimations suggest that its design will allow 300–350 MW of electricity production, equivalent to powering approximately 150,000 households, for approximately 8 hours during peak demand. It could also be operated to provide 225 MW of power over 12 hours at similar levels of efficiency. The anticipated life of the Project is approximately 80 years.

3.1.1 Key project elements

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

Table 3.1 Project key elements

Project component	Description
Key project elements – operational infrastructure:	<ul style="list-style-type: none"> • A rockfill gully dam on Mt Walker acting as an upper reservoir, complete with an intake structure. <hr/> • An intake/outtake structure in the Farmers Creek arm of Lake Lyell that will allow Lake Lyell to act as a lower reservoir. <hr/> • Existing spillway to manage the release of water from the lower reservoir. <hr/> • A power waterway consisting of tunnels between the reservoirs. <hr/> • An underground powerhouse including a transformer and at least one pump-turbine unit. <hr/> • Access tunnels and portals between the surface and the powerhouse. <hr/> • New roads to access the site, switchyard, powerhouse and upper reservoir. This includes a new bridge crossing across the Farmers Creek arm of Lake Lyell. <hr/> • A high-voltage switchyard. <hr/> • A transmission line between the powerhouse and the nearby existing 330 kV transmission, via the high voltage switchyard. <hr/> • An administration building. <hr/> • A dredged channel within the Farmers Creek arm of Lake Lyell.
To support the construction of operational infrastructure, the following elements and activities are needed and are referred to as construction elements:	<ul style="list-style-type: none"> • Supporting services infrastructure, including: <ul style="list-style-type: none"> – construction power supply – potable water supplies – waste and wastewater management – communications infrastructure – site control infrastructure. <hr/> • Emergency infrastructure, including fire water tanks for fire control. <hr/> • Management of excavated spoil, cleared soils, vegetation and overburden. <hr/> • Spoil management areas. <hr/> • Construction pad(s) and facilities including a laydown area.



Source: EMM (2023); DFSI (2020, 2021); GA (2011); Metromap (2022)



KEY

- | | | |
|---|---|-------------------------|
| Project area | Upper reservoir | Major road |
| Main works | Indicative disturbance footprint | Minor road |
| Primary site access | Indicative location of intake | Vehicular track |
| Internal site access road | Indicative location for bridge crossing | Named watercourse |
| Primary site access route | Indicative HV switchyard location | 330kV transmission line |
| Indicative power waterway | Ancillary works area | Named waterbody |
| Indicative transmission line connection | | NPWS reserve |
| | | State forest |

Project areas and key design elements

Lake Lyell PHES Project
Scoping report
Figure 3.2



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3.1.2 Project areas

The Project area is approximately 760 ha in area and is shown in Figure 3.2. It comprises land owned and managed by EnergyAustralia and is intended to encompass the land and waterbody directly impacted by the Project. A portion of the land within the Project area owned by EnergyAustralia is currently leased to Lithgow City Council for the management and operation of the Lake Lyell Recreation Park.

The Main Works area is approximately 317 ha in area and is also shown in Figure 3.2. It comprises land owned and managed by EnergyAustralia where all direct, surface works are anticipated for the Project. This includes for the construction of all operational infrastructure listed previously in Table 3.1.

An indicative disturbance footprint is also shown in Figure 3.2 and is approximately 167 ha in area. The indicative disturbance footprint has been determined based on very early design reviews and is likely to change as the design and constructability of the project is developed and assessed. Further, the disturbance footprint would be refined as part of the EIS and as environmental studies are completed, to allow for survey, avoidance and minimisation to be incorporated into the design. As such, this indicative disturbance footprint is not fixed and will evolve with the Project.

Lake Lyell is an impounded water body that extends from Lilyvale Dam at the south of the Project Area, to the Cox's Creek arm of Lake Lyell to the north, and the Farmers Creek arm to the east. The impoundment up to the full supply level is a modified lake, with natural creeks and rivers extending beyond the impounded regions. Reference to the relevant impounded or natural sections of waterways is also shown on Figure 3.2.

3.1.3 Design options and early contractor involvement

The Project is still in an early stage with the development of a feasible design that is still subject to further advancement. As such there are elements that may change or be optimised as the design continues to be developed and refined. This includes the powerhouse and penstocks and their underground or above ground location, and final location of the bridge crossing and switchyard. This would also determine access requirements, i.e. the location, width and treatments of access roads needed both temporarily for construction and permanently for operation.

This report presents the design concepts in their current form and highlights where alternatives are being considered. Any alternatives considered are expected to occur within the currently defined Main Works area.

Early contractor involvement (ECI), including optimisation and selection of the preferred concept design is underway, and will be undertaken to ensure construction scope and impacts are fully understood, and to enable avoidance and minimisation of impacts to be considered as part of the design process. Once completed, the ECI will provide additional detail into the nature of the construction works, which will be reported in the EIS. This process and proposed timing is shown in Figure 3.3.

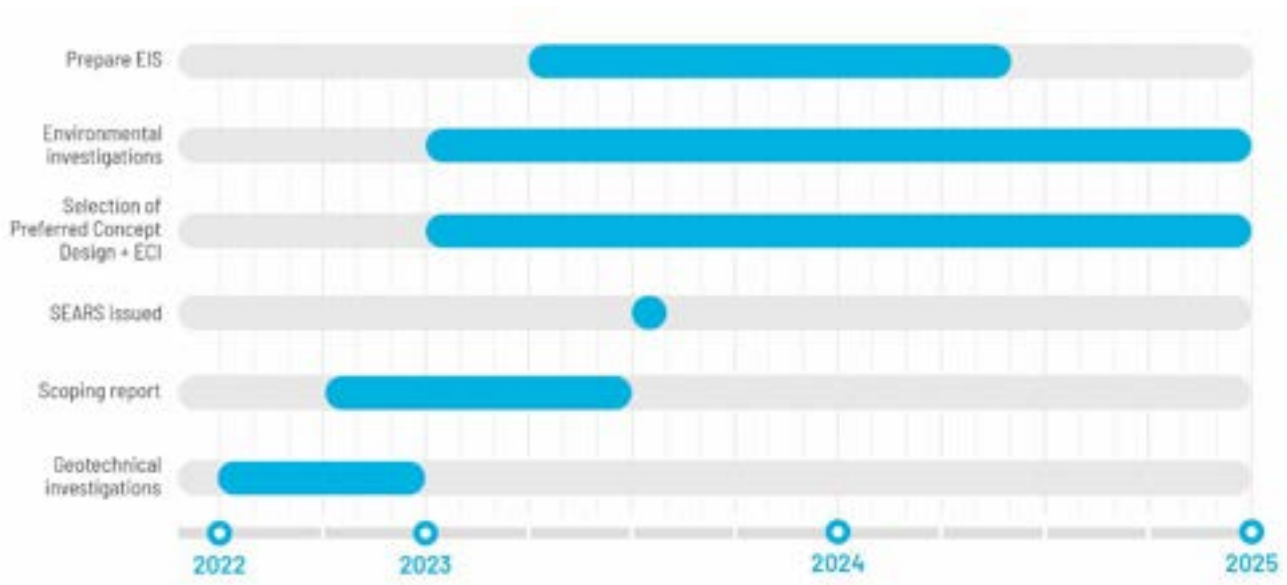


Figure 3.3 Indicative timing of design development

3.1.4 Capital project investment

The current cost estimate for the development of the Project is approximately \$1 billion. This estimate will be refined during the design phase.

3.2 Operational infrastructure

This section provides an overview of the infrastructure required for the Project, which will include the construction of a power house (likely underground), upper reservoir, tunnels and intake/outtakes with modifications to the Farmers Creek arm of Lake Lyell which will allow Lake Lyell to act as the lower reservoir. A schematic of the operational infrastructure is shown in Figure 3.4, and further described in this section. Three potential options for underground powerhouse cavern locations are shown, with the exact location to be informed by the results of geotechnical investigations.

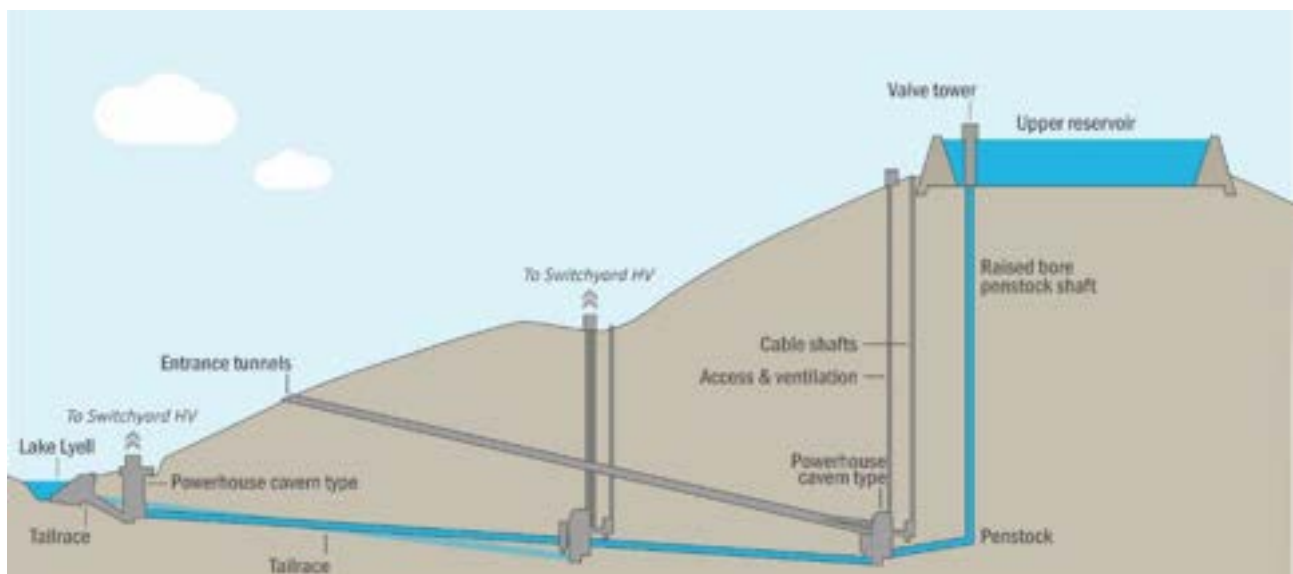


Figure 3.4 Operational infrastructure

3.2.1 Lower reservoir

The Project has been designed to take advantage of the existing body of water at Lake Lyell to use as the Project's lower reservoir.

Permanently submerged intake/outtake structures will be necessary and will be situated in the Farmers Creek arm of Lake Lyell, at the north-easternmost corner of the Lake (within the Main Works area). Current designs for the Project include a dredged channel that is approximately 40 m wide and 3–5 m deep. This will minimise the risk of scouring of the lakebed and potential debris/sediment carryover during the Project's operation.

The operation of the Project once completed is not expected to interfere with recreation on the lake however some restrictions are likely to be required in proximity of the intake/outtake to ensure public safety, as well as consideration for shore based recreation with water levels to fluctuate by approximately 2 m per pumping and generating cycle.

Preliminary assessment of the existing lower reservoir dam wall and its ability to withstand the cyclic nature of the loading and wetting caused by a PHES system has been completed and concluded that the proposed change in operation would have minimal impact on the safety status of the dam and the risk position of the dam.

A review of the existing Lilyvale Dam wall will be completed as part of the detailed design process and would identify any additional works or upgrades that may be required to facilitate the project. The Lilyvale Dam includes an existing spillway for management of release of flood water flows. Releases are currently regulated and managed through the Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011. Operational restrictions would ensure no change to downstream flood releases from Lilyvale Dam to the Cox's River occurs as a result of the project.

3.2.2 Upper reservoir

The upper reservoir will be situated west of and adjacent to the southern shoulder of Mt. Walker utilising a gully running south west towards Lake Lyell. It will be a rockfill dam design, meaning that the reservoir will be created by building a rockfill embankment to impound the reservoir within the gully. Utilising the gully allows the upper reservoir to be nested into the terrain substantially shielding visibility of the structure from the north and east. Present design concepts are for an embankment with a mean height of approximately 40 m although the centre of the embankment may extend to a height of approximately 90 m into the centre of the gully. The reservoir capacity is created through excavation and quarrying material from the mountain to create the embankment, which would allow the reservoir to contain approximately 4.4 GL of water with a gross head of approximately 255 m.

The upper reservoir will also include permanent intake structures to convey water to and from the power house. The type of structures to be implemented will be determined during the detailed design phase.

3.2.3 Power house

The pump turbine equipment will be situated in an underground cavern type power house between the penstock and the tailrace tunnels. It will contain the two pump-turbine units, auxiliaries and transformers which will distribute the generated electricity to the high-voltage switchyard (located at the surface). The exact location of the underground tunnels, shafts and power house will be informed by the results of geotechnical investigations and the concept design optioneering currently underway.

An alternative design also being considered is a surface embedded power house. If chosen, this design would remove the need for extensive tunnelling as the powerhouse would be constructed at the surface, with only the waterways being tunnelled. This alternative may be considered further subject to the findings of geotechnical investigations and further environmental assessment activities proposed as part of the detailed design and EIS process.

3.2.4 Power waterway tunnels and shafts

The upper and lower reservoirs will be connected via power waterways. The power waterways are a series of tunnels and shafts that will enable water to flow between the reservoirs through the pump turbines in the power house. The main components of the power waterway are the vertical penstock shaft, the horizontal penstock section, and the tailrace.

Both the vertical penstock shaft and the horizontal penstock section are likely to be concrete and steel lined to contain the pressure and minimise the turbulence of the water passing through them. These will connect the pump turbines to the upper reservoir. The tailrace tunnel will connect the pump turbines to the lower reservoir at a shallow incline ending at the water intake/outtake structure in Farmers Creek Arm.

3.2.5 Permanent access tunnels

Access tunnels are needed to provide efficient and safe access to the permanent underground infrastructure during both construction and operation of the power station. They serve multiple purposes including provision of access for personnel, electrical connection to the electricity grid, emergency egress, and ventilation. The expected tunnels for the Project are indicated in Table 3.2.

Table 3.2 Permanent access tunnels

Access tunnel	Description
Entrance tunnel	This will be the primary access route that connects the powerhouse cavern to the surface. It will have the largest diameter of the tunnels to allow vehicles and large machinery to be transported through it.
Access and ventilation tunnel	This will be a vertical shaft connecting the powerhouse to the surface. Its primary functions will be as a secondary access route and a means to cycle air through the powerhouse cavern.
Cable shafts	A vertical shaft used to provide a path for high voltage (HV) electrical and communications cables between the powerhouse and the surface.

3.2.6 High-voltage switchyard

A high-voltage (HV) switchyard will be required to allow power generated by the Project to be distributed to the NEM. It will likely be situated on the low hill opposite the water intake/outtake location on the south side of Farmers Creek. This location will minimise its impact on visual amenity without requiring a lengthening of the path of the transmission lines connecting the powerhouse to the existing TransGrid transmission lines. The existing lines are the 76/77 Sydney South – Wallerawang – Ingleburn 330 kV lines.

Key functions of the HV switchyard are switching, metering and electrical protection. The indicative location of the HV switchyard is shown in Figure 3.2.

3.2.7 Additional infrastructure

Several other pieces of infrastructure will be necessary for the operation of the Project. These include:

- an administration building for the management of site operations and communications
- workshops and storage facilities
- access roads, including a bridge across the Farmers Creek arm of Lake Lyell to provide vehicle access to the upper reservoir and underground components of the Project

- a short transmission line connecting the powerhouse to the existing 330 kV transmission line via the HV switchyard.

The location of the additional infrastructure will be informed by environmental and engineering constraints and confirmed as part of the detailed design. However, all components would be located within the Main Works area.

3.3 Construction

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

The project is expected to generate around 600 jobs during the construction period.

3.3.1 Overview of construction methods

Construction methods and techniques will be confirmed during the detailed design and ECI process. However, it is expected that excavation for the power waterway tunnels, access tunnels and the power house cavern will include drilling, boring and blasting methods. Construction of the upper reservoir will include civil excavation and construction, quarrying, drilling, and blasting. Intake/outtake works will also include dredging within the Farmers Creek arm of Lake Lyell.

3.3.2 Supporting services and infrastructure

Temporary and permanent ancillary facilities will be constructed during the construction phase. The exact requirements of the construction process will be established during the ECI and design phase, however the facilities are likely to include rock and aggregate crushing, concrete batching plants, stockpiling areas, storage areas, offices, amenities, first aid facilities and water supply and sewage management. An accommodation strategy would also be developed as part of the ECI and design phase, in consultation with Lithgow City Council.

3.3.3 Site access

The Project site will be accessed from the south, via Sir Thomas Mitchell Drive and Magpie Hollow Road from Great Western Highway as shown in Figure 3.5. It is expected that at least one new sealed road and two access tracks will be required to allow effective access for the construction, operation and maintenance of the Project.

Sir Thomas Mitchell Drive will need to be upgraded to carry construction traffic however the extent of upgrade will be informed by further design and road safety investigation. A new entry road from Sir Thomas Mitchell Drive into the site to the HV Switchyard and onto the power station site is necessary. Construction of a new bridge across the Farmers Creek arm of Lake Lyell will be needed to reach the lower intake/outtake location. Additional roads to the powerhouse access tunnel and on up to the upper reservoir will branch from it on the northern side of Farmers Creek. All newly constructed access roads are planned to be situated on land owned by EnergyAustralia, within the Main Works area.

3.3.4 Spoil management

To minimise the spoil generated by the construction of the Project, a number of removal and beneficial reuse methods will be considered including:

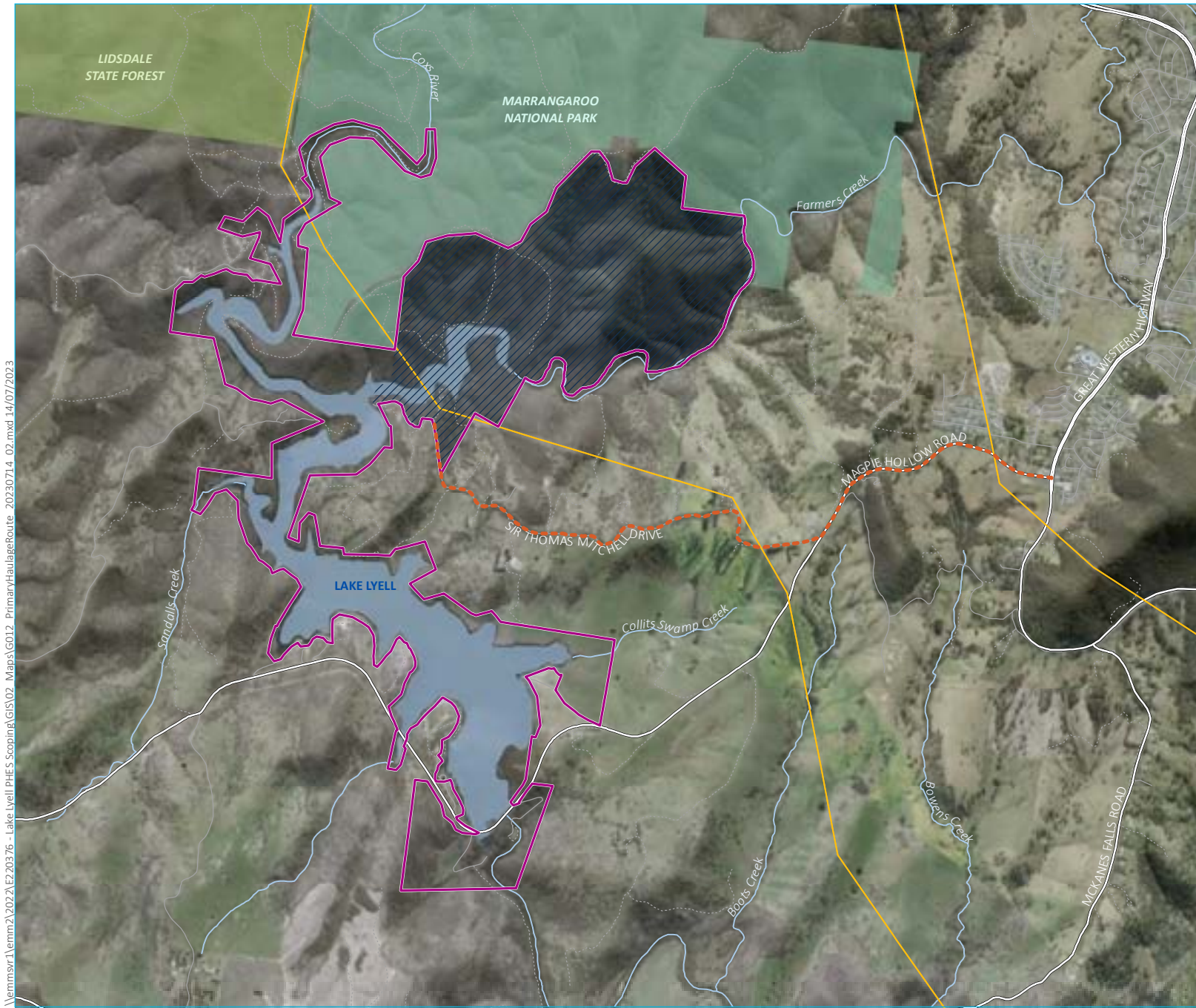
- use onsite won rock material in the construction of the upper reservoir dam wall
- use onsite won rock as aggregate for powerhouse concrete and cavern facing
- use onsite won rock to form hard stand and laydown areas

- use onsite won rock for road base and tracks
- spoil generated from the upper reservoir excavation to be used for local resurfacing
- excess quality rock and gravels stored as a resource for later beneficial use by the State of NSW.

These methods will ensure that minimal spoil is needed to be relocated within the local environment, thereby mitigating the ecological impacts of the Project. There may be a need for surplus spoil placement within the Main Works area however this would be determined through further investigation.

Further testing will be required to determine the viability of using the onsite won rock in the construction of the dam walls and as aggregate for the powerhouse.

Detailed investigation into spoil management and placement options within the Main Works for any further spoil is underway and will form part of the ECI.



- KEY**
- Project area
 - Main works
 - Primary site access route
 - Existing environment
 - 330kV transmission line
 - Major road
 - Minor road
 - Vehicular track
 - Named watercourse
 - Named waterbody
 - NPWS reserve
 - State forest

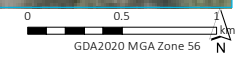
Primary site access route

Lake Lyell PHES Project
Scoping report
Figure 3.5



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Source: EMM (2023); DFSI (2017, 2020); GA (2011); Metromap (2022)



3.3.5 Construction schedule

The completion of technical designs and development activities for the Project are expected to take approximately 3 years concluding in 2025, and construction to take approximately 4 years to commencement of commercial operations in 2029. Preferred construction staging would be developed as part of the preferred concept design and ECI process.

3.4 Rehabilitation and decommissioning

All areas utilised during the construction phase that will not be required for the ongoing operation of the Project will be rehabilitated. The nature of this rehabilitation will be informed by relevant technical investigations and influenced by community and stakeholder engagement. The planned rehabilitation methods will be reported in the EIS.

3.5 Alternatives considered

EnergyAustralia supports the transition of the NEM and is proactively decarbonising its fleet of assets and seeking opportunities to provide renewable forms of energy generation and storage. Several other projects are currently underway. As part of EnergyAustralia's transition and the retirement of Mt Piper power station, EnergyAustralia has a unique opportunity to re-purpose existing energy generation assets and land at Lake Lyell.

During the early preliminary concept stage of the Project, consideration was given to a range of alternative development scenarios and options as outlined in this section.

3.5.1 Development scenarios

i 'Do Nothing' Scenario

The 'Do Nothing' scenario would mean no PHES development with the following outcomes:

- This option does not support national targets in relation to emissions reduction, the diversification of the NEM, the 2022 ISP and the need for more secure and affordable energy services across the NEM.
- This option does not support NSW state targets and strategies for renewable energy development, reduced emissions and a more affordable, secure and diverse NEM.
- This option does not support regional and local objectives including increasing renewable energy in the region or the themes identified in the Lithgow community strategic plan and strategic framework.
- This option does not provide ongoing, long-term use of Lake Lyell for energy generation (as it is currently zoned) to justify continued ownership, management, and maintenance costs. On closure of Mt Piper Power Station the inherent economic support for maintenance of the Lake would also end.
- At a local level this option removes the potential for local jobs and training related to the PHES development, including the diversification of opportunities within the local area.

The 'Do Nothing' scenario is not the preferred option.

ii Development Scenario

The 'Development' scenario would mean a PHES development with the following outcomes:

- This option supports national targets in relation to emissions reduction through continued diversification of the NEM, alignment with the 2022 ISP and the provision of services which contribute to a more secure and affordable energy provision across the NEM.
- This option would support NSW state targets and strategies for renewable energy development, reduced emissions and a more affordable, secure and diverse NEM.
- This option supports regional and local objectives including increasing renewable energy in the region and the themes identified in the Lithgow community strategic plan and strategic framework.
- This option provides ongoing, long-term use of Lake Lyell for energy generation (as it is currently zoned).
- At a local level this option provides opportunities for local jobs and training related to the PHES development, including the diversification of opportunities within the local area and helps secure the long-term future of Lake Lyell.

The 'Development' scenario is the preferred option.

3.5.2 Development requirements

i Selection of Lake Lyell

EnergyAustralia owns and operates the land and water at Lake Lyell, including large parcels of the surrounding land. The existing 330 kV transmission line from Mt Piper also passes through this land. The topography surrounding Lake Lyell ranges from low lying and rolling hills to the south, south east and west, to steep and very steep terrain to the north and north east associated with Mt Walker.

The EnergyAustralia owned land and lake are zoned for power generation purposes.

This landscape setting of an existing reservoir below areas of steep elevation, existing ownership of assets and land by EnergyAustralia, zoning for power generation, available water resource and close proximity to existing transmission infrastructure, make it a prime location for pumped hydro energy generation by EnergyAustralia.

While there are other reservoirs within the Lithgow region (such as Lake Wallace and Thompsons Creek reservoirs), Lake Lyell is the only existing reservoir with surrounding suitable topography close enough to the reservoir that would allow for a technically and economically feasible PHES scheme.

ii Criteria for reservoir arrangement

The technical and economic feasibility of a PHES scheme is significantly driven by the relative arrangement of the upper and lower reservoirs. Where the lower reservoir already exists such as at Lake Lyell, the considerations are reduced to options for positioning the upper reservoir. The energy stored is a simple product of the volume (as mass of water) and height, where more height and volume means more energy is stored. The larger the water volume and greater the height, the more energy storage capacity and duration is created. Utility scale energy storage requires millions of tonnes of water to be stored hundreds of metres above the lower reservoir. A further factor is the distance between the reservoirs. The shorter the horizontal distance then the lower the capital cost of expensive high pressure water ways, and lower friction losses resulting in better efficiency. These criteria when combined drive a project towards improved efficiency and better economics, with more energy stored more efficiently for a specific capital cost.

Accordingly the reservoir arrangement is more ideal when the:

- upper reservoir is of sufficient volume to provide a utility scale mass of water storage (as an order of magnitude > 2 GL, i.e. 2 million tonnes)
- upper reservoir is positioned at greatest vertical height to create maximum potential energy (preferably greater than +200 m above lower reservoir level)
- upper reservoir is positioned at a minimum horizontal distance from the lower reservoir to minimise pressure waterway capital cost and friction energy loss (preferably less than 1,000 m).

EnergyAustralia has developed preliminary screening criteria for identifying optimal reservoir arrangements. The ratio of distances between the upper and lower reservoir can be expressed as height (H) divided by horizontal distance (L). Where H/L is > 0.2 then the reservoir arrangement is more conducive to supporting an efficient and economically feasible project (noting there are many other factors which also drive project economics).

iii Selection of Mount Walker

EnergyAustralia owns a significant area of land on the north side of the lake including almost the full southern flank of Mt Walker from the Trig Point down to Farmers Creek extending to Farmers Creek Arm. The land is zoned as SP2 Infrastructure (Electricity Generation). For this reason, in assessing the development of a PHEs at Lake Lyell an early requirement was that the project be fully located within the existing boundaries of EnergyAustralia's appropriately zoned land holdings around the lake. A further criteria was that upper reservoir sites achieve the H/L ratio criteria of >0.2, with potential to store a volume of water greater than 2GL. This required study of topography surrounding the lake applying the H/L >0.2 criteria and considering the upper reservoir storage volume and constructability possible in those locations. This work quickly eliminated all surrounding land areas around Lake Lyell except for positioning a reservoir on Mt Walker. Only Mt Walker provides location options with a H/L ratio >0.2 with scope for a reservoir volume of at least 2 GL.

3.5.3 Possible upper reservoir locations considered

During the preliminary Project development stages, four potential site location options for upper reservoir placement in proximity to Lake Lyell were identified within and immediately adjacent to the EnergyAustralia landholdings at Lake Lyell. These site locations are:

- Location A – Mount Walker Trig Point. This is the highest elevation option with +340 m working height above Lake Lyell ($H/L = 340/1400 = 0.24$).
- Location B – Mount Walker Southern Ridge. This is an intermediate elevation with +260 m working height above Lake Lyell ($H/L = 260/980 = 0.26$).
- Location C – Mount Walker South West Valley. This is a lower elevation with +160 m working height above lake Lyell ($H/L = 160/640 = 0.25$).
- Location D – Mount Walker Gully. This is an intermediate elevation with +255 m working height above Lake Lyell ($H/L = 255/845 = 0.30$).

These options are illustrated by Figure 3.6 and described below.

i Location A: Mount Walker Trig Point

This location on Mt Walker considers the use of the top of Mt Walker including the trig point, offering a working average height approaching +340 m. Creating the upper reservoir would require removing the top of the mountain to create the plinth for the reservoir footprint. This arrangement would however require land acquisition on the north side of Mt Walker within the Marangaroo National Park. Visual impact would be significant with the loss of the highest peak, and significant change in skyline. These factors were evaluated as having greater environmental and social impact than the preferred location and accordingly this siting option is not preferred.

ii Location B: Mount Walker Southern Ridge

This location would utilise the southern shoulder of Mt Walker, positioning the upper reservoir on the ridgeline running south approximately 90 m lower than the peak of Mt Walker. Initial assessment found that a reservoir with volume up to 4.4 GL was likely feasible, requiring the ridge height to be reduced by approximately 40 m to create the plinth for the reservoir footprint. Construction of the reservoir walls to approximately 40 m height would create the volume of the storage. The ridgeline location was assessed to create a lesser visual impact (than Location A) as the higher peak is retained with the reservoir wall partly restoring the elevation profile of the original ridgeline. This location provides for an elevation average of +260 m above, and 980 m horizontal distance to the lower reservoir, which provides a H/L ratio = 0.26 which satisfies the criteria outlined in Section 3.5.2i. With a possible volume of 4.4 GL it provides a grid scale energy storage in water to generate up to 335 MW for 8 hours, providing 2,680 MWh of energy. This location was identified as part of the early concept and as the preferred siting option for the Project, and was shared with the community. Community feedback to date has suggested this option is not supported due to potentially extensive visual impacts. Accordingly, this siting option is no longer preferred.

iii Location C: Mount Walker South West Valley

This location considered the creation of an elevated valley dam in a fold of the south west flank of Mt Walker. While the H/L criteria was achieved with a reduced visual profile, the low elevation of the valley dam would require a significantly larger volume to be stored. Accordingly a proposed upper reservoir at this site could not hold sufficient water to support a grid scale energy storage facility. This, together with the low elevation of +160 m resulted in an assessed energy storage capacity of less than 1 GWh which is below the scale required to support a grid scale storage project. Accordingly, this siting option is not preferred.

iv Location D: Mount Walker Upper Gully (Preferred location)

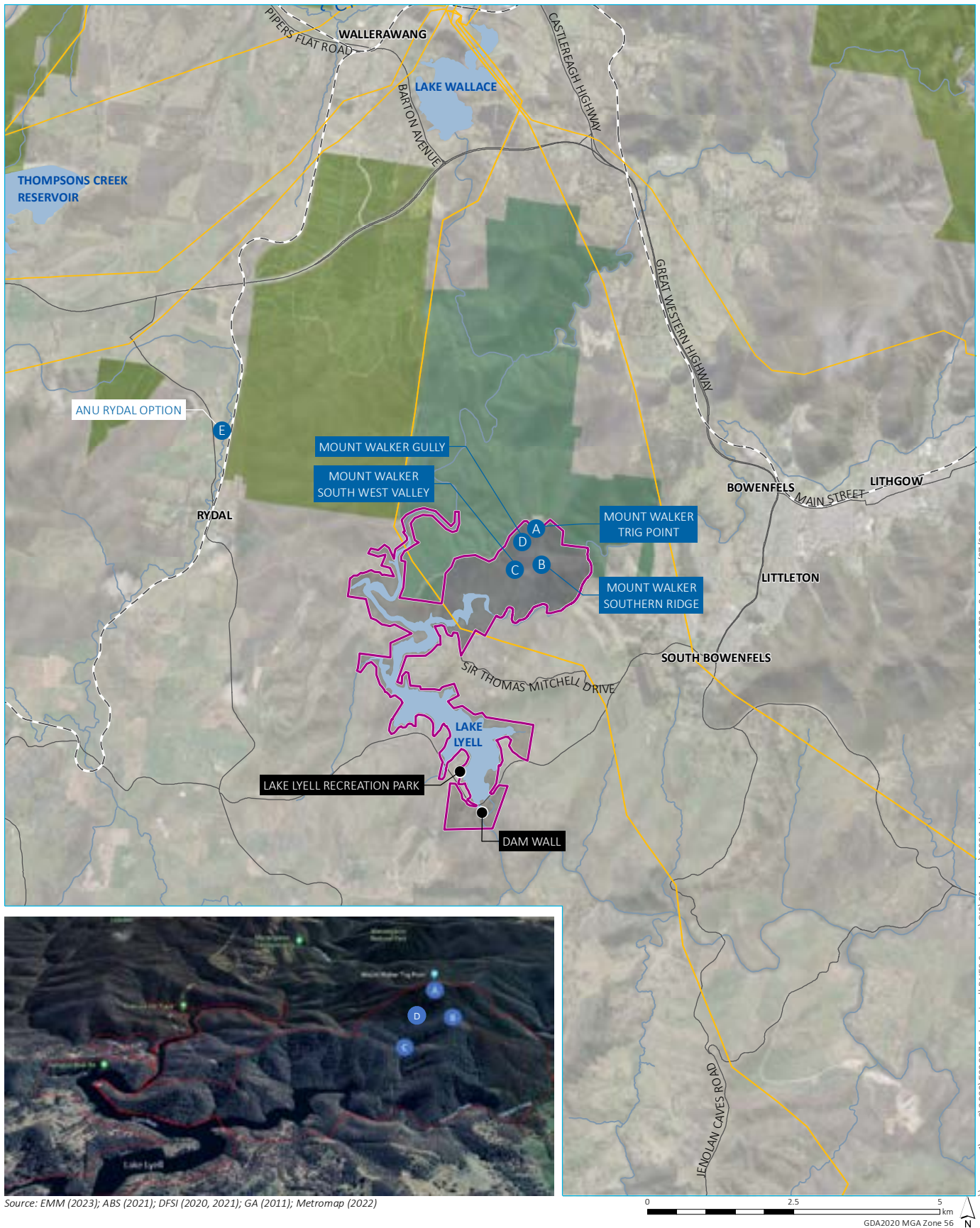
In response to community feedback to the early concept for the southern ridge location, optioneering was undertaken to challenge improvement on Location B. This work identified the possibility of constructing a nested reservoir in the upper gully of the south west flank of Mount Walker, here referred to as Location D. Further development of the concept has shown the feasibility of construction and satisfaction of the performance criteria. Visibility of this location option is substantially reduced compared to the early concept as the natural southern ridgeline is retained and screens visibility from the north and east. This location provides for an elevation average of +255 m above, and 845 m horizontal distance to the lower reservoir, which provides a H/L ratio = 0.30 which satisfies the criteria outlined in Section 3.5.2i and provides the best performance option. With a volume of up to 4.4 GL it provides a grid scale energy storage in water to generate up to 335 MW for 8 hours, providing 2,680 MWh of energy. Further investigation is needed to confirm the overall geotechnical suitability of the location and as such further micrositing or refinement may still be required.

If the requirement for the project to be located within or adjacent to existing EnergyAustralia landholdings is relaxed there are still no other locations in proximity of Lake Lyell which meet the $H/L > 0.2$ upper reservoir location criteria. As a comparison, work by Prof. Andrew Blakers published online in the ANU RE100 'Bluefield Atlas of PHES Sites' identifies another Lake Lyell connected upper reservoir location in proximity to Rydal (see Location E shown on Figure 3.6). EnergyAustralia reviewed available information relating to this work by ANU (2022) following feedback from the local community during engagement carried out for the Project and assessed it against the identified criteria for reservoir arrangement (Section 3.5.2i above).

The location is immediately up valley from Rydal village and would likely generate significant community concern in relation to hazards from potential dam break and flooding impacts. The Rydal site also does not meet the $H/L > 0.2$ criteria with $H=175$, $L=2900$ therefore $H/L=0.06$. Accordingly, the location is unlikely to be economically feasible due to the lower height, and significantly long horizontal distance between reservoirs. In addition, the upper reservoir has a very large footprint inclusive of farmland, residences, a connecting highway and railway line. Accordingly, this upper reservoir siting is not preferred from a technical feasibility or environmental and social impact perspective.

3.5.4 Ongoing options assessment and refinement opportunities

Alternatives to the location of the upper reservoir have been considered however ultimately Mt Walker provides the only suitable elevation in proximity to Lake Lyell to provide sufficient pumped hydro electric generation potential to make the Project feasible. As part of the design process and early contractor involvement referenced in Section 3.1.3, a detailed options analysis will be completed to ensure the final design and positioning of the upper reservoir is optimised to meet technical requirements as well as minimise environmental and visual impacts as much as technically feasible. This may involve carrying out further geotechnical investigations to assess other reasonable micro-siting options, alternative dam types, and mitigative design treatments should they be identified.



- KEY**
- Project area
 - Possible upper reservoir location
 - 330kV transmission line
 - Rail line
 - Major road

- Named watercourse
- Named waterbody
- NPWS reserve
- State forest

Alternative upper reservoir locations considered

Lake Lyell PHES Project
Scoping report
Figure 3.6



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4 Statutory context

The key relevant statutory requirements for the Project having regard to the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act), other NSW and Commonwealth legislation, and environmental planning instruments are summarised in this chapter. This chapter has been set out in accordance with the Scoping Report Guidelines and *State Significant development – preparing an environmental impact statement Appendix B to the state significant development guidelines* (DPIE 2021d) (EIS Guidelines), to cover the following:

- permissibility
- power to grant approval (i.e. approval pathway)
- other approvals
- pre-conditions to exercising the power to grant approval
- mandatory matters for consideration.

Detailed consideration of relevant statutory requirements will be provided in the EIS.

4.1 Permissibility

The applicable local planning instrument applying to the project is the *Lithgow Local Environmental Plan 2014* (Lithgow LEP). As defined by the Lithgow LEP, the project area is wholly within land zoned as SP2 Infrastructure (Electricity Generation). Within SP2 zone, the purpose shown on the Land Zoning Map (i.e. Electricity Generation), including any development that is ordinarily incidental or ancillary to development for that purpose, is permissible with consent. As the project is for the purpose of electricity generation, the project is permissible with consent.

4.2 Power to grant approval

4.2.1 Approval pathway

The EP&A Act defines the statutory framework for planning approval and environmental assessment in NSW. The EP&A Act is administered by the Minister for Planning and Homes, statutory authorities, and local councils. Part 4 of the EP&A Act relates to development assessment and Division 4.7 relates specifically to State Significant Development (SSD).

The project is SSD as declared by the *State Environmental Planning Policy (Planning Systems) 2021* (Planning Systems SEPP) for the reasons set out below. Accordingly, approval for the project is required under Part 4, Division 4.7 of the EP&A Act.

The Planning Systems SEPP identifies development that is SSD. Section 2.6(1) of the Planning Systems SEPP states:

- (1) Development is declared to be State significant development for the purposes of the Act if:
 - (a) the development on the land concerned is, by the operation of an environmental planning instrument, not permissible without development consent under Part 4 of the Act, and
 - (b) the development is specified in Schedule 1 and 2.

The project meets both these requirements; it requires development consent, and is a development specified in Schedule 1 of the Planning Systems SEPP.

Schedule 1 of the Planning Systems SEPP defines the following as SSD:

Electricity generating works and heat or co-generation

Development for the purpose of electricity generating works or heat or their co-generation (using any energy source, including gas, coal, biofuel, waste, hydro, wave, solar or wind power) that:

(a) has a capital investment value of more than \$30 million.

The project is development for the purpose of electricity generation and will have a capital investment value of more than \$30 million.

As SSD, an environment impact statement (EIS) will be prepared to comprehensively assess potential impacts and engage with the community throughout the process.

4.2.2 Consent authority

The Minister for Planning and Homes is the consent authority for the Project. However, as per Section 4.5(a) of the EP&A Act, the Independent Planning Commission (IPC) may be the consent authority for the Project if relevant criteria are met.

It is noted that a referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) will be made and should the project be a 'controlled action', approval from the Commonwealth Minister for the Environment and Water is also required.

4.3 Other approvals

This section identifies other approvals that are required to carry out the Project and explains why they are required. These approvals are outlined in Table 4.1 and have been grouped into the following categories:

- consistent approvals: which are approvals that, under Section 4.42 of the EP&A Act, cannot be refused for SSD and must be substantially consistent with the consent
- whether approval is required under the EPBC Act and whether the bilateral agreement applies
- other approvals: approvals that are not expressly integrated into the SSD assessment process
- approvals not required: approvals that would be required if the Project was not SSD as per Section 4.41 of the Act.

Table 4.1 Approvals and licences required

Approval	Requirement
Consistent approvals	
Overview	Section 4.42 of the EP&A Act outlines that the approvals listed below cannot be refused if necessary for carrying out an approved SSD and are to be consistent with the terms of the development consent for the SSD.
An approval under Chapter 3 of the <i>Protection of the Environment Operations Act 1997</i>	An EPL will be required for the applicable scheduled activities during construction and an EPL for operation (electricity generation). Certain construction activities would be determined during development of the detailed design and construction methodology but are expected to include concrete works, crushing, grinding or separating, road construction and waste disposal.

Table 4.1 Approvals and licences required

Approval	Requirement
An approval under Section 138 of the <i>NSW Roads Act 1993</i>	<p>Under Section 138 of the <i>Roads Act 1993</i>, a person must not undertake any works that impact on a road, including connecting a road (whether public or private) to a classified road, without approval of the relevant authority, being either Transport for NSW or local council, depending upon the classification of the road.</p> <p>The project will involve works on the local roads between the Great Western Highway and the project site, and therefore, would require approval under Section 138.</p>
Commonwealth approvals	
<i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act)	<p>An EPBC referral will be submitted to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW). The project has been referred for potentially significant impacts on a threatened species or ecological community.</p> <p>If the project is determined to be a 'controlled action', approval under the EPBC Act will be required.</p>
<i>Native Title Act 1993</i>	<p>The Commonwealth <i>Native Title Act 1993</i> recognises and protects native title rights in Australia. It allows a native title determination application (native title claim) to be made for land or waters where native title has not been validly extinguished, for example, extinguished by the grant of freehold title to land.</p> <p>Claimants whose native title claims have been registered have the right to negotiate about some future acts, including mining and granting of a mining lease over the land covered by their native title claim. Where a native title claim is not registered, a development can proceed through mediation and determination processes, though claimants will not be able to participate in future act negotiations. There are currently no native title determinations over the project area.</p>
Other NSW approvals	
<i>Crown Land Management Act 2016</i>	Approval(s) may be required from DPE-Crown Lands should closure of Crown roads be required during construction of the project.
Approvals not required	
Overview	Section 4.41 of the EP&A outlines the following approvals, permits etc are not required for an approved SSD.
<i>Fisheries Management Act 1994</i>	<p>The project will require work in water land to facilitate the construction of the intake/outtake, establishment of access roads and to establish a new crossing over the Farmers Creek arm of Lake Lyell within the project area. These works will be undertaken in accordance with NSW DPI <i>Policies and Guidelines on Fish-Friendly Waterway Crossings</i> (undated), <i>Policy and Guidelines for Fish Habitat Conservation and Management</i> (DPI 2013), and NSW <i>Guidelines for Controlled Activities</i>.</p> <p>A permit under the <i>Fisheries Management Act 1994</i> to dredge or carry out reclamation work on water land (s201), harm marine vegetation (s205), or block fish passage (s219) will not be required pursuant to Section 4.41 of the EP&A Act.</p>
<i>Heritage Act 1977</i>	An approval under Part 4, or an excavation permit under Section 139, of the <i>Heritage Act 1977</i> will not be required pursuant to Section 4.41 of the EP&A Act.
<i>National Parks and Wildlife Act 1979</i>	<p>An Aboriginal heritage impact permit under Section 90 of the <i>National Parks and Wildlife Act 1974</i> will not be required pursuant to Section 4.41 of the EP&A Act.</p> <p>There is potential for Aboriginal sites to occur within the Project site. Any Aboriginal heritage sites identified within the Project site will be avoided as far as practicable through the design process, and any potentially impacts Aboriginal heritage values will be subject to management measures commensurate with their assessed significance.</p>
<i>Rural Fires Act 1997</i>	<p>A bushfire safety authority under Section 100B of the <i>Rural Fires Act 1997</i> will not be required pursuant to Section 4.41 of the EP&A Act.</p> <p>A bushfire assessment in accordance with NSW Rural Fire Service <i>Planning for Bushfire Protection 2019</i> will be carried out to inform the EIS.</p>

Table 4.1 Approvals and licences required

Approval	Requirement
<i>Water Management Act 2000</i>	<p>A water use approval under Section 89, a water management work approval under Section 90 or an activity approval (other than an aquifer interference approval) under Section 91 of the <i>Water Management Act 2000</i> pursuant to Section 4.41 of the EP&A Act.</p> <p>The Project will require use of water for the pumped hydro process, will involve construction of a water supply work, and are works within 40 m of a watercourse. Therefore, a water use approval, water management work approval and controlled activity approval under the WM Act would have been required for the Project, if not for Section 4.41 of the EP&A Act.</p> <p>EnergyAustralia holds an existing water use approval for the use of Lake Lyell in the generation of electricity. It is anticipated this existing water use approval would be applied to the project.</p>

4.4 Pre-conditions and mandatory matters for consideration

The mandatory conditions that must be satisfied before the consent authority may grant approval to the Project are listed in Table 4.2. These conditions will be addressed in the EIS.

Table 4.2 Mandatory considerations for the project

Statutory document	Section reference	Mandatory consideration
Considerations under the EP&A Act and Regulation		
<i>Environmental Planning and Assessment Act 1979</i>	Section 1.3	Relevant objects of the Act.
	Section 4.15(1)	The provisions of any relevant environmental planning instruments.
		The provisions of any proposed instrument(s).
		The provisions of VPA (enter details of any planning agreement that has been entered into or any draft planning agreement that a developer has offered to enter into).
		The provisions of the regulations.
		The likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality.
		The suitability of the site for the development.
The public interest.		
Considerations under environmental planning instruments		
<i>State Environmental Planning Policy (Resilience and Hazards) 2021</i>	Section 3.7	<p>The EIS will consider the following relevant departmental guidelines:</p> <ul style="list-style-type: none"> Applying State Environmental Planning Policy No. 33 Hazardous and Offensive Development HIPAP No. 3 – Risk Assessment HIPAP No. 12 – Hazards.
	Section 4.6	Whether the land is contaminated.

Table 4.2 **Mandatory considerations for the project**

Statutory document	Section reference	Mandatory consideration
<i>State Environmental Planning Policy (Transport and Infrastructure) 2021</i>	Schedule 3	Whether the project is traffic-generating development.
<i>State Environmental Planning Policy (Biodiversity and Conservation) 2021</i>	Part 8.2	Practices and performance standards of WaterNSW. Neutral or beneficial effect. The project is within the Sydney drinking water catchment.
<i>Lithgow Local Environmental Plan 2014</i>	Land Use Table	Objectives and land uses for SP2 zone.
	Part 4	Principal development standards.
	Part 7	Additional local provisions.
Considerations under other legislation		
<i>Biodiversity Conservation Act 2016</i>	Section 7.14	The likely impact of the proposed development on biodiversity values as assessed in the biodiversity development assessment report. The Minister for Planning may (but is not required to) further consider under that Act the likely impact of the proposed development on biodiversity values.

4.5 Environment Protection and Biodiversity Conservation Act 1999

Under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), a person proposing to take an action that may, or will, have a significant impact on matters of national environmental significance (MNES) must refer the action to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) for determination as to whether or not it is a ‘controlled action’. If deemed a controlled action, the project is assessed under the EPBC Act and a decision made by the Commonwealth Minister for the Environment and Water as to whether to grant approval.

The bilateral agreement between the Commonwealth of Australia and the State of New South Wales relating to environmental assessment (the assessment bilateral agreement), allows the Commonwealth Minister for the Environment to rely on specified environmental impact assessment processes of the State of New South Wales in assessing actions under the EPBC Act.

The project was referred to DCCEEW under the EPBC Act (EPBC number: 2022/09445), due to uncertainty regarding impacts on threatened species and has been deemed a controlled action. The Minister, or their delegate, has also made a decision that the project will be assessed using the bilateral agreement.

5 Community engagement

5.1 Introduction

EnergyAustralia has been a longstanding operator in the local area due to its ownership of the nearby Mount Piper power station, and has been actively undertaking community engagement since acquisition of both Mount Piper and Wallerawang power stations in July 2013. EnergyAustralia commenced stakeholder engagement and consultation with Lithgow community members, interested stakeholders, and Mount Piper community members on development of the Lake Lyell Project in 2021.

EnergyAustralia anticipates that the significant scale and technical complexity of the Project will likely result in significant interest from the community relating to a broad variety of impacts anticipated from the Project. Key areas of interest are expected to include:

- the design of the Project
- planned impact mitigations relating to ecosystem preservation
- planned impact mitigations relating to recreational activities
- social benefits, particularly potential employment opportunities.

A Community and Stakeholder Engagement Plan has been prepared that provides a detailed breakdown of the principles, strategies, and plans that will be employed to ensure that community engagement undertaken for the Project is as effective as possible.

This section lays out the engagement that has been undertaken so far, its results, and the plans for future community engagement.

5.2 Stakeholder identification

A variety of stakeholder groups with an interest in the Project have already been consulted. These include:

- the NSW Department of Planning and Environment
- the Lithgow City Council and Councillors
- Federal and state local members
- immediate residents (via drop-in sessions, letter drops and door knocking)
- local Lake Lyell tourism operators
- the Lake Lyell Community Group
- the Lithgow Community Consultative Committee
- EnergyAustralia staff
- Traditional Owners
- the Lithgow Environment Group
- the Lithgow Power Project Group

- the Central Acclimatisation Society
- TransGrid
- the National Parks and Wildlife Service
- the Rural Fire Service
- Crown Lands
- Private Landholders.

Not all stakeholder groups have been consulted at the time of writing. Some groups that are yet to be explicitly contacted include:

- recreational fishers
- hard to reach and vulnerable members of the community
- education outlets
- media outlets.

5.3 Engagement carried out

EnergyAustralia commenced stakeholder engagement for the project in 2021 and has continued to identify and engage additional stakeholders as the project develops. The key stakeholders engaged during the scoping phase have been identified in Section 5.2 and are categorised as follows, with further detail on engagement activities provided in the following sections:

- Local residents, in particular those that would be affected by site access along Sir Thomas Mitchell Drive and Magpie Hollow Road. Residents have been engaged through doorknocking, face-to-face meetings, phone and email, letterbox drops and provided opportunity to attend community information sessions.
- Local community, meaning individuals within the Lithgow region. Local community have been engaged through letterbox drops and provided opportunity to attend community information sessions or seek further information via phone or email.
- Community and interest groups. These groups have been invited to meetings and presentations, and ongoing engagement via phone and email.
- Council and government agencies. Council have been engaged through various staff levels and via meetings, phone and email. Engagement with government agencies is in its early stages and as part of the planning approval process.
- Traditional Owners. Aboriginal community have been engaged through face-to-face meetings and site visits, phone and email. EnergyAustralia has also commenced the formal consultation process to identify the Registered Aboriginal Participants to be engaged through the EIS development.

5.3.1 Project community engagement

Engagement proceedings for the identified stakeholders (in Section 5.2) that have been undertaken have been performed at the time of writing have occurred in a variety of forms, including:

- door knocking nearby residential properties
- face to face meetings
- emails
- phone calls
- resident letterbox drops
- project newsletter
- fact sheet, FAQs and project presentation
- website (<https://www.energyaustralia.com.au/about-us/what-we-do/new-energy-projects/lake-lyell-pumped-hydro>) providing project information including copies of the project newsletter, fact sheet and FAQs
- project Facebook page
- contact email and enquiries line
- advertising and media
- Community Consultative Committee briefing and updates
- a series of community drop in sessions/forums.

In addition to direct consultation, EnergyAustralia hired Zing Insights between December 2021 and March 2022 to aid in improving its understanding of community sentiment by undertaking social research in the Lithgow region.

EnergyAustralia is currently in the process of securing and establishing a shop front within the Lithgow township. This will be used as an engagement hub for the community throughout the EIS.

i Local residents and businesses

An overview of some of the engagement activities carried out with local residents and businesses is provided in Table 5.1. EnergyAustralia maintains details of its community interactions relating to the project. This summary focuses on the key activities used to create awareness of the project and obtain early community feedback.

Table 5.1 Engagement with local residents and businesses

Activity	Description	Stakeholders
Letterbox drop	EnergyAustralia completed an initial letter box drop and door knock along Sir Thomas Mitchell Drive in November 2021. Most properties had closed and/or locked gates or nobody was home, however a flyer with contact information was left where possible.	Residents along Sir Thomas Mitchell Dr and Magpie Hollow Road.
	About 5,200 flyers were delivered in the Lithgow township in September 2022. The area of distribution covered areas of Lithgow, South Bowenfels. Littleton, Sheedy's Gully, Bowenfels, and Pottery estate. This was a copy of the 1 st edition of the project newsletter.	Community in Lithgow, South Bowenfels. Littleton, Sheedy's Gully, Bowenfels, and Pottery estate.
	A letterbox drop was completed in late May to early June 2023 to residents and local community generally within 4 km of the project that have potential for some visibility of the project. They were provided a project fact sheet and an opportunity to provide early feedback.	Residents in Bowenfels, South Bowenfels and Rydal.
Face-to-face meetings/ door-knocking /personal discussions	EnergyAustralia has doorknocked and met with residents along Sir Thomas Mitchell Drive and Magpie Hollow Road and other local residents that have potential for higher visibility of the project, including during a recent door-knocking of >100 residents properties in late May to early June 2023. Eleven residences of Sir Thomas Mitchell Drive, nine on Magpie Hollow Road and four in Rydal took the opportunity to express their concerns and seek clarifications in 1:1 discussions with project team members. Many of these neighbours are also members of the Lake Lyell Community Group. This activity involved providing project information and contact details for further enquiries. A letter was provided prior to the door-knocking to advise residents of the dates this would be undertaken. Where residents were not home, a calling card was left advising the time and date EnergyAustralia visited and a contact number provided.	Residents along Sir Thomas Mitchell Dr and Magpie Hollow Road. Neighbours in proximity of the project, including in Bowenfels and Rydal Lake Lyell Recreation Centre. Local businesses and tourist operators generally within 4 km of the project.
Phone and email	Since 2021 and based on the engagement activities, phone and email enquiries were received from community. EnergyAustralia responded individually to each of these enquiries and followed up with meetings for some residents identified.	Local residents including Sir Thomas Mitchell Dr, Hillcrest Estate, broader Lithgow region.
Newspaper advert	An advertisement was placed in local Lithgow Mercury newspaper in September 2022 advising the media release that EA has secured funding to carry out the feasibility study for the project. A follow-up advertisement was provided to advise the community of upcoming drop-in information sessions.	Community in Wallerawang, Portland, Rydal, Lithgow and surrounding areas.
Community information sessions	EnergyAustralia Project staff provided information about the Project, while the community asked questions and raised concerns. <ul style="list-style-type: none"> Wallerawang Bowling Club – Town Hall meeting 8 December 2021 Wallerawang Library on 4 October 2022 Portland Foundations Building on 5 October 2022 Rydal Showground Pavilion on 5 October 2022 Lithgow Library on 6 October 2022. Additional information sessions were provided: <ul style="list-style-type: none"> Hoskins Memorial Hall in Lithgow on 20 February 2023 Wallerawang Library on 21 February 2023 Portland Foundations Annexe on 21 February 2023. 	Community in Wallerawang, Portland, Rydal, Lithgow and surrounding areas.
Meetings (in person and online)	Presentation and discussion on the project occurred through the existing Mt Piper CCC and then extended to other meetings and opportunities with the local business chambers and other events (see below). The most recent meeting with the Lithgow Business Chamber occurred in February 2023.	Local Business Chambers in Lithgow, Portland and Wallerawang. Mt Piper CCC (local business is represented).

Table 5.1 Engagement with local residents and businesses

Activity	Description	Stakeholders
Email	Project updates have been provided to local businesses via email including the Community Newsletter, Fact Sheet and FAQs.	Businesses who have registered via stakeholder mailing list.
Tourism survey	A letter was either letter box dropped or emailed to Tourism operators in December 2022, with the survey closing in March 2023.	Lake Lyell Recreation Centre, Japanese Bath House, Eagle View Escape, and other local tourist operators. Lithgow Tourism Centre.
Other events	EnergyAustralia attended a number of other events such as the Energy Expo and a Procurement Seminar hosted by the Lithgow Business Chamber. The intent was to raise awareness about the project and potential for business opportunities.	Local businesses. Lithgow Business Chamber.

ii **Community and other interest groups**

EnergyAustralia has been engaging with community groups initially through its long established relationships through the Mt Piper Community Consultative Committee (CCC) and individuals representing these groups. As feasibility of the PHES has progressed, engagement with other community interest groups such as the Lake Lyell Community Group has increased in order to establish a relationship and build effective communication pathways. EnergyAustralia recognises this group as one of the many key stakeholders for the project, with many members also being local residents that would be impacted by the project. A summary of engagement activities with community and other special interest groups is provided in Table 5.2.

Table 5.2 Engagement with community and special interest groups

Activity	Description	Stakeholders
Meetings	Meetings with community groups including existing groups known to EnergyAustralia through the presence of Mt Piper and Wallerawang power station in the Lithgow community. Initial consultation started in May 2021 was focused on introducing the project concept. Presentations were provided at some meetings, including to the Mt Piper CCC in August 2022, Lithgow Environment Group in late 2022, and Wallerawang Progress Association in February 2023. Representatives from other community groups also form part of the CCC. The Lithgow Community Power Project Inc was briefed on the project in February 2023. Consultation with the various representatives of the Lake Lyell Community Group started in 2021 and continues to be a focus for EnergyAustralia (see below).	Central Acclimatisation Society, Wallerawang Progress Association, Mt Piper CCC, Lithgow Environment Group, Lake Lyell Community Group, Lithgow Community Power Project Inc.
Email	Copies of project information including newsletter, fact sheet and media release were provided as updates to the various groups between 2021 to present. Meetings and presentations were offered (per above).	
Personal discussions	EnergyAustralia team members met individual neighbours of the project through the doorknocking program in Bowenfels and Rydal during late May and first week of June 2023. Many of these neighbours are also members of the Lake Lyell Community Group (see below).	Neighbours in proximity of the project, including in Bowenfels and Rydal

Table 5.2 Engagement with community and special interest groups

Activity	Description	Stakeholders
Phone and email	The Lake Lyell Community Group was formed to voice concern regarding the project. EnergyAustralia has provided copies of information via email and had discussions via phone calls to provide updates and discuss and respond to concerns raised, where possible. EnergyAustralia has acknowledged that the project is in early stages and is unable to answer or provide further technical information until the design process progresses.	Lake Lyell Community Group.

iii Council and government agencies

An overview of engagement activities carried out with Lithgow City Council and government agencies is provided in Table 5.3.

Table 5.3 Engagement with Council and government agencies

Activity	Description	Stakeholders
Meeting (in person and online)	Since May 2021, EnergyAustralia has met regularly (generally monthly) with Lithgow City Council representatives including General Manager, Executives, Councillors and the Mayor to provide information and updates relating to the project. The Mayor, and two Councillors visited the geotech drilling operations while in progress on the project site in February 2023.	Lithgow City Council
Presentation	EnergyAustralia presented to DPE in November 2021 to provide an introduction to the project. A scoping meeting for the project was held in November 2022. Additional meetings regarding the scoping phase of the project were held between January and June 2023 leading up to the lodgement of this Scoping Report.	Department of Planning and Environment
Site visit	EnergyAustralia facilitated a site visit for DCCEEW in March 2023. It provided an opportunity for DCCEEW to ask questions regarding the project and timing for assessment.	Department of Climate Change, Energy, Environment and Water
Meeting, phone and email	Initial consultation for general project awareness and to facilitate site access and early project investigation activities.	National Parks and Wildlife Service, Crown Land, WaterNSW

5.3.2 Social impact scoping assessment

The social impact scoping assessment for the project has also been complemented as part of broader community engagement carried out for the project as well as supplemented by targeted survey. A summary of these engagement activities is provided in Table 5.4.

Table 5.4 Engagement activities informing the social impact scoping assessment

Activity	Description	Stakeholders
Project stakeholder briefings	Stakeholder briefings have been conducted by EnergyAustralia. Three of these were attended and utilised for the SIA scoping assessment.	Bathurst Local Aboriginal Land Council Lithgow City Council Lithgow Chamber of Commerce

Table 5.4 Engagement activities informing the social impact scoping assessment

Activity	Description	Stakeholders
Community survey	A community survey was published on the Project website on 14 October 2022, was advertised via a letter promoting the community drop-in sessions on 23 September 2022, and was distributed to the Project email mailing list on 14 October 2022 and was closed on 25 October 2022.	Local community
Community information sessions	EnergyAustralia Project staff provided information about the Project, while the community asked questions and raised concerns. <ul style="list-style-type: none"> • Wallerawang Library on Tuesday 4 October 2022 • Portland Foundations Building on Wednesday 5 October 2022 • Rydal Showground Pavilion on Wednesday 5 October 2022 • Lithgow Library on Thursday 6 October 2022. 	Local community

These engagement activities have informed the preparation of the social impact assessment (SIA) scoping report (Appendix D), including the identification of preliminary set of potential social impacts and benefits of the project. A summary of the findings is provided in Section 6.11, or provided in full at Appendix D.

5.3.3 Aboriginal community consultation

Stemming from a long term presence in the Lithgow region, EnergyAustralia has existing relationships with the local Aboriginal community. This includes through the existing Mt Piper Community Consultative Committee (CCC) which involves the local Traditional Owner representative from Mingaan Aboriginal Corporation. Updates and presentations on the project have been provided at the CCC briefings (18/10/2021, 28/03/2022, 18/07/2022 and 7/12/2022).

Specifically for the project, EnergyAustralia started conversations with the local Aboriginal community in 2021 and has continued to liaise with relevant representatives throughout the project development, as summarised in Table 5.5. EnergyAustralia appreciates the importance of engaging with the Traditional Owners and existing representatives of the local Aboriginal community and will continue to engage throughout the EIS process. This includes broader engagement activities as well as the more formal requirements of consultation with registered Aboriginal parties as part of the Aboriginal Cultural Heritage Assessment during the EIS process. Formal consultation commenced on 23 June 2023, with a local newspaper advertisement placed in the Lithgow Mercury (published 23/6/2023) and with notification letters issued to Aboriginal groups inviting them to register for their involvement in the project.

Table 5.5 Local Aboriginal community engagement

Activity	Description	Community representative
Face-to-face meeting	Initial meeting (27 May 2021) regarding EnergyAustralia’s investigation into new energy generation.	Mingaan Aboriginal Corporation
Face-to-face meeting	A meeting not specific to the project on 1 November 2021, however engagement for the project was discussed and Mingaan Aboriginal Corporation expressed interest in involvement of any heritage study works for the EIS.	Mingaan Aboriginal Corporation
Site inspection	A site walkover by an EMM archaeologist and representative of Bathurst Local Aboriginal Council was undertaken in December 2021 to inform proposed geotechnical investigation works.	Bathurst Local Aboriginal Land Council

Table 5.5 Local Aboriginal community engagement

Activity	Description	Community representative
Face-to-face meeting	Meeting on 3 March 2022 where the project was discussed as well as local resident Facebook page and potential impacts to Platypus.	Mingaan Aboriginal Corporation
Face-to-face meeting	An informal follow up meeting (29 March 2022) to a Mt Piper CCC meeting to allow further questions and knowledge sharing about the project and cultural involvement.	Mingaan Aboriginal Corporation
Face-to-face meeting	EnergyAustralia provided a general update on the project to Bathurst Local Aboriginal Land Council on 14 September 2022. Discussion included engagement during heritage investigation works and noted some concerns for cultural values and how they would be incorporated into the development.	Bathurst Local Aboriginal Land Council
Face-to-face meeting	EnergyAustralia sought advice from Mingaan Aboriginal Corporation in December 2022 for Cultural Awareness training for the project team.	Mingaan Aboriginal Corporation
Telephone and face-to-face meeting	EnergyAustralia sought advice in December 2022 for local representative to partake in site walkover for geotechnical investigations.	Mingaan Aboriginal Corporation
Site inspection	A site walkover for geotechnical investigations by EMM archaeologist and representative of Bathurst Local Aboriginal Council was carried out in December 2022.	Bathurst Local Aboriginal Land Council
Face-to-face meetings and site inspection	A number of meetings occurred during January 2023 to introduce members of the EnergyAustralia project team, discuss recent media, and carry out site walkover for geotechnical investigations.	Mingaan Aboriginal Corporation
Telephone	EnergyAustralia spoke with Bathurst Local Aboriginal Land Council on 14 February 2023. The BLALC expressed interest in a meeting for Mt Piper as well as involvement with the project.	Bathurst Local Aboriginal Land Council
Cultural awareness training	A 2 day cultural awareness training was conducted for the EnergyAustralia project team with Mingaan Wiradjuri Aboriginal Corporation (1 day classroom, 1 day on Country) on 22 and 23 February 2023.	Mingaan Aboriginal Corporation
Face to face meeting	EnergyAustralia met with Mingaan Elders in Bathurst for a further update on the project on the 8 June 2023.	Mingaan Aboriginal Corporation

5.4 Community views

Preliminary investigations suggest that community interest is likely to predominantly occur within the local region. Concerns and areas of interest identified by stakeholders during the consultation process have been varied, with key feedback and views summarised in Table 5.6. These concerns primarily relate to matters which will be explicitly addressed as key matters within the EIS. Section 5.5 further details how EnergyAustralia will continue to engage with the community to obtain feedback to be incorporated into the design and/or EIS.

Table 5.6 **Community views identified during scoping phase**

Category	Community views	How community views will be incorporated into the EIS
Strategic context	<ul style="list-style-type: none"> • The transition towards renewable energy is broadly supported by the majority of stakeholders that provided feedback. • Some community see a local renewable generation asset as a positive step for Lithgow to become a renewable energy hub. 	The EIS will identify the renewable energy context and how the project will contribute regionally and locally.
Alternatives considered	<ul style="list-style-type: none"> • Smaller and lower cost alternatives could be considered. • Alternative access and design options to minimise traffic and visual impacts. 	<p>Alternatives to the project (e.g. battery storage), and alternatives within the project (e.g. road access and design options), will be explored as part of design development, including engagement with community and government stakeholders, and documented in the EIS.</p> <p>Alternative upper reservoir locations have been explored (as discussed in Section 3.5.3) and as a result of community feedback, the preferred option has been updated. However, further community engagement is proposed on the preferred option is proposed as part of the EIS.</p>
Statutory issues	<ul style="list-style-type: none"> • Concern/confusion that a DA for geotechnical investigations were for the entire project. • Query Commonwealth referral process. 	The EIS will identify the approval pathway and the relevant statutory issues that apply to the project, including the consultation undertaken with government as required by the SEARs.
Community engagement for the EIS	<ul style="list-style-type: none"> • A need for more direct community correspondence. • Request for transparency and access to design information, and information on the timing of the project. 	The community engagement strategy will be implemented including targeted interviews with community members, providing regular project updates and newsletters, etc. (see Section 5.5). A community engagement outcomes report will accompany the EIS, which would detail the consultation activities conducted, the feedback obtained, and how this feedback has been incorporated into the project.

Table 5.6 Community views identified during scoping phase

Category	Community views	How community views will be incorporated into the EIS
Key matters for assessment in the EIS	<ul style="list-style-type: none"> • More information on the design is needed to be shared. • Concern for impact on the value of rural residential property with vistas to the project site. • Concern for the likely impacts of the Project on the water quality and water level of Lake Lyell. • Whether public access to Lake Lyell or recreational use of the lake will be curtailed. • Information on what steps will be taken to ensure that environmental and cultural heritage impacts are identified and assessed, and avoided or reduced. • Information on what the impacts to local roads and residential properties will be, and how they will be minimised. • Concern for what the local business impacts are, and whether employment opportunities and economic benefits are likely. • Concern on the extent of visual and landscape impacts and associated social impacts. • Concern for how the Project will impact fish and their movements. • Need for further information on what steps will be taken to minimise construction impacts. 	<p>EnergyAustralia will have early contractor involvement on the project which will assist in the development of feasible construction measures that can be adopted to minimise impacts, where possible. An iterative design and assessment approach is proposed for the project (Section 1.2.2) and avoidance measures will be detailed in the EIS.</p> <p>The EIS and technical studies will include assessment of the environmental and social impacts of the project, including consideration of the potential and/or perceived impacts identified by the community. The community engagement activities will provide a summary of these concerns to the technical study teams to incorporate as appropriate.</p>
Issues that are beyond the scope of the project	Not identified at this stage.	The consultation report accompanying the EIS will detail any issues raised during the preparation of the EIS that are beyond the scope of the project.

Key findings from additional research undertaken include that:

- Stakeholders feel uncertain about the future of Lithgow and the energy industry.
- Balanced information about the merits of renewable energy projects is difficult to find, with stakeholders reporting that efforts to engage are clouded by a ‘mix of agendas’.
- The announcement of the closure of the Mount Piper coal-fired power station in 2040 brought options for the transition into greater focus.
- Stakeholders are interested in receiving further information about the Project through a variety of channels.
- Stakeholders are in favour of EnergyAustralia acknowledging the concerns raised as a part of the community engagement process.

At the time of writing, these viewpoints had been taken into consideration and used to inform the Project team’s understanding of local concerns and values, and to refine communication channels and consultation methods.

5.5 Engagement to be carried out by EnergyAustralia

EnergyAustralia remains committed to continuing the stakeholder engagement process, and to using the insights gained in the assessment of environmental, social, and economic impacts.

An EIS consultation plan has been prepared that sets out the stakeholder engagement procedures which are planned to be undertaken during the EIS preparation and exhibition period that is expected to occur between 2022 and 2025. During this period, the goals of EnergyAustralia’s community engagement program are to:

- Inform communities and stakeholders about the project, the EIS process, and opportunities to participate.
- Actively involve communities and stakeholders in the project’s development and planning to improve outcomes.
- Encourage participation and seek input during preparation of the EIS, to identify issues of potential concern, obtain local insights and gain feedback on measures to address concerns.
- Demonstrate how community and stakeholder issues and feedback are being captured and used to inform project development and assessment.

Stakeholders proposed for further engagement as part of the EIS consultation plan are outlined in Table 5.7.

Table 5.7 Stakeholders for further engagement

Category	Stakeholder	Likely interests
NSW Government	<ul style="list-style-type: none"> • Treasurer • Minister for Energy • Minister for Planning and Public Space • Department of Planning and Environment • Treasury Department • Local MPs 	<ul style="list-style-type: none"> • Understanding project rationale and benefits. • Impacts and sentiment of constituents. • Community consultation process.
Registered Aboriginal Parties and Traditional Owners	<ul style="list-style-type: none"> • Mिंगaan Wiradjuri Aboriginal Corporation • Local Aboriginal Land Council • NSW Aboriginal Land Council • Other Registered Aboriginal Parties (currently being identified) 	<ul style="list-style-type: none"> • Understanding cultural values of Lake Lyell and surrounds. • Understanding project rationale and benefits. • Understanding and avoiding/minimising potential adverse impacts. • Water resource use. • Opportunities to provide input to project planning, delivery, and land use. • Minimising impacts to Native Title land. • Development and implementation of Cultural Heritage Management Plan if required. • Optimal outcomes for Country including natural environment. • Opportunities for First Peoples businesses and employment.
Australian Government	<ul style="list-style-type: none"> • Australian Energy Infrastructure Commissioner • Federal Members of Parliament • Regional Development Australia 	<ul style="list-style-type: none"> • Understanding project rationale and benefits. • Impacts and sentiment of constituents. • Community consultation process.

Table 5.7 Stakeholders for further engagement

Category	Stakeholder	Likely interests
NSW statutory authorities	<ul style="list-style-type: none"> • Department of Planning & Environment • National Parks Wildlife Service • Energy Corporation of NSW (EnergyCo) • Environment Protection Authority • NSW Consumer Trustee • Office of Environment and Heritage • Water NSW • Roads and Maritime Services • NSW Rural Fire Service • Department of regional NSW 	<ul style="list-style-type: none"> • Planning process complies with applicable legislation and requirements. • Involvement in project development and assessment. • Optimal outcomes for environment and community. • Preparation of EIS and conformance with SEARs. • Broader regulatory requirements. • Community and stakeholder consultation.
Local Government	<p>Councillors, executive and officers from the following councils:</p> <ul style="list-style-type: none"> • Lithgow City Council • Bathurst City Council 	<ul style="list-style-type: none"> • Understanding project rationale and benefits. • Understanding and avoiding/minimising adverse impacts on council land and assets, the local environment and for local residents and businesses. • Opportunities to provide input to project planning and delivery. • Opportunities to regenerate or transition local industries, businesses and the economy. • Community consultation process. • Infrastructure benefiting local communities.
Local community, business and tourism	<ul style="list-style-type: none"> • EnergyAustralia’s Community Consultative Committee • Mt Piper power station employees • Lithgow Business Association • Lithgow District Chamber of Commerce • Cullen Bullen Progress Association • Hartley District Progress Association • Capertee and District Progress Association • Centennial Coal – Springvale Mine • Local residents • Lake Lyell Community Group • Lake Lyell recreational users and businesses • Lithgow community • Portland community • Lidsdale community • Wallerwang community • Cullen Bullen community 	<ul style="list-style-type: none"> • Understanding project rationale and benefits. • Understanding potential impacts from project in local area. • Ability to provide local knowledge to enhance the project and delivery and to help avoid/minimise impacts. • Opportunities to provide input to the project. • Clear information and updates about the project. • Maximising local benefits from the project. • Opportunities for local businesses and employment.
Energy market operators and regulators	<ul style="list-style-type: none"> • Australian Energy Market Commission • Australian Energy Market Operator • Clean Energy Regulator • Energy Security Board 	<ul style="list-style-type: none"> • Understanding project scope, capacity and operations. • Grid connection. • Safety. • National Electricity Market operations.

Table 5.7 Stakeholders for further engagement

Category	Stakeholder	Likely interests
Industry groups, peak bodies and NGOs	<ul style="list-style-type: none"> Clean Energy Council Unions NSW 	<ul style="list-style-type: none"> Understanding project rationale, benefits and impacts. Opportunities to provide input to project planning and delivery. Opportunities to regenerate or transition local industries, businesses and the economy. Opportunities for local businesses and job seekers.
Environmental groups and NGOs	<ul style="list-style-type: none"> Colong Foundation for Wilderness Lithgow Environment Group Inc Blue Mountains Conservation Society Bathurst Community Climate Action Network Lithgow District Landcare Group Lithgow Oberon Landcare Association 	<ul style="list-style-type: none"> Understanding project rationale, benefits and impacts. Understanding and avoiding/minimising adverse impacts. Opportunities to provide input to project planning and delivery.
Educational institutions	<ul style="list-style-type: none"> Local primary and secondary schools TAFE NSW – Lithgow NSW Skills Commission 	<ul style="list-style-type: none"> Clear information and updates about the project. Future workforce needs and opportunities.
Media	<ul style="list-style-type: none"> Lithgow media (print, TV, radio, online) NSW and Australian media (print, TV, radio, online) Specialist media 	<ul style="list-style-type: none"> Clear information and updates about the project. Involvement in key milestone media opportunities. Access to project team for interviews and public comment.

A tentative outline of the planned stakeholder engagement activities to be undertaken during EIS preparation and exhibition along with the purpose of these activities is included in Figure 5.1. The responses received during phases one and two will be presented in the EIS.

As part of consultation planned during the development of the EIS, EnergyAustralia is advancing with targeted plans to further engage with residents and stakeholders in Rydal, Bowenfels, South Bowenfels, Littleton and several additional large lot properties that may be potentially affected regarding the existing visual landscape and the potential for noticeable changes to existing views.

EnergyAustralia has met with the Australian Energy Infrastructure Commissioner and is rolling out a work stream to implement the principles and recommendations practicable as contained in Section 2 of the Appendix A of the AEIC 2022 Annual Report relating to fair dealing with neighbours of energy infrastructure projects.

Consultation with the community and stakeholders will continue to occur throughout the life of the Project. How feedback received during various points of the Project’s operation will be used is shown in Table 5.8.

Table 5.8 The planned use of feedback in the Project’s stages

Project stage	Application of feedback
Design	<ul style="list-style-type: none"> • Inform reference design. • Considered in project scope refinement. • Considered in locating infrastructure.
Planning and environmental assessment	<ul style="list-style-type: none"> • Enhances EnergyAustralia’s understanding of the local environment, potential issues and opportunities. • Considered in preparing impact assessments. • Considered in developing mitigations. • Informs communication and consultation approach. • Informs performance requirements for construction and operation.
Construction and operation	<ul style="list-style-type: none"> • Considered in construction methodology, timing and impact mitigation. • Informs communication and consultation approach.

All of the above procedures will be regularly reviewed and updated as deemed necessary. All feedback received from the local community and other stakeholders will be reviewed by EnergyAustralia, as well as recorded in EnergyAustralia’s stakeholder management system. EnergyAustralia will seek to incorporate feedback received into its project development where possible and will share the reasoning behind decisions not to incorporate stakeholder preferences when they cannot be accommodated.

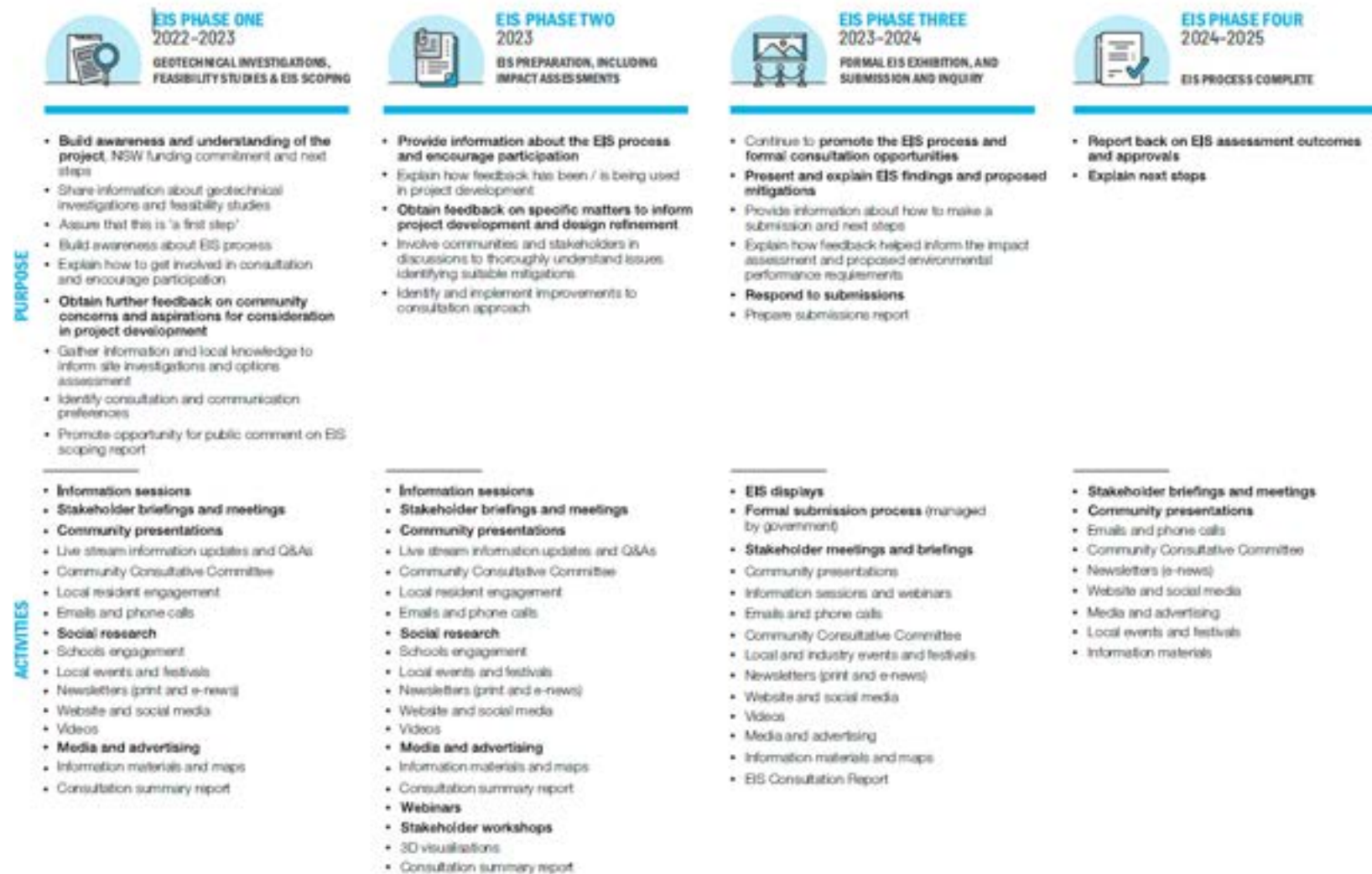


Figure 5.1 Stakeholder engagement activities to be undertaken during EIS preparation and exhibition

6 Proposed assessment of impacts

6.1 Scoping of key issues

The identification and consideration of matters for assessment in the EIS have been guided by the *SSD guidelines – preparing a scoping report* (DPIE, 2021) (Scoping Report Guidelines), and informed by preliminary assessments completed for the project to date.

The following factors have been considered in accordance with the Scoping Report Guidelines:

- the scale and nature of the likely impact of the project and the sensitivity of the receiving environment
- whether the project is likely to generate cumulative impacts with other relevant future projects in the area
- the ability to avoid, minimise and/or offset the impacts of the project, to the extent known at the scoping phase.

The categories of assessment matters listed in Scoping Report Guidelines, and the proposed level of assessment of these matters in the EIS are summarised in Appendix A of this report.

The environmental matters requiring further standard or detailed assessment in the EIS (in accordance with Section 3.6 and Appendix D of the Scoping Report Guidelines) are described in the following sections. These will be addressed in technical assessments appended to the EIS and/or in the main body of the EIS. It is considered that assessment of these matters should be included within the SEARs.

The environmental matters that require no further assessment are addressed in Section 6.13. It is not proposed to further assess these matters in the EIS (in accordance with Section 3.6 of the Scoping Report Guidelines). It is considered that these matters should not be included within the SEARs.

6.2 Water

6.2.1 Existing environment

i Surface water

a Regional catchment

The Project is in the Coxs River catchment (Figure 6.1). The Coxs River is a major tributary to the Hawkesbury-Nepean system. It has a total catchment area of approximately 1,450 km² and ultimately flows into the northern arm of Lake Burragorang (also known as Warragamba Dam). Lake Burragorang is a major water supply dam for the Sydney metropolitan region and is managed by WaterNSW. The Project area is located within and near Lake Lyell, which is in the upper portion of the Coxs River catchment.

The Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011 applies to surface water resources in the Coxs River catchment, the Upper Nepean & Upstream Warragamba water source and Wywandy River management zone apply to the Project area.

b Lake Lyell

The Project area includes Lake Lyell and adjacent land that may be directly impacted by the Project. Lake Lyell is an impounded water body located on the Coxs River. The lake was formed following the construction of the Lilyvale Dam in 1981/82. It is part of the Coxs River Water Supply Scheme, and its initial purpose was to provide a reliable water supply water to the Mount Piper and the now retired Wallerawang power stations. Currently, the lake provides water to the Mount Piper power station and is a popular recreational area used for water sports, fishing and camping.

The lake receives inflows from the Coxs River to the north and Farmer Creek to the east. The total contributing catchment area to the dam wall is approximately 380 km². At Full Supply Level (FSL) the lake has a maximum depth of approximately 40 m, an active storage volume of approximately 32.1 GL and a 2 km² inundation area. The lake and its outflows are managed under the current water sharing plan, with regulated downstream releases made to maintain riparian health. Outflows from the lake occur via:

- The dam's outlet works which include three riparian valves to regulate outflows. Controlled releases are made from these riparian valves to meet environmental flow requirements.
- The dam's spillway.
- The Lilyvale pump station, which has capacity to transfer 95 ML/day into the Coxs River Water Supply Scheme and ultimately to supply water to Mt Piper Power Station.

c Downstream waterways

Downstream of Lake Lyell, the Coxs River flows generally in a southerly direction through parts of the Central Tablelands and Blue Mountains regions of NSW and ultimately enters the northern arm of Lake Burragarang (also known as Warragamba Dam). Lake Burragarang is a major water supply dam for the Sydney metropolitan region and is managed by WaterNSW. The lower reach of the Coxs River and Lake Burragarang is located in the Blue Mountains National Park.

ii Groundwater

a Groundwater availability

The project lies within the Coxs River Fractured Rock Groundwater Sources (the groundwater source), managed under the *Water sharing plan for the Greater Metropolitan Region Groundwater Sources 2011* (the WSP). A draft revision to the WSP is also available (the draft *Water sharing plan for the Greater Metropolitan Region Groundwater Sources 2023*). Groundwater entitlement held within the water source totals 255 share components (noting that 1 share component is equivalent to 1 megalitre (ML)). The remaining unallocated share component totals 6,560 ML, demonstrating sufficient depth in the market.

b Hydrogeology

The project lies within the Devonian Lambie Group, typically comprising terrigenous to shallow marine, quartz sandstone, quartzite, siltstone, mudstone and conglomerate (Colquhoun, et al., 2022). The Carboniferous Bathurst Suite, comprising various intrusions, contacts the Lambie Group near the project, likely inducing metamorphism throughout the geology underlying the project. The project will likely intercept metamorphosed geology, including quartzite and metasediment. Structural deformation is also observed throughout the project area.

The geological units underlying the project would typically support a fractured rock groundwater system, with groundwater storage and hydraulic conductivity highly dependent on the frequency and interconnectivity of fracturing, enhanced locally by structural deformation if intercepted.

c Potential groundwater receptors

Potential groundwater receptors are shown on Figure 6.2 and include landholder bores and potential groundwater dependent ecosystems (GDEs).

Based on a search of the national groundwater information system (BoM, 2013), two water supply work approvals associated with groundwater bores were identified within a three km radius of the project. A summary of the available information is provided in Table 6.1 and the location of the bores is shown on Figure 6.2.

Table 6.1 Registered landholder bores near the project

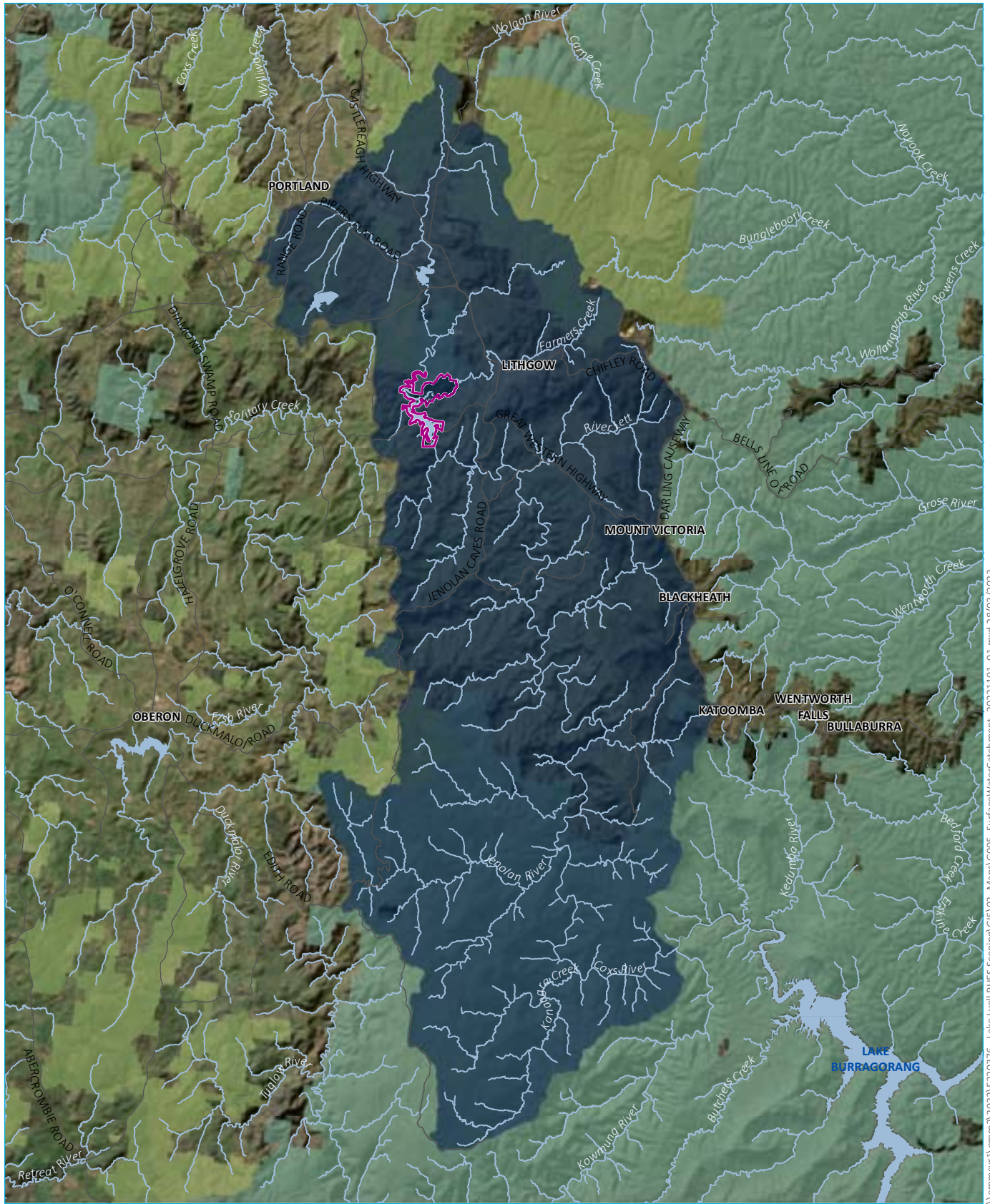
Bore ID	Easting (MGA 56)	Northing (MGA 56)	Distance from project (m)	Depth (mbgl) ¹	Screen depth (mbgl) ¹		Target lithology	Purpose	Date
					Top	Base			
GW072313	230868	6288252	~2,000	30	17	21	Granite	Domestic water supply	11 July 1994
GW109204	228975	6288355	~1,500	3	0	3	Unknown	Commercial and industrial	12 August 2008

Notes: 1. Metres below ground level

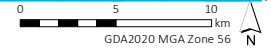
Based on the groundwater WSP, no high priority groundwater dependent ecosystems (GDE) are mapped within 30 km of the project. It is therefore considered unlikely the project will interact with any mapped high priority GDE's.

Based on a search of the Bureau of Meteorology's (BOM) GDE atlas (BoM, 2017) low–high potential GDE's are mapped near the project (refer Figure 6.2). High potential GDE's mapped near the project area include:

- River Oak forest and woodland wetland
- Broad-leaved Peppermint – Ribbon Gum grassy open forest
- Snow Gum – Candle Bark woodland
- Broad-leaved Peppermint – Red Stringybark grassy open forest
- Snow Gum – Mountain Gum tussock grass-herb forest.



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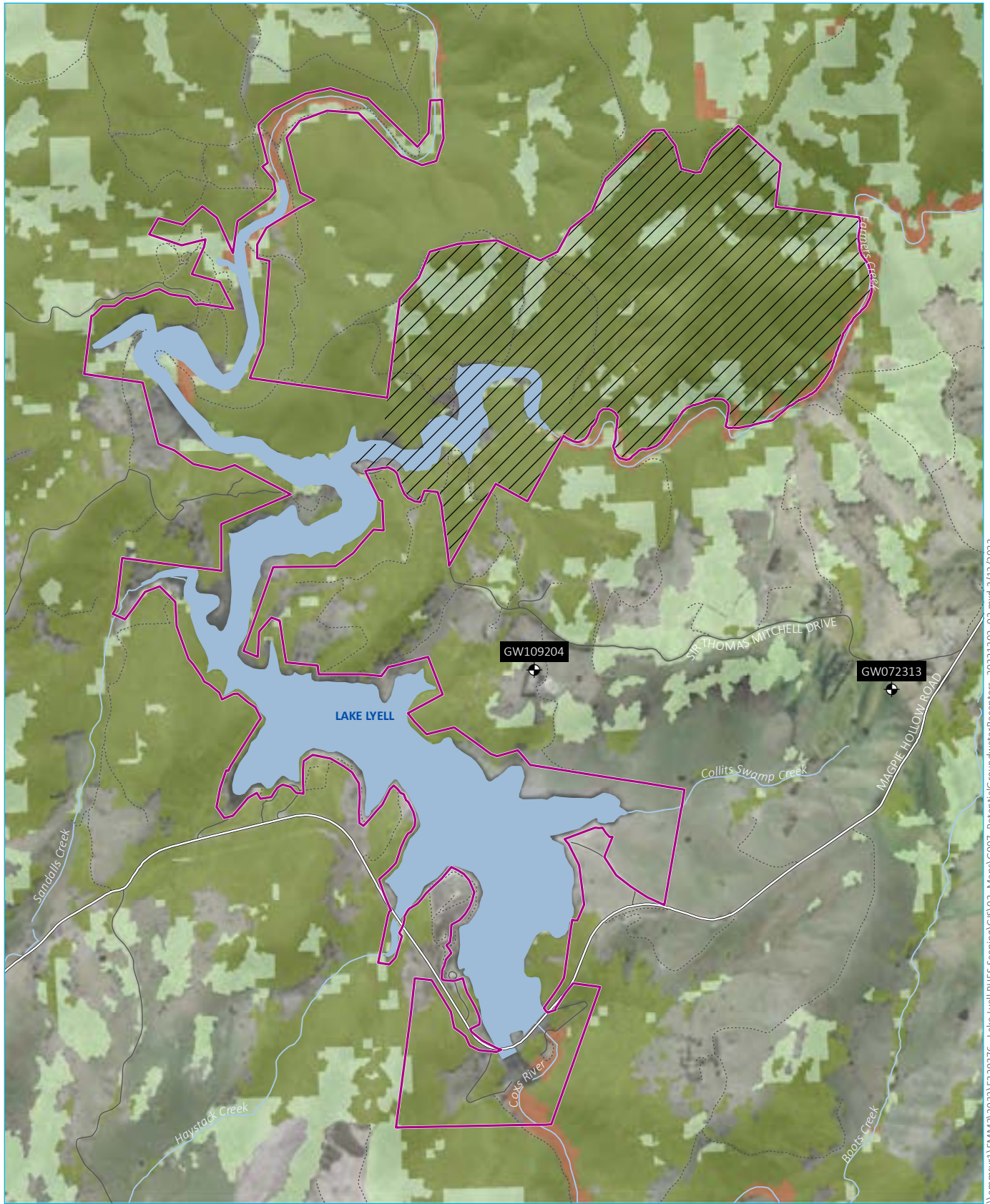


- KEY**
- Project area
 - Main works
 - Surface water catchment
 - Major road
 - Named watercourse
 - Named waterbody
 - NPWS reserve
 - State forest

Surface water catchment

Lake Lyell PHES Project
Scoping report
Figure 6.1





Source: EMM (2022); DFSI (2020, 2021); GA (2011); Metromap (2022); BoM (2017, 2022)



KEY

- Project area
- Main works
- Registered bores
- Low potential GDE - from regional studies
- Moderate potential GDE - from regional studies
- High potential GDE - from regional studies
- Major road
- Minor road
- Vehicular track
- Named watercourse
- Named waterbody

Potential groundwater receptors

Lake Lyell PHES Project
Scoping report
Figure 6.2



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6.2.2 Preliminary impact assessment

i Surface water

a Construction phase

The construction of the project may involve surface works, major excavations, subsurface excavations (i.e. tunnelling), storage and handling of construction materials and dredging within Lake Lyell. The proposed works have potential to impact water quality in Lake Lyell, the Coxs River downstream of Lake Lyell and local watercourses that are downgradient of the Upper Reservoir and other land-based construction areas. There is also potential for some impacts to recreational users of Lake Lyell due to restricted access.

Potential impacts associated with the following aspects of the construction phase of the project will require consideration and assessment in the EIS:

- surface water runoff from areas disturbed by construction
- the management of water intercepted by construction activities
- dredging in Lake Lyell
- water supply for construction activities
- storage and disposal of any surplus excavated rock
- management of wastewater produced by amenities.

b Operational phase

The operation of the PHES will involve circulating water between Lake Lyell and the Upper Reservoir. Preliminary analysis has estimated that water levels in the lake will fluctuate by approximately 2 m in a typical pumping and generating cycle and the maximum rate of change in lake levels would be 0.3 to 0.4 m/hr¹. No material changes to the volumes of water entering or leaving the lake are expected due to the short-term circulating of water between Lake Lyell and the Upper Reservoir.

Potential impacts associated with the cycling of water levels in Lake Lyell include:

- Potential 'pulsing' of regulated releases from the dam which are a function of water level in the lake and the setting of outlet controls. This could be fully mitigated by real-time adjustments to the outlet controls to compensate for the changes in lake levels.
- Flood impacts in the Coxs River downstream of Lake Lyell could occur if generating (i.e. release from the Upper Reservoir to Lake Lyell) occurs when the dam is spilling during periods of high catchment inflow. The increase in lake levels would temporarily increase discharge rates over the spillway and associated flow rates in the Coxs River downstream of the dam. These potential impacts would be fully mitigated by operational restrictions.
- Impacts to shoreline erosion due to potential bank slumping associated with the lowering of lake levels during the pump cycle.
- Impacts to recreational users due to the sub-daily cycling in lake levels.

¹ Based on a full or near full lake.

It is likely that the operation of the PHES will improve the circulation and mixing of water in Lake Lyell which may reduce the extent and nature of seasonal stratification in the lake and associated water quality issues such as algae blooms. These aspects will be assessed in the EIS.

No changes are proposed to the controlled releases from Lilyvale Dam as a result of the Project, therefore EnergyAustralia would continue to meet environmental flow requirements to the Cox's River to maintain riparian health and downstream impacts are not expected.

ii Groundwater

Preliminary geotechnical investigations for the project are currently underway and are expected to provide a greater understanding of the underlying geology and hydrogeology of the project area. Preliminary groundwater sampling and a staged groundwater monitoring network is proposed to be established to inform the detailed design and the preparation of the EIS.

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

Key groundwater issues are associated with the potential for dewatering of the regional groundwater system which may occur due to tunnelling activities for the underground powerhouse cavern, waterway tunnels and shafts.

General groundwater issues requiring consideration during construction may include:

- loss of spring flows that may be sustaining creeks, rivers and GDEs
- loss of baseflow in permanent streams
- lowered regional groundwater levels and loss of yield in existing water supply bores and loss of water supply to terrestrial GDEs
- high groundwater inflows when heavily fractured or faulted geology is encountered
- degraded inflow water quality because of construction activities (e.g. sediment and explosive residues)
- management of groundwater captured by construction dewatering activities
- maintaining a viable shallow and deep groundwater monitoring network
- groundwater licensing consistent with the requirements of the WSP (accounting for water take, as the construction works are an aquifer interference activity).

Once tunnels are constructed, groundwater inflows from major structural features such as open fractures and faulted zones are expected to be minimal, however, there is still likely to be a contribution from minor fracture systems. Groundwater issues requiring consideration during operation may include:

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

6.2.3 Proposed approach for EIS

i Surface water

A surface water assessment will be prepared as part of the EIS. It will include:

- Characterisation of the existing water quality and lake water level/streamflow regime in Lake Lyell and the Coxs River downstream of the lake.
- A description of the Coxs River Water Supply scheme (as relevant to Lake Lyell) and existing infrastructure (i.e. Lilyvale dam and pump station), recreation areas/infrastructure, dam operational requirements and management plans.
- Water quality objectives for the project established with reference to the NSW Government's Water Quality and River Flow Objectives (DEC 2006) and the ANZG (2018) framework.
- A description of the construction water management approach and any associated water discharges.
- An assessment of impacts due to the cycling of water levels in Lake Lyell.
- An assessment of changes to mixing and circulation in Lake Lyell and associated water quality implications.
- An assessment of water take during the construction and operation of the project. The assessment will address water regulations and establish any water licencing requirements and pathways.
- A description of any new measures which may include changes to the existing Lake Lyell management approach.

The following guidelines will be considered (where relevant during) the preparation of the surface water assessment:

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018 & ANZECC 2000)
- Australian Rainfall and Runoff (Ball 2019)
- NSW Water Quality and River Flow Objectives (DEC 2006)
- Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom, 2004) and Volume 2 (Department of Environment and Climate Change, 2008)
- Guidelines for controlled activities on waterfront land (NRAR 2018)
- Neutral or Beneficial Effect on Water Quality Assessment guideline (WaterNSW 2021).

ii Groundwater

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

- Characterise the existing groundwater environment and provide a conceptual understanding of the groundwater regime using the following data and/or information:
 - A spatial groundwater monitoring network of monitoring bores and piezometers, with baseline water level and water quality datasets.
 - Temporal data from the monitoring network of at least 12 months duration.

- Other hydrological data, such as rainfall and evaporation.
- Hydraulic testing of the installed monitoring network.
- Numerical flow modelling to replicate the current head distribution (based on known hydrogeological characteristics) and to predict future impacts during construction and operation.
- Identify and assess the predicted impacts of construction and operation on the groundwater source and receptors (landholder bores, GDEs), with regard to the established baseline.
- Establish groundwater management controls to mitigate identified groundwater changes if warranted by the predicted impacts. All practical controls will be considered.
- Assess any groundwater licensing requirements and detail a defined pathway for securing the required entitlement (if required).

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

- *Australian Groundwater Modelling Guidelines* (Waterlines Report, National Water Commission 2012)
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ 2000)
- DPE (2022) *Guidelines for Groundwater Documentation for SSD/SSI Projects – Technical Guideline*
- DPE (2022) *Minimum groundwater modelling requirements for Major Projects in NSW*
- Middlemis, H. Peeters, L. (2018) *Information guidelines explanatory notes: Uncertainty analysis – guidance for groundwater modelling with a risk management framework*
- Barnett, B., et al (2012) *Australian groundwater modelling guideline*
- DPI-Water (2012) *NSW Aquifer Interference Policy – NSW Government Policy for the licensing and assessment of aquifer interference activities*
- Serov P., et al (2012) *Risk assessment guidelines for groundwater dependent ecosystems.*

6.3 Biodiversity

Preliminary biodiversity assessments have been completed for terrestrial and aquatic biodiversity and are attached as Appendix B.1 and Appendix B.2, respectively. The preliminary assessments are summarised in this scoping report.

6.3.1 Existing environment

i Terrestrial biodiversity

The Project area is located in the South Eastern Highlands Interim Biogeographic Regionalisation for Australia (IBRA) region and crosses two IBRA subregions: Hill End subregion and Bathurst subregion. The main works area falls entirely within the Hill End IBRA subregion. The Project is in proximity to the Marrangaroo National Park, with the Project area located to the south of the Park's boundary.

Much of the Project area contains undulating and steep terrain ranging from approximately 780 m to around 1,140 m above sea level that is heavily vegetated. It also contains the water body of Lake Lyell, and parts of streams leading into the lake, including sections of the Coxs River and Farmers Creek. However small areas, predominately restricted to areas fringing Lake Lyell, appear to have been previously cleared for agriculture and other purposes. Selective logging is also likely to have occurred historically within the Project area.

The primary vegetation classes mapped within the Project area are:

- Southern Tableland Grassy Woodlands
- Southern Tableland Dry Sclerophyll Forests
- Southern Escarpment Wet Sclerophyll Forests.

Smaller areas of Eastern Riverine Forests, Subalpine Woodlands, Tableland Clay Grassy Woodlands, Southern Tableland Wet Sclerophyll Forests, South East Dry Sclerophyll Forests, Upper Riverina Dry Sclerophyll Forests, and Montane Bogs and Fens are also mapped in the Project area.

The Plant Community Types (PCTs) present on a site are key to determining the possible presence of threatened species, populations and ecological communities in accordance with the NSW *Biodiversity Conservation Act* (BC Act).

The PCT classification system in NSW is currently transitioning from a qualitative to a quantitative system of classification and hence there are two PCT classifications currently available for the Project area. These two classifications differ substantially in the mapping of vegetation in the Project. Our experience on the site to date, and with other projects, has indicated that neither the current nor new classifications are likely to reliably represent the actual vegetation in the Project area. For the purposes of this assessment, both classifications have been considered and a conservative approach has been taken to predicting which threatened species, populations and ecological communities (threatened entities) may be present. However, it should be noted that the suite of potentially affected threatened entities may change once the actual PCTs on the site are confirmed.

Based on the current qualitative PCT mapping, the following eight PCTs (as mapped in Figure 6.3) may occur in the project area:

- Broad-leaved Peppermint – Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion (PCT 731)
- Broad-leaved Peppermint – Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion (PCT 732) (Decommissioned)
- Red Stringybark – Brittle Gum – Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion (PCT 1093)
- River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion (PCT 85)
- Silvertop Ash – Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands Bioregion and South East Corner Bioregion (PCT 1155)
- Snow Gum – Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion (1191)
- Snow Gum – Mountain Gum tussock grass-herb forest of the South Eastern Highlands Bioregion (PCT 1197)

- Narrow-leaved Peppermint – Mountain Gum – Brown Barrel moist open forest on high altitude ranges, northern South Eastern Highlands Bioregion (PCT 963).

Three of the above PCTs are associated with threatened ecological communities (TECs) that may occur within the Project area, based on current mapping:

- Werriwa Tablelands Cool Temperate Grassy Woodland in the South Eastern Highlands and South East Corner Bioregions which is listed as critically endangered under the BC Act. This TEC is associated with PCT 1191 and PCT 1197.
- Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions which listed as critically endangered under the BC Act. This TEC is associated with PCT 1197 and PCT 963).
- Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion which listed as endangered under the EPBC Act. This TEC is associated with PCT 963.

The Werriwa Tablelands Cool Temperate Grassy Woodland in the South Eastern Highlands and South East Corner Bioregions TEC is considered moderately likely to occur in the Project area. Geotechnical investigations to date have not indicated the presence of any basalt or basalt-like volcanic rocks, such as amphibolite in the project area. As such, the likelihood that the BC Act listed Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions and the corresponding EPBC Act listed TEC, Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion, occurs on the site is low.

Based on the new quantitative PCT mapping, the following fifteen PCTs (as mapped in Figure 6.4) may occur in the project area, none of which area associated with (TECs):

- Central and Southern Tableland River Oak Forest (PCT 4063)
- Central Tableland Granites Grassy Box Woodland (PCT 3367)
- Central Tableland Montane Wet Forest (PCT 3211)
- Central Tableland Peppermint Shrub-Grass Forest (PCT 3735)
- Central Tableland Peppermint-Gum Montane Forest (PCT 3294)
- Central Tableland Ranges Peppermint-Gum Grassy Forest (PCT 3369)
- Central Tableland Ribbon Gum Sheltered Forest (PCT 3303)
- Central West Stony Hills Stringybark-Box Forest (PCT 3534)
- Goulburn-Lithgow Ranges Silvertop Ash Forest (PCT 3650)
- Goulburn-Lithgow Tableland Hills Grassy Forest (PCT 3738)
- Newnes Plateau Swamp Woodland (PCT 3946)
- Southern Tableland Creekflat Ribbon Gum Forest (PCT 3347)
- Southern Tableland Creekflat Swamp Woodland (PCT 3385)
- Southern Tableland Granites Ribbon Gum Grassy Forest (PCT 3348)
- Southern Tableland Western Hills Scribbly Gum Forest (PCT 3747).

Detailed field-based analysis of vegetation will be required to determine whether any TECs occur in the Project area, particularly given that the new PCT mapping classification does not indicate the presence of any TECs.

Some vegetation within the Project area forms part of a contiguous area of forest and woodland vegetation that is linked to Marrangaroo National Park and Lidsdale State Forest. While limited to no survey has been completed within the project area or the surrounding areas (including Marrangaroo National Park), the large expanse of woodland and forest, encompassing national park, state forest and parts of the project area is likely to support a wide range of flora and fauna species. It is also likely to contain habitat features such as hollow-bearing trees, abundant fallen timber and rocky outcrops that could provide shelter and breeding sites a range of threatened fauna. Conversely, within the majority of cleared areas around the lake margin, there is a reduced or limited value in terms of flora and fauna habitat, other than foraging opportunities for species such granivorous birds, raptors and macropod grazing. The high levels of disturbance and introduction or invasion of exotic species in some areas have substantially diminished the habitat values in these areas. Waterways and riparian corridors provide aquatic habitat for species and fauna movement corridors.

The following factors were assessed to determine the potential risk of significant impacts on threatened species and for the prioritisation of impact avoidance recommendations:

- The likelihood that the species occurs in the study area.
- The status of the species under the BC Act and/or EPBC Act – if present, Endangered and Critically Endangered species are typically at higher risk of significant impacts than species listed as Vulnerable.
- Whether or not the species is listed an entity at risk of Serious and Irreversible Impacts (SAIL) in accordance with the BC Act.
- Whether important habitat features for the species (e.g. breeding sites or roosting habitat) or critical habitat as defined under the EPBC Act is likely to be present.
- Whether any population of a Vulnerable species that may be present would likely constitute an important population as defined under the EPBC Act.
- Whether the species is likely to be highly susceptible to any indirect impacts of the project.

The species included in Table 6.2 are those considered to be at most risk of significant impacts based on a combination of their probability of occurring in the study area and their likely susceptibility to impacts if they do occur. This is not a complete list of the species that are likely to occur in the project area. A complete list of species considered to require further assessment based on available data, is provided in Appendix B.1. It should be noted in the case of several of these species, the probability of them occurring in the Project area is low but due to their extreme rarity, if they do occur the risk of a significant impact would be high.

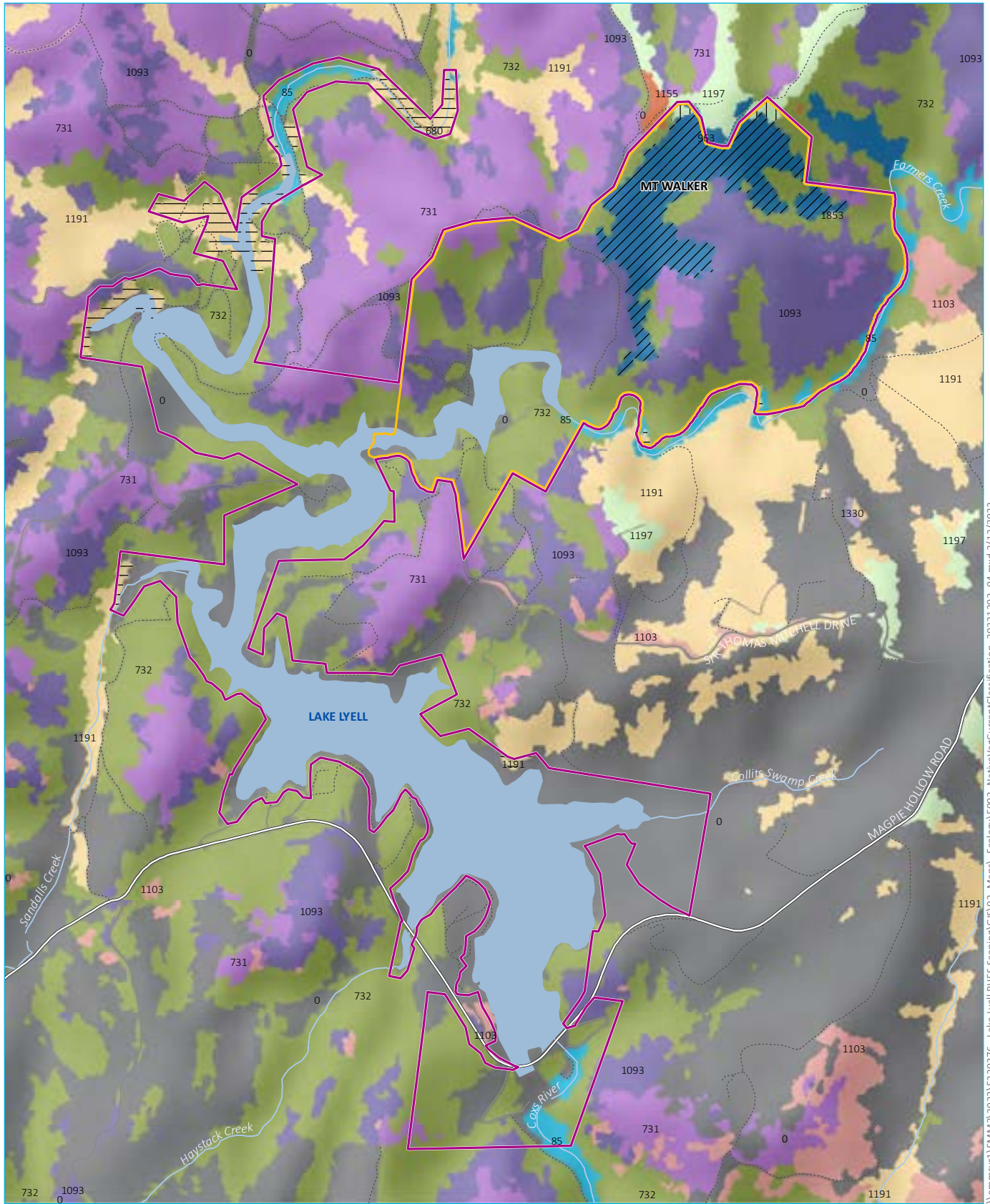
Table 6.2 Threatened species with a moderate or higher risk of significant impacts

Scientific name	Common name	Conservation status		Likelihood of occurrence	Risk of significant impact if species present	Risk rating
		EPBC Act	BC Act			
Birds – large hollow-dependent						
<i>Collocephalon fimbriatum</i>	Gang-gang Cockatoo	E	V	High	Moderate	Moderate to High
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo	V	V			
Birds – owls						
<i>Ninox strenua</i>	Powerful Owl	-	V	High	Moderate	Moderate to High
<i>Ninox connivens</i>	Barking Owl	-	V	Moderate	Moderate	Moderate
<i>Tyto novaehollandiae</i>	Masked Owl	-	V			
Birds – raptors						
<i>Hieraetus morphnoides</i>	Little Eagle	-	V	High	Moderate	Moderate to High
<i>Lophoictinia isura</i>	Square-tailed Kite	-	V			
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	Ma	V	High	Low	Moderate
Invertebrates						
<i>Paralucia spinifera</i>	Bathurst Copper Butterfly	V	E	High	High	High
Mammals – moderate to large gliders						
<i>Petauroides volans</i>	Greater Glider	V	-	Moderate	Moderate	Moderate
<i>Petaurus australis</i>	Yellow-bellied Glider	V	V			
Mammals – cave-dwelling bats						
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	High	Moderate	Moderate to High
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	-	V			
Plants						
<i>Acacia meiantha</i>	-	E	E	Moderate	High	Moderate to High
<i>Caladenia attenuata</i>	Duramana Fingers	CE	CE	Low to Moderate	Very High	Moderate to High
<i>Grevillea divaricata</i>	-	-	E			

Table 6.2 **Threatened species with a moderate or higher risk of significant impacts**

Scientific name	Common name	Conservation status		Likelihood of occurrence	Risk of significant impact if species present	Risk rating
		EPBC Act	BC Act			
<i>Leucochrysum albicans</i> <i>subsp. tricolor</i>	Hoary Sunray	E	-	Moderate	Moderate	Moderate
<i>Pomaderris cotoneaster</i>	Cotoneaster Pomaderris	E	E	Low to Moderate	High	Moderate
<i>Rhizanthella slateri</i>	Eastern Australian Underground Orchid	E	V			
<i>Zieria obcordata</i>	Granite Zieria	E	E	Low to Moderate	High	Moderate

Notes: 1. V = Vulnerable, E = Endangered, CE = Critically Endangered, Ma = species listed as marine under the EPBC Act; impact significance criteria for marine species relate exclusively to impacts within Commonwealth marine areas.
 2. V = Vulnerable, E = Endangered, CE = Critically Endangered



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

KEY

- Project area
- Main works
- Major road
- Minor road
- Vehicular track
- Named watercourse
- Named waterbody
- Non native vegetation

Areas mapped as PCTs associated with threatened ecological communities in the project area

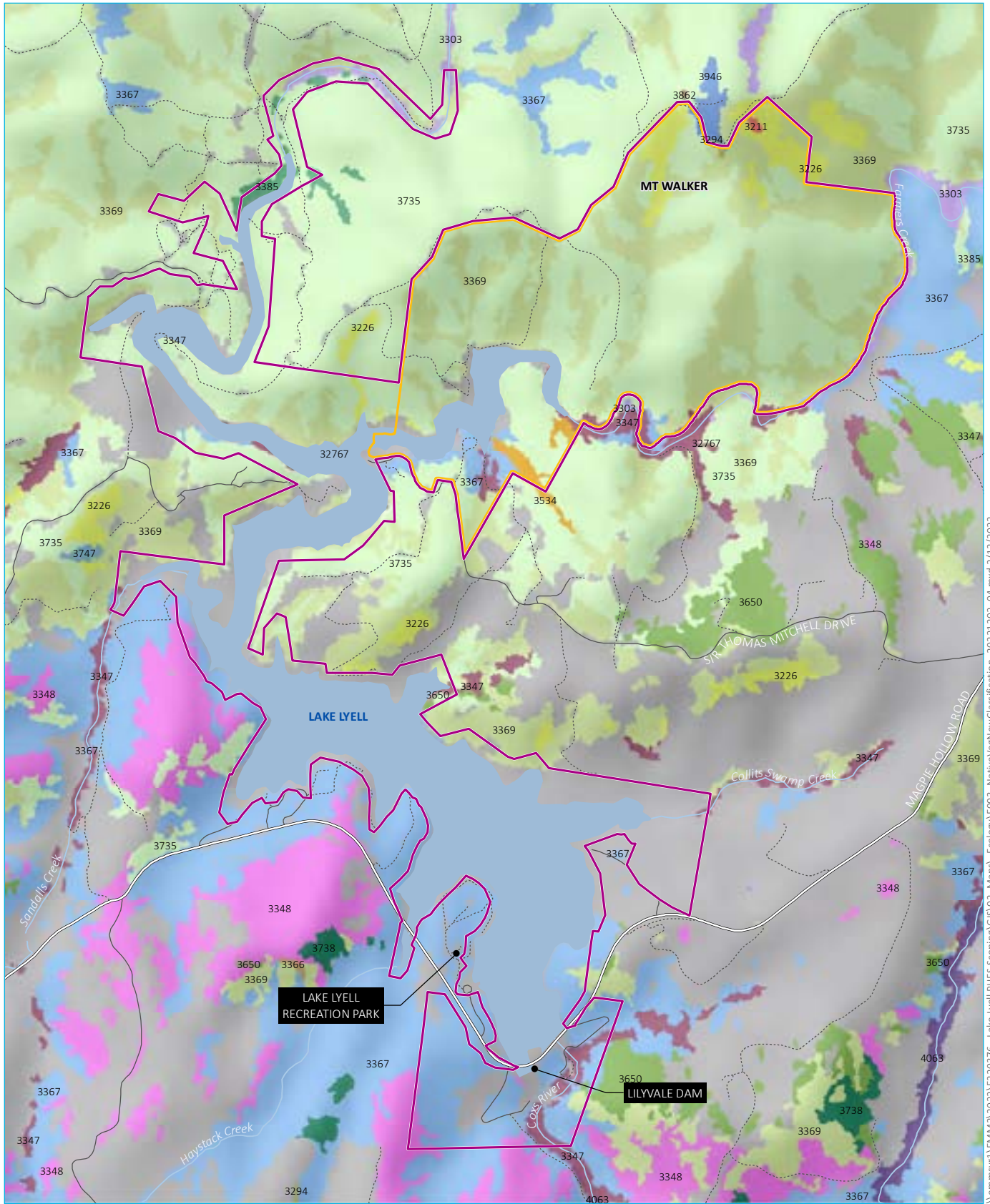
- PCT1191 (BC Act)
- PCT1197 (BC Act)
- PCT963 (BC Act and EPBC Act)

<p>Plant community type (ID Name)</p> <ul style="list-style-type: none"> 85 River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion 680 Black Sallee - Tussock Grass open woodland of the South Eastern Highlands Bioregion 731 Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills; South Eastern Highlands Bioregion 732 Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion 	<ul style="list-style-type: none"> 963 Narrow-leaved Peppermint - Mountain Gum - Brown Barrel moist open forest on high altitude ranges; northern South Eastern Highlands Bioregion 1093 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands; South Eastern Highlands Bioregion 1103 Ribbon Gum - Yellow Box grassy woodland on undulating terrain of the eastern tablelands; South Eastern Highlands Bioregion 	<ul style="list-style-type: none"> 1155 Silvertop Ash - Narrow-leaved Peppermint open forest on ridges of the eastern tableland; South Eastern Highlands Bioregion and South East Corner Bioregion 1191 Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes; South Eastern Highlands Bioregion 1197 Snow Gum - Mountain Gum tussock grass-herb forest of the South Eastern Highlands Bioregion 1330 Yellow Box - Blakelys Red Gum grassy woodland on the tablelands; South Eastern Highlands Bioregion 1853 Blue Mountains Gorges Grey Gum Sheltered Forest
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Native vegetation based on current vegetation classification

Lake Lyell PHES Project Scoping report
Figure 6.3

\\emmsvr1\EMM\2022\220376 - Lake Lyell PHES Scoping\GIS\02_Maps\Ecology\VE002_NativeVegCurrentClassification_20221202_04.mxd 2/12/2022



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

KEY

- Project area
- Main works
- Major road
- Minor road
- Vehicular track
- Named watercourse
- Named waterbody
- Non native vegetation
- Areas mapped as PCTs associated with threatened ecological communities:
- None mapped in project area

Plant community type (ID Name)	
 3211 Central Tableland Montane Wet Forest	 3366 Central Tableland Clay Apple Box Grassy Forest
 3226 Western Blue Mountains Montane Wet Fern Forest	 3367 Central Tableland Granites Grassy Box Woodland
 3294 Central Tableland Peppermint-Gum Montane Forest	 3369 Central Tableland Ranges Peppermint-Gum Grassy Forest
 3303 Central Tableland Ribbon Gum Sheltered Forest	 3385 Southern Tableland Creekflat Swamp Woodland
 3347 Southern Tableland Creekflat Ribbon Gum Forest	 3534 Central West Stony Hills Stringybark-Box Forest
 3348 Southern Tableland Granites Ribbon Gum Grassy Forest	 3650 Goulburn-Lithgow Ranges Silvertop Ash Forest
	 3735 Central Tableland Peppermint Shrub-Grassy Forest
	 3738 Goulburn-Lithgow Tableland Hills Grassy Forest
	 3747 Southern Tableland Western Hills Scribbly Gum Forest
	 3862 Newnes Plateau Rockplate Heath
	 3946 Newnes Plateau Swamp Woodland
	 4063 Central and Southern Tableland River Oak Forest
	 32767 Unattributed

Native vegetation based on new vegetation classification

Lake Lyell PHES Project Scoping report Figure 6.4



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GDA2020 MGA Zone 56

The Project is classified by IBRA as lying within the South Eastern Highlands Bioregion, in the Hill End subregion, and in the Upper Cocks River catchment. The Upper Cocks River catchment is a component of the Hawkesbury-Nepean catchment that is an element of the Warragamba drinking catchment. Land uses within the Hawkesbury-Nepean catchment include a wide range of agricultural industries, urban and residential development, power generation, mining, quarrying, industry, tourism and recreation, and forestry.

The Upper Cocks River catchment it is characterised by low hills, rises, and alluvial floodplains, all of which are predominantly formed on fluvial sediments and metasediments. Large amounts of the Cocks River's riparian zone has been cleared or modified, although areas of intact riparian vegetation remain.

The overstorey of remaining riparian vegetation is reportedly dominated by River Oak (*Casuarina cunninghamiana*), with invasive willows (predominantly *Salix fragilis*) also being present and forming dense stands in some areas. The understory and midstorey are reportedly dominated by *Acacia*, *Callistemon*, *Leptospermum*, *Lomatia*, and *Bursaria*. Invasive species such as Blackberry (*Rubus fruticosus*) and Broom (*Genista*) are common.

495 wetlands, coastal floodplains, and swamps of regional significance are present within the region, with 187 such wetlands present within the Upper Cocks River catchment area. Five Ramsar wetlands are located upstream of the Project Area, the nearest of which is over 300 km away. No Ramsar wetlands are located downstream of the Project Area.

The 2010 Hawkesbury-Nepean State of the Catchment Report found that the condition of fauna and threatened species within the catchment is 'very poor' and that pressure on fauna and threatened species is 'very high'. The condition of wetlands in the catchment is 'very poor' and pressure on these wetlands is 'very high' with the risk from invasive species assessed to be 'very high'.

The most significant source of pressure on wetlands within the Hawkesbury-Nepean catchment is habitat disturbance, particularly from roads crossing or adjoining wetlands, feral animals, and grazing. The State of the Catchment Report also found that seven freshwater pest fish were emerging within the catchment and contributing to environmental pressure.

The location and condition of GDEs within the Cocks River catchment is not currently known as they are not monitored directly, and have not yet been fully identified and mapped. The Bureau of Meteorology Groundwater Dependent Ecosystems Atlas suggests that both high potential and low potential aquatic GDEs occur in the vicinity of the study area.

Lake Lyell itself has been measured to have higher levels of salinity than nearby streams, although the water is still considered to be fresh. The lake receives urban runoff as well as sewage treatment plant effluent from Lithgow via Farmers Creek.

A limited number of stygofauna assessments have been undertaken in the region of the Cocks River and Lake Lyell. Macroinvertebrate condition in the region reported to be 'moderate – good', while fish condition has been found to be 'extremely poor'.

Results from the desktop assessment suggest that six threatened aquatic species listed under the *Fisheries Management Act 1994* (FM Act) and/or the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act), as well as the Platypus, have the potential to occur in waterways associated with the Hawkesbury-Nepean catchment. These are listed in Table 6.3. None of these fish species have been reported within the vicinity of the study area, and it is considered unlikely that they are present due to the lack of records in the area, barriers to fish passage and lack of connectivity to existing known records.

A high number of records of Platypus presence have been made in the Cocks River Catchment, including in the Cocks River itself and other tributaries of Lake Lyell. The Platypus is not listed under the EPBC Act, the FM Act, or the NSW BC Act, however is an important species to the local community.

Table 6.3 **Threatened species with potential to occur in, or adjacent to, the Project area**

Common name	Scientific name	Likelihood of occurrence
Flathead galaxias	<i>Galaxias rostratus</i>	Unlikely
Southern Purple-spotted Gudgeon	<i>Mogurnda adspersa</i>	Unlikely
Macquarie perch	<i>Macquaria australasica</i>	Unlikely
Murray cod	<i>Maccullochella peelii</i>	Unlikely
Trout cod	<i>Maccullochella macquariensis</i>	Unlikely
Australian grayling	<i>Prototroctes maraena</i>	Unlikely
Platypus ¹	<i>Ornithorhynchus anatinus</i>	Known

Notes: 1. Species not listed as threatened under the EPBC Act, BC Act or the FM Act

6.3.2 Preliminary impact assessment

i Terrestrial biodiversity

Disturbance would occur within the 317 ha Main Works area identified for the project, with disturbance areas focused on those areas required for infrastructure and access. Indicatively, this has been estimated as about 167 ha although this area is not fixed and is likely to change as the design and constructability of the Project advances. It is expected much of the refinement to the disturbance footprint would be as a result of the findings of the terrestrial ecology survey and assessment to be carried out.

a Construction phase

Impacts to terrestrial biodiversity during the construction phase would include direct, indirect and prescribed impacts. The construction of new access roads, the upper reservoir and associated facilities for the operation of the Project would require clearing of vegetation and reshaping of the topography and landscape. These activities may result in a direct and long-term impact on the extent and coverage of native vegetation, habitat for threatened species and possibly TECs. Direct impacts to threatened flora species could also occur from clearing and changes in landscape. The indirect impact may relate to alteration of vegetation and associated habitat for native flora and fauna due to issues such as edge effects on moisture and light availability. Loss of habitat connectivity and potentially habitat fragmentation may also occur, potentially also with Marrangaroo National Park depending on the final design.

Short-term direct impacts may also occur where areas of land are cleared for establishing the compound sites, rock crushing and grading, cement batching plant, material storage and other construction staging facilities. Post construction these areas would be rehabilitated and revegetated. However, the successful recovery and re-establishment of plant communities would be slow and may be limited by biophysical constraints. Opportunities for progressive rehabilitation would be explored during design development to facilitate efficient and effective restoration outcomes. Changes in surface hydrology may directly impact on drainage lines and waterways.

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

b Operation phase

Impacts to terrestrial biodiversity during operation would be limited to the margins of Lake Lyell that would be subject to short-term fluctuations in water levels. As Lake Lyell is an artificial waterbody, most of the surrounding native vegetation is unlikely to be reliant on water levels in the lake for its health. Such areas would only be at substantial risk of impacts if they are subject to increased inundation frequency or duration.

Remnant riparian vegetation in the upstream reaches of the Coxs River and Farmers Creek may be more susceptible to changes however, these areas are likely to have already been impacted by historical changes to flow regimes and are likely to be adapted to variable flows including temporary inundation.

In shallower areas where silt has accumulated around the margins of the lake, particularly around the larger tributaries, native emergent aquatic vegetation is likely to have developed. While this vegetation is unlikely to represent a naturally-occurring plant community, it may provide habitat for native animals, including common and threatened species of waterbirds, frogs and migratory waders. The project may affect the potential suitability of this habitat for some of these species.

Increased vehicle traffic within and adjacent to woodland and forest areas may present a roadkill risk to animal populations and may be a source of weed introduction.

c Impact mitigation in design

The mitigation hierarchy included in the BC Act calls for proponents to manage impacts to biodiversity in the following order of importance: avoid, minimise, mitigate and lastly offset.

The greatest opportunities for avoidance and minimisation of impacts occur early in a project, prior to detailed design. However, data such as the locations of threatened plants, key animal habitat features and threatened ecological communities that best inform design decisions are often only available in the later stages of projects.

The terrestrial biodiversity discussion in this report is based almost entirely on desktop data and relies heavily on regional scale vegetation mapping which is typically of only moderate to low accuracy.

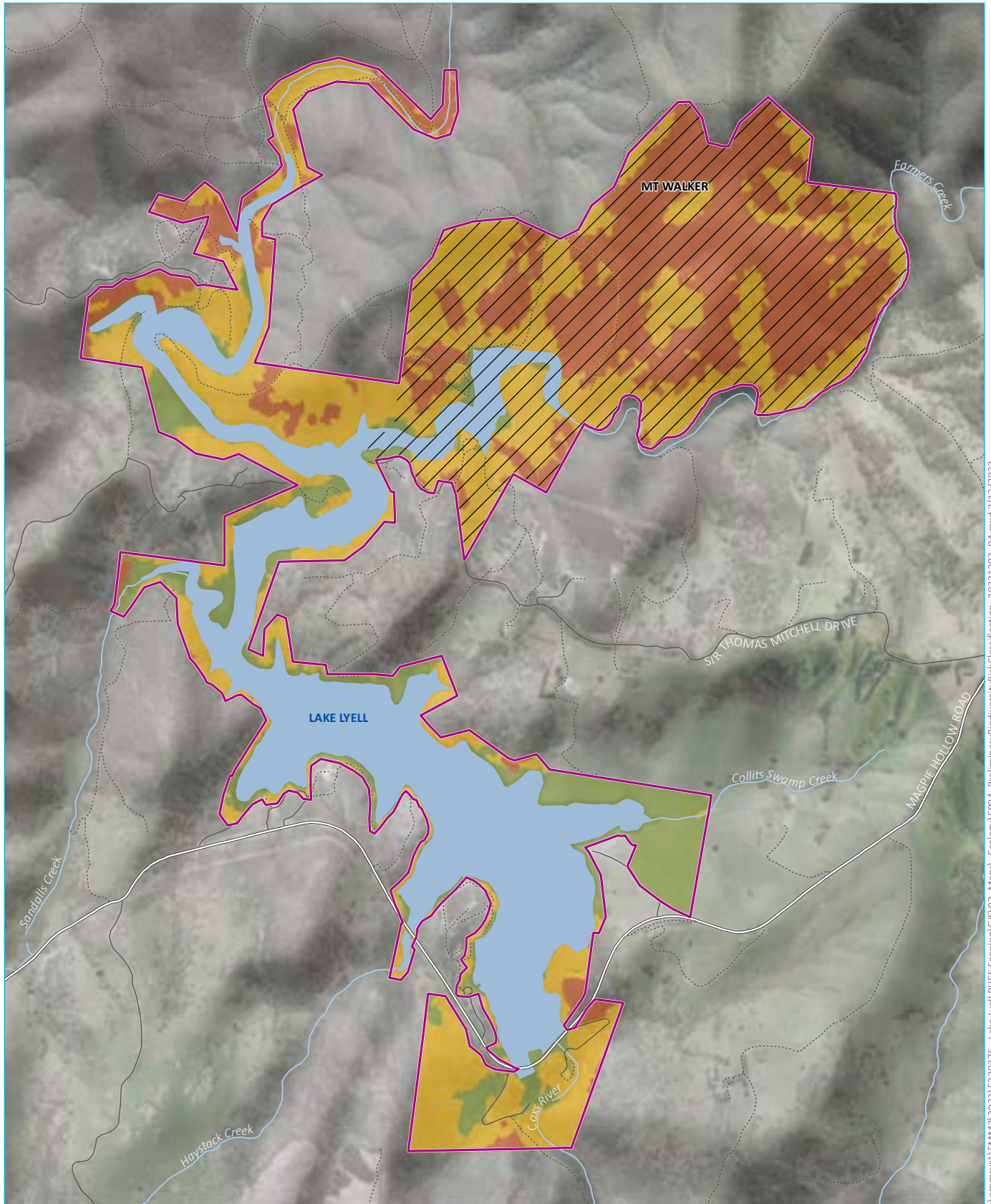
Commencement of biodiversity studies as soon as possible is therefore recommended in order to maximise the potential for avoidance and minimisation of impacts without the need for redesign and associated costs later in the project timeline. Any early-stage biodiversity surveys should be focussed on collecting data to inform mitigation, including:

- Focusing on locations where there is the most flexibility in design.
- Accurately determining the identity and distribution of PCTs and any associated TECs in the Project area, particularly the Main Works area.
- Determining if suitable habitat is present for the species most at risk of significant impacts if they were to be present – particularly Endangered and Critically Endangered species and species listed as at risk of Serious and Irreversible Impacts (SAIL).
- Determining the presence and distribution or absence of the species most at risk of significant impacts and key habitat features such as breeding sites.

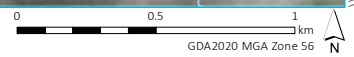
A preliminary biodiversity risk classification mapping exercise has been undertaken to guide the avoidance and minimisation of potential impacts on biodiversity. Mapping of preliminary risk classification is provided in Figure 6.5 and described in Table 6.4. The potential for indirect impacts to the Marrangaroo National Park will be considered and included in avoidance and mitigation measures during the detailed design, and assessed as part of the EIS.

Table 6.4 Preliminary risk classification mapping

Risk mapping category	Features included in category	Recommended actions associated with mapped areas
High	<ul style="list-style-type: none"> • Areas mapped as PCTs that are associated with TECs. • Areas mapped as PCTs that are associated with the threatened species considered most at risk of significant impacts. 	<ul style="list-style-type: none"> • Prioritise assessment in areas where there is greatest design flexibility followed by any other areas of High risk. • Undertake vegetation zone mapping to confirm the identity and condition of the PCTs present and determine if any areas conform to TEC definitions.
Moderate to high	<ul style="list-style-type: none"> • Areas mapped as containing native vegetation communities that are not included in the High constraint category. 	<ul style="list-style-type: none"> • Assess the suitability of habitats in these areas for threatened species, prioritising those species considered most at risk of significant impacts if they occur in the project area (refer Table 5.3 and Table 5.4 of Appendix B.1). • Undertake targeted surveys as soon as possible for those species considered most at risk of significant impacts and other species that may be surveyed concurrently.
Low to moderate	<ul style="list-style-type: none"> • Areas mapped as non-native vegetation 	<ul style="list-style-type: none"> • Undertake PCT mapping to confirm whether these areas contain native vegetation and determine the condition and distribution of any native vegetation present. • Where non-native vegetation or very poor condition native vegetation is found, prioritise these areas for the placement of infrastructure.



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



KEY

- Project area
- Main works
- Major road
- Minor road
- Vehicular track
- Named watercourse
- Named waterbody

Preliminary biodiversity risk classification

- Low to moderate
- Moderate to high
- High

Preliminary terrestrial biodiversity risk classification

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Scoping report
Figure 6.5



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ii Aquatic ecology

Potential impacts that are likely to adversely affect threatened species and the Platypus include the following:

- Fluctuations in water height. This may expose nesting sites for the Platypus, as well as foraging and spawning fish habitat. Vegetation within the littoral zone and riparian vegetation may also be adversely impacted. Temperature fluctuations also caused by water level changes may impact species, such as by interfering with temperatures cues for spawning.
- Physical habitat loss from the scouring of the floor of Lake Lyell.
- Decreases in water quality arising from construction activities. Hydrocarbon spills, sedimentation, and increases in runoff may impact the Lake directly, and cause a range of adverse impacts to species within the lake.

6.3.3 Proposed approach for EIS

i Terrestrial biodiversity

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

The scope of the BDAR will generally include:

- Detailed background from existing literature sources.
- A desktop review of relevant databases and extensive available literature to identify declared wilderness areas, flora, fauna species, GDEs and vegetation communities with a potential to occur within the Project area.
- Seasonal field surveys of vegetation communities, terrestrial flora and fauna and habitat condition across the Project area to comply, where possible, with the NSW Biodiversity and Conservation Division's (BCD)s and DCCEEWs recommendations for survey.
- Mapping the distribution of vegetation communities within the Project area.
- Targeted searches for threatened species, populations and communities (as listed under the schedules of the BC Act and EPBC Act) that may potentially occur in the Project area.
- Habitat assessments within the Project area.
- Assessment of impacts on listed vegetation communities and threatened flora and fauna species.
- Identification of any impact avoidance, mitigation and offset measures necessary for the project.
- Development of any required offset strategy in accordance with the BC Act and EPBC Act.

In addition, a review of land categorisation under the NSW *Local Land Services Act 2013* to clarify the native vegetation management regime would be undertaken where substantial areas of cleared land will be affected by the project. Where applicable (i.e. rural land), the potential for land to be mapped as Category 1 exempt land should be evaluated to determine if a more streamlined assessment of these areas may be undertaken.

The BDAR will be conducted in accordance with the Biodiversity Assessment Method (OEH, 2020) and other relevant guidelines.

ii Aquatic ecology

Further assessments to be undertaken as a part of the comprehensive aquatic ecology assessment for the EIS are anticipated to include:

- Fish surveys. These will be performed in accordance with *the Survey guidelines for Australia's threatened fish: Guidelines for detecting fish listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999*. This will allow greater insight into the abundance and distribution of species within Lake Lyell and its tributaries.
- eDNA assessment. This will also provide additional information relating to the abundance and distribution of species within the Project Area.
- Key fish habitat assessments. In-field characterisation, in combination with examination of existing stream order data, will be undertaken to update existing key fish habitat mapping and provide additional detail.
- Assessment of other biotic and abiotic components. Other biotic and abiotic components will be assessed, including algae (phytoplankton, periphyton), riparian vegetation, macroinvertebrates and sediment quality. Results from such assessments will improve the understanding of ecological values within the study area.

6.4 Aboriginal cultural heritage

6.4.1 Existing environment

The project area is within the traditional boundaries of the Wiradjuri people – one of the largest Aboriginal clan groups in central New South Wales. The people of the Wiradjuri country are known as “people of three rivers” being the Macquarie River (Wambool), Lachlan River (Kalari) and the Murrumbidgee River (Murrumbidjeri), which border their lands.

EnergyAustralia has engaged with the Bathurst Aboriginal Land Council and Mingaan Wiradjuri Aboriginal Corporation on the project as outlined in Section 5.3.3. Representatives from Bathurst Aboriginal Land Council and Mingaan Wiradjuri Aboriginal Corporation have also been involved in recent walkovers (December 2022 and January 2023) of portions of the site as part of the geotechnical investigations for the project.

The project area can be broadly defined by two distinct environments bisected by the Farmers Creek – a now inundated 4th order (Strahler) watercourse within the current Lake Lyell. In the northern portion of the project area, the landscape encompasses Mount Walker and its associated ridge lines and steep slopes. In the south, there is a wide variety of landforms, including broad rounded crests, mid and lower slopes descending down to Lake Lyell and the former Farmers Creek. This environment influences the type of cultural materials that may be expected, with steeper relief more conducive to the presence of rockshelters (and associated elements such as engravings and art) in the north of the Project area. While to the south, surface and/or shallowly buried stone artefacts, freshwater midden, and/or cultural modified trees may be more likely to occur.

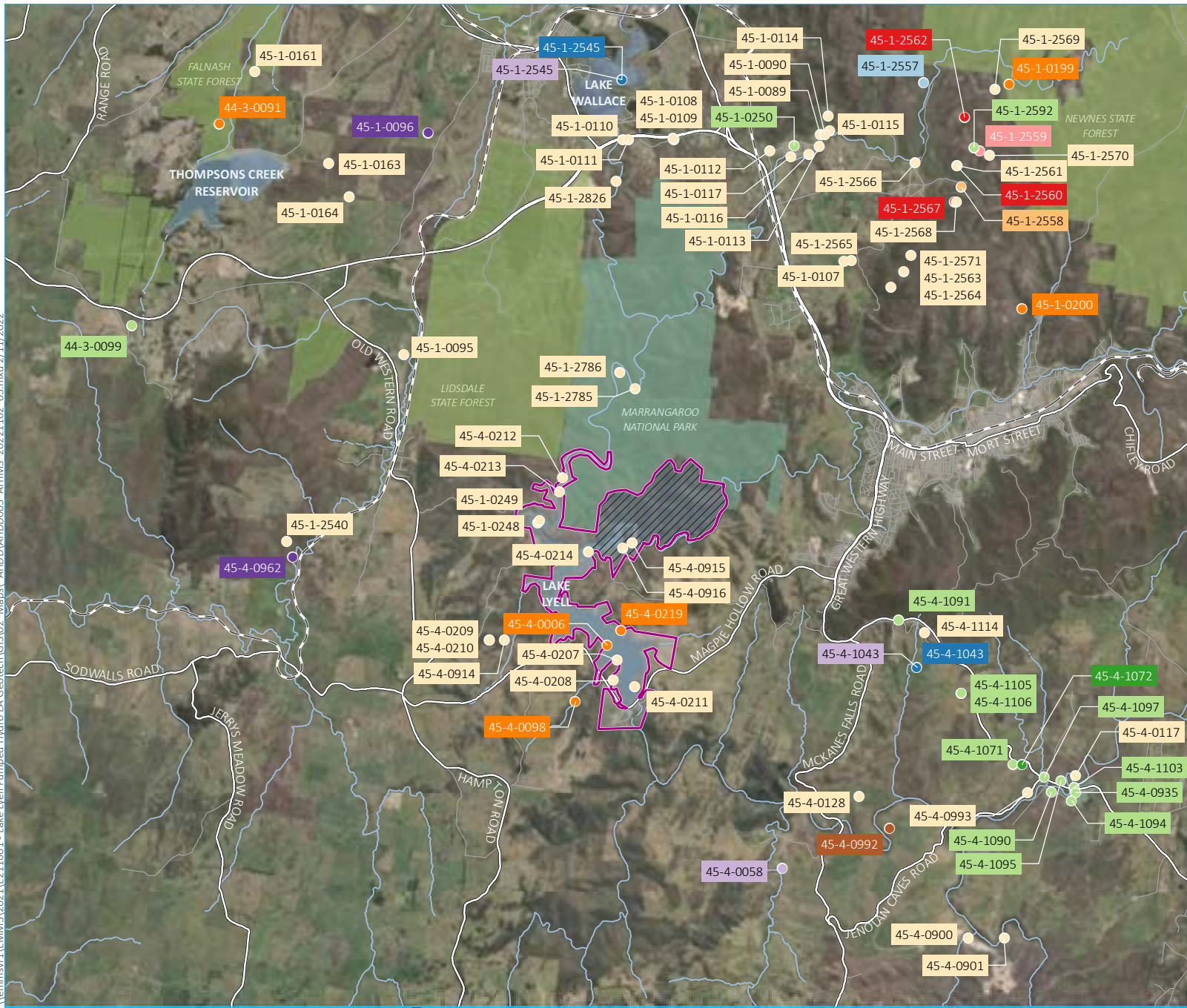
Based on the regional archaeological record, it is considered the steeper relief and especially ridgelines would have been used for generally ephemeral or transiently used. Indeed, ridgelines are known anecdotally as being good transport corridors across the landscape. Where caves or overhangs are present in these environments, and typically where readily accessible and/or near good resources, they may contain increasing evidence of lengthier occupation. More commonly, evidence of past activity and occupation is found in close proximity to water courses and bodies, and more often permanent hydrological sources. These environments would have provided both drinking water and a range of flora and fauna (e.g. fish, birds, mussels and oysters). Previous archaeological studies further suggest that elevated areas on the fringes of Farmers Creek and Coxs River formed a past focus, with numerous archaeological sites documented.

This pattern of past potential land use is evident in the documented archaeological record. A search of Heritage NSW's AHIMS database shows that rockshelters and stone artefact scatters are the most commonly identified site types in the region (see Figure 6.6). The former is generally constrained to ridgelines, crests and spurs, while the latter are usually encountered in alluvial channels and terraces near watercourses. The presence of grinding grooves and rockshelters where steep relief encroaches into the river corridors are also documented. Two previously documented sites (AHIMS #45-4-0915 and #45-4-0916) are within the Main Works area and were located again during a limited site inspection by an EMM archaeologist and a representative of the Bathurst Local Aboriginal Land Council (LALC) (December 2021).

The data demonstrate that Coxs River, Farmers Creek and associated tributaries were all foci for past activities. Indeed, Barry et al (2020) has proposed that Coxs River formed one of the main thoroughfares for movement across the Blue Mountains extending back some 14,000 years.

Based on this information, it is considered that the project area contains numerous landforms within which cultural materials may be expected to occur. To the north, these may be more ephemeral unless the presence of caves or overhangs are encountered, while in the south lower slopes, terraces and floodplains around Farmers Creek and its tributaries would be expected to contain discrete foci of past activity.

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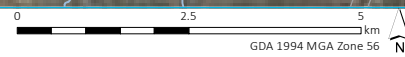
- KEY**
- Project area
 - Main works
 - Rail line
 - Major road
 - Minor road
 - Named watercourse
 - Named waterbody
 - NPWS reserve
 - State forest
- AHIMS (by site type)**
- Aboriginal ceremony and dreaming
 - Burial
 - Burial; undefined artefact scatter
 - Culturally modified tree
 - Isolated artefact
 - Low density artefact scatter (2-14)
 - Rock art (engraved)
 - Rock art (pigment)
 - Rock art (pigment); undefined artefact scatter
 - Rockshelter with deposit
 - Undefined artefact scatter
 - Water hole; low density artefact scatter (2-14)

AHIMS sites in the vicinity of the project area

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Figure 6.6



Source: EMM (2022); EnergyAustralia (2022); ESRI (2022); OEH (2019, 2021); DFSI (2017); GA (2011)



6.4.2 Preliminary impact assessment

i Cultural materials that may be impacted

Overall, the results of the preliminary assessment suggest the following:

- The southern part of the Project area would have been utilised by Aboriginal people for camping and resource gathering activities in the past. The evidence for this is in the form of low-density background scatters of stone artefacts and is demonstrated by two previously documented and re-located sites (AHIMS #45-4-0915 and #45-4-0916).
- The northern part of the Project area may have been utilised as a travelling route through the rugged local terrain. However, this finding is not conclusive, as the ridgeline here terminates at very steep gullies to the south (i.e. landforms that are hard to traverse by foot) and does not connect to other ridgelines. If this landform was used as a travelling route, it is likely that very low densities of stone artefact scatters are present (representing accidental loss and/or incidental tool maintenance). However, no cultural materials have been identified previously, nor as part of the preliminary site inspection. There is also some potential in these environments for rockshelters where natural caves or overhangs occur, although none have been documented in the Project area to date.

ii Construction impacts

Associated with large-scale ground disturbance, the construction phase of works may result in direct and indirect harm to Aboriginal objects. Based on the predictive model it is likely Aboriginal objects will occur within the boundary of the Ancillary works area and lower slopes of the Main Works area.

iii Operation impacts

Impacts to Aboriginal heritage during operation are not anticipated. However, this will be determined during the preparation of the EIS and informed by consultation with the local Aboriginal community.

iv Cultural values that may be impacted

Recent site inspections and engagement with the local Aboriginal community highlighted the importance and need for EnergyAustralia to maintain its active engagement with relevant Aboriginal community members in relation to the identification and management of broad intangible and landscape heritage values (the values of Country) that may be impacted if the project is constructed.

6.4.3 Proposed approach for EIS

The Project area requires further investigation to further characterise and assess potential cultural materials, and provide suitable management and mitigation. This includes more detailed field survey, test excavation (where required), and consultation with the local Aboriginal community.

As such, in accordance with Heritage NSW guidelines, further assessment would comprise of an Aboriginal cultural heritage assessment (ACHA). The ACHA will be prepared with general consideration to the following guidelines:

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

In addition to standard best practice, EnergyAustralia will be carrying out cultural values mapping with Traditional Owners. The purpose of the cultural values mapping will be to consider and assess, based on available materials and fieldwork with contemporary Aboriginal people, the intangible cultural heritage significance of the project area.

6.5 Historic heritage

6.5.1 Existing environment

Searches of the following heritage registers have been completed:

- Australian Heritage Database, including the National and Commonwealth heritage lists, as well as the World Heritage List
- State Heritage Inventory, including the State Heritage Register, Section 170 registers and local heritage items
- Schedule 5 of Lithgow LEP
- Register of the National Estate (non-statutory).

Several sites listed on the Lithgow LEP are located to the east of the proposed development within the Lithgow area. No sites are within the project area or adjacent to proposed access route.

Some areas of the project area have been historically cleared. Modern disturbances include the establishment of Lake Lyell and for associated recreational pursuits, establishment of fire trails, rural residential development and agriculture, and tourist/commercial developments.

6.5.2 Preliminary impact assessment

The project area is not within a heritage conservation area, nor have any items of historic heritage been identified within or adjacent to the project area. There is unlikely to be any direct impact on the known historic heritage values. It's considered that there is low potential for unregistered historic heritage items to be present within the project area however further assessment is required to confirm any potential historical values.

6.5.3 Proposed approach for EIS

A historical heritage assessment will be prepared that provides a detailed review of the historical background for the project area and identifies any places, sites or items of historical value. The assessment will be informed by a site survey to identify any historical items such as built-heritage, archaeological sites and significant landscapes.

6.6 Transport and access

6.6.1 Existing environment

The project transport route is expected to primarily comprise vehicle movements originating east of the project area and travelling along the Great Western Highway before making a turn onto Magpie Hollow Road (as shown previously on Figure 3.5). The Great Western Highway is an approved B-double transport route.

Primary access to the project area will be via Magpie Hollow Road and Sir Thomas Mitchell Drive. Magpie Hollow Road is a local sealed road and connects Great Western Highway in the east with Hampton Road in the west. It is also the main access to Lilyvale Dam and Lake Lyell. Sir Thomas Mitchell Drive is a local sealed road with minimal through traffic used primarily to access scattered rural residences.

6.6.2 Preliminary impact assessment

Construction of the project would result in increases in traffic on the external road network, in particular an increase in heavy vehicles due to deliveries of materials and plant to site. For safety reasons, nearby trails may need to be closed to public access for the duration of the project construction work due to the need to intensively utilise the road for construction access. Site access will be investigated further through detailed design and any road upgrade requirements will be identified and outlined in the EIS.

Minimal traffic generation is anticipated during operation, primarily limited to access for operational management and maintenance.

6.6.3 Proposed approach for EIS

A traffic and access assessment will be carried out to investigate potential impacts associated with the project. The traffic and access assessment will include the following key elements:

- Projections of traffic volumes (both light and heavy vehicles) and transport routes during construction and operation.
- Assessment of the potential traffic impacts of the project on road network function, including intersection performance, site access arrangements, and road safety, including school bus routes and cyclist safety.
- Assessment of the capacity and condition of the existing road network to accommodate the type and volume of traffic generated by the project (including over size vehicles, cover mass vehicles and escorted deliveries) during construction and operation.
- Provide details of measures to manage potential impacts, including a schedule of required road upgrades and other traffic control measures, developed in consultation with the relevant road authority.

6.7 Amenity

6.7.1 Existing environment

The project area includes the southern side of Mount Walker, adjacent to the Marrangaroo National Park, and lower lying areas surrounding Lake Lyell. The project area includes incised valleys and slopes ranging from 780 m at Lake Lyell to about 1,140 m (near the peak of 1,190 m at the Mount Walker Trig station located outside the project area). Vegetation ranges from densely vegetated to open grassland.

Lake Lyell and the surrounding Mount Walker area is used for recreation including camping, four-wheel driving and biking, hiking, fishing and other water-based activities. The lake itself provides scenic amenity and vistas for recreational users, as well as to permanent residents and tourist/commercial operators.

There are no residential areas within the project area however there are several residences located within close proximity to the eastern portion of the project area and along the primary access route. Residential areas that are located outside the project area may have views of the project include Rydal and South Bowenfels.

Rural residential properties along Sir Thomas Mitchell Drive adjoining the project area are intersected by the existing easement and infrastructure of the Wallerawang to Sydney South 330 kV Transmission Lines #76 & 77.

There are no industrial land uses within the project area or other significant noise generating activities. The ambient noise environment is expected to be reflective of its remote location with little impact of human activity. Existing noise activities are expected to be generated by recreation (primarily during summer season), agriculture and traffic movements.



Photograph 6.1 **Mount Walker and Lake Lyell**

Photograph 6.1 shows Mount Walker and Lake Lyell from distant view west of the project area. The northern part of the project area is dominated by the landform of Mount Walker, and densely vegetated slopes down to Lake Lyell. Limited human activity contributes to the ambient noise environment.

6.7.2 Preliminary impact assessment

The project area is within a remote location with the nearest residences within 40 m of the study area boundary and little influence from significant noise generating activities.

The visibility of the site is influenced by its location on a visible landform (Mount Walker), vegetation density (densely vegetation hill slopes) and the low lying Lake Lyell. The potential visual catchment of the project is likely to extend beyond the boundary of the project area due to the elevation of the upper reservoir and the prominence of Mount Walker in the landscape, including potential for long distance views from Rydal and rural properties to the south and south west. Mid to short range views are expected from residences within the project area. Due to the surrounding topography and vegetation, views of the project from Marrangaroo National Park (to the north) are unlikely, and vantage points from the south west are likely have the greatest visibility of the upper reservoir.

The project has potential to result in landscape changes, and visual amenity and construction noise impacts to residences, recreational users and tourist/business operators surrounding Lake Lyell and along the primary access route.

The project will result in the introduction of new permanent infrastructure elements in addition to the existing transmission lines within an otherwise relatively undisturbed landscape. The visibility and effect of these elements on key vantage points will need to be determined through further assessment, including assessment of residences and businesses outside of the project area that may have views of the project (such as Rydal and possibly elevated areas of South Bowenfels). Frequent changes to the water level within Lake Lyell by up to 2 m has potential to change landscape and scenic value, which may also result in social and economic impacts for commercial operators that rely on the amenity of the lake.

The project has potential to result in noise and vibration impacts primarily during construction as a result of earthworks, tunnelling, access establishment and other activities. The lake below has potential to carry noise further distance due to the lack of intervening topography. Construction vibration from the works has potential to impact Aboriginal sites in and around the proposed tunnelling alignment, as will works such as compaction activities associated with construction of the upper reservoir and road construction.



Photograph 6.2 **Lake Lyell Recreation Park**

Photograph 6.2 shows a view toward Mount Walker from the Lake Lyell Recreation Park. Changes in water level up to 2 m would be perceptible at this location (photo taken during full supply).



Photograph 6.3 **Upper Reservoir Outlook**

Photograph 6.3 shows a view toward South Bowenfels from the southern ridge of Mount Walker, adjacent to the upper reservoir footprint. Glimpses of the residential area are visible through the trees. It is anticipated this ridge and existing vegetation would screen the majority of views to the upper reservoir from South Bowenfels.

6.7.3 Proposed approach for EIS

i Landscape and visual impact assessment

A detailed landscape character and visual impact assessment will be prepared to support the EIS and will include an assessment of landscape changes and the likely visual impacts of the project on surrounding residences and scenic or significant vistas.

A comprehensive viewshed analysis or zone of theoretical influence and site verification will be carried out to identify locations and receivers within the local setting that may experience views of project infrastructure. An analysis of the visual sensitivity and potential magnitude of change for these locations will be performed to inform the overall visual impact of the project. Where relevant, the visual impact assessment will recommend mitigation measures to reduce the project's visual amenity impacts (e.g. perimeter vegetation screening). Possible mitigation measures will be discussed with relevant stakeholders during the preparation of the assessment.

The assessment will be undertaken with reference to the *Guidelines for Landscape and Visual Impact Assessment* (3rd edition) (Landscape Institute and Institute of Environmental Management and Assessment, 2013) and relevant DPE visual assessment guidelines and bulletins and include:

- Establishing the landscape and visual baseline using preliminary viewshed analysis and viewshed mapping to identify representative viewpoints for further assessment.
- A detailed landscape character and visual assessment to assess the magnitude of change, visual sensitivity of the surrounding area and inform the visual impact assessment, and to inform project design and consultation.
- Identification of appropriate avoidance or mitigation measures to be incorporated into the project design.

Targeted community engagement is proposed with surrounding landholders and recreational users in relation to visual amenity impacts and development of mitigation options. The preparation of photomontages from key vantage points may be prepared to support the landscape and visual impact assessment and for use in community engagement.

ii Noise and vibration assessment

A noise and vibration assessment will be prepared to support the EIS and include assessment of construction and operational noise impacts, including road traffic noise, at identified sensitive receivers. Given the subject site is remote with little impact from human activity, minimum rating background noise levels (RBLs) as outlined in the NSW Environment Protection Agency (EPA) Noise Policy for Industry (NPfI) could reasonably be adopted. Supplementary road traffic noise monitoring may be conducted at communities along Sir Thomas Mitchell Drive and Magpie Hollow Road that will be utilised to access the project area. Appropriate construction and operational noise and vibration criteria would then be derived with reference to the relevant policies and guidelines.

Noise from proposed construction and operational activities would be predicted using DGMR iNoise noise modelling software, which allows prediction under the ISO9613-2 *Acoustics – Attenuation of Sound during Propagation Outdoors – general method* algorithm. This algorithm is commonly accepted by the EPA. The model would be populated with topography of the project area and its surrounds, including all identified assessment locations. Construction and operational plant and equipment representing the range of proposed construction and operation scenarios would be placed at locations which would represent worst case noise levels throughout the project. Predicted noise generation will then be modelled to determine the worst-case impacts at each assessment location.

Construction and operational vibration would be assessed in accordance with the Department of Environment and Conservation (DEC) *Assessing Vibration: a technical guideline*. Potential noise impacts from additional road traffic movements on public roads generated by the construction and operational phases of the project would be assessed in accordance with the NSW Road Noise Policy (RNP). Air blast overpressure and ground vibration stemming from blasting works would be assessed in accordance with Australian and New Zealand Environment Council (ANZEC) *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration*.

6.8 Air quality

6.8.1 Existing environment

Air quality in the vicinity of the project area is influenced by a range of potential sources, including existing mining operations, agricultural activities, heavy industry (e.g. Mount Piper coal-fired power station), vehicle movements, roads, wind-blown dust and domestic wood fires.

A review of the National Pollution Inventory (NPI) and NSW EPA EPL register indicates that there are a number of existing industrial air pollution emission sources within 50 km of the project area, primarily related to industrial developments in Lithgow and a number of surrounding mine, quarry and power generation sites to the north and east.

6.8.2 Preliminary impact assessment

Dust generation may result during the construction phase of the project, due to the increase in exposed areas during and following site preparation works (such as clearing of vegetation, site levelling, access road establishment etc.), excavation of the upper reservoir, tunnelling and construction of the intake/outtake, and from construction traffic movements on unsealed access roads within the project area. This dust generation is expected to be localised and able to be easily mitigated through implementation of standard management measures. No significant dust generation is expected during operation given exposed areas and roads will be sealed, treated or rehabilitated.

Other air emissions including gaseous pollutants (such as oxides of nitrogen, carbon monoxide, sulfur dioxide, volatile organic compounds) may also be generated as a result of plant operation and diesel combustion from equipment, trucks and electricity generators.

Construction and operation of the project have the potential to generate greenhouse gas (GHG) emissions. Emissions from construction and operational phase GHG emissions will be quantified for the project.

6.8.3 Proposed approach for EIS

A quantitative air quality assessment with dispersion modelling is not considered to be warranted given risk of air quality impacts is expected to be low and will not extend beyond the construction phase of the project. Cumulative impacts of dust from surrounding mining operations and coal fired power stations that influence the existing background environment will be considered.

The impacts to neighbouring sensitive receptors (human and ecological) from construction dust emissions will be assessed using a qualitative impact assessment approach. While no specific methodology for such an assessment is available in Australia, the United Kingdom-based Institute of Air Quality Management (IAQM) has prepared the *Guidance on the Assessment of Dust from Demolition and Construction* (GADDC) (IAQM, 2014).

The GADDC has been applied for construction projects in NSW and accepted by the EPA air technical policy department as a progressive approach to assess the particulate matter impact risk associated with short-term construction and demolition projects. The approach reviews the sensitivity of the local environment and identifies residual risks to dust impacts. Recommendations on dust mitigation measures are then provided.

A GHG assessment will be prepared as part of the air quality assessment, with consideration of project benefits in facilitating the development of renewable energy in the region.

6.9 Hazard and risks

6.9.1 Existing environment

Lilyvale Dam is a 46 m high concrete-face rockfill dam constructed during 1981–1982. It was upgraded in the 1990s to increase the flood capacity and augment the storage capacity. The results of routine inspections, instrumentation monitoring, and surveillance activities indicate that the dam, its foundations and the appurtenant structures are in satisfactory condition.

Lilyvale Dam, Lake Lyell and the project area is not within a mine subsidence area.

The project is on bushfire prone land and is within the Lithgow Bushfire Management Committee (BFMC) area. The Lithgow BFMC has, on average, 128 bush/grass fires per year, of which an average of 3 per year may be considered to be major fires (>20 ha) (Lithgow BFRMP 2020).

Historical land uses across the project area include agricultural and pastoral uses, rural residential development, establishment of roads and tracks for access and connectivity as well as fire management.

6.9.2 Preliminary impact assessment

i Land movement

Subsidence, or ground movement, above tunnels is possible during the construction phase. Steep slopes of the southern face of Mount Walker show evidence of erosion and soil movement downslope which requires consideration during development of design and construction methodology for the upper reservoir.

The risk of the subsidence, or ground movement, is due to a range of factors, including overlying geology, the depth of excavation and tunnelling, groundwater depressurisation and the construction methodology. Subsidence, or ground movement, above tunnels during the operational phase are possible due to settling of land at the surface but are considered unlikely.

ii Dam safety

EnergyAustralia sought a risk assessment of the existing Lilyvale Dam infrastructure and a review as to whether proposed cyclic change in storage water level impact dam safety risks. The outcome of the risk assessment indicated that the societal risk rating of the dam lies within the Dam Safety NSW's SFAIRIP (So Far As Reasonably Practicable) region and is approximately three orders of magnitude below the Dam Safety NSW safety threshold. It was also concluded that the proposed change in operation would have minimal impact on the safety status of the dam and the risk position of the dam.

iii Bushfire

Part of the project area (surrounding Mount Walker) is within the Central strategy fire advantage zone, the purpose of which includes "to provide strategic areas of fire protection advantage which will reduce the speed and intensity of bush fires". Consideration of the project impacts on bushfire prone land and advantages for bushfire protection will be investigated during the EIS.

iv Contamination

Based on the likely historical land uses across the project area, the potential to encounter areas of existing contamination is likely limited to areas of former and current agricultural and pastoral uses. However, further investigation is needed to inform a more detailed understanding of the existing environment and potential contaminants of concern that may be impacted by the project's construction or operation.

v Hazardous and offensive development

Electricity generating works are not an 'industry', nor are they listed in Appendix 3 of *Applying SEPP 33* or IAEA Table II of the MLRA. The amounts of dangerous goods required for the project would be determined following development of the detailed construction methodology and detailed assessment against the relevant thresholds in *Applying SEPP 33* would need to be carried out as part of the EIS.

vi Waste

Waste streams likely to be generated during the construction and ongoing operation of the project include general waste and green waste (from vegetation management). Management of excavated material (spoil) is a key consideration that will be addressed in the EIS, including stockpiling, transport and placement of excavated material.

vii Other hazards

Other potential hazards would be considered in relevant technical assessment, including flooding (within the surface water assessment) and biosecurity (within the biodiversity assessments).

6.9.3 Proposed approach for EIS

The assessment of hazard and risks will be supported by:

- Geotechnical and seismic data collected during the current geotechnical investigation program to identify the ground conditions for earthworks and tunnelling and inform potential subsidence, or land movement, impacts.
- Bushfire hazard assessment prepared in accordance with the NSW Rural Fire Service (RFS) *Planning for Bush Fire Protection, A guide for Councils, planners, fire authorities and developers (2006) (PBP)*.
- Consideration of the existing contamination potential within the project area, including potential impact pathways and measures to avoid, mitigate and manage potential contamination.
- An assessment of public safety with consideration of hazards including flooding, bushfire, dangerous goods, dam safety and other relevant risks.
- Consideration as to how the project's waste will be managed in accordance with relevant guidelines and policies. The EIS will identify, quantify and classify the likely waste streams to be generated during different phases of the project, and will describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste.

6.10 Land

6.10.1 Existing environment

i Land and soil capability

The land and soil capability (LSC) of the Project area is classified as being subject to extremely severe limitations, which is the 7th most extreme of 8 the LSC classifications. Nearby areas tend to have similar or less extreme LSC classifications, with most nearby areas being subject to moderate to severe limitations or extremely severe limitations.

ii Soil landscapes

The primary soil landscape group present within the Project area is the Mount Walker soil landscapes. These landscapes are characterised by steep to very steep hills with shallow soils. Marrangaroo and Round Mount soil landscapes surround the shores of Lake Lyell south and west of Sir Thomas Mitchell Drive, which are both characterised by shallow, rapidly draining sands and soils on lower slopes and drainage depressions. All soil landscapes within the project area are characterised as having extreme soil erosion hazard.

iii Acid sulphate soils

Acid sulphate soils (ASS) are soils which have high concentrations of minerals, such as pyrite, which can produce harmful acids when disturbed or exposed to oxygen. These usually occur in low-lying coastal areas such as swamps and mangroves. ASS risk has not been mapped around the Project area, as the high altitude of the region renders it unlikely that ASS will be present in the area. Risk from the disturbance of ASS is therefore deemed to be minimal.

iv Soil salinity

Soil salinity testing has been undertaken throughout the region encompassing Lake Lyell and the Project area. All tests performed within a 15 km radius of the Project area found there to be no salting evident.

6.10.2 Preliminary impact assessment

The project would result in soil and ground disturbance during construction. While large areas of the disturbed areas would be rehabilitated, some areas of disturbance would be retained for permanent project infrastructure.

Soil and ground disturbance, including the removal of vegetation, has potential to increase erosion and effect land and soil capability.

Detailed rehabilitation would be required to ensure potential impacts are managed in the long term and to promote contiguous vegetation with the surrounding environment.

6.10.3 Proposed approach for EIS

It is proposed to prepare a detailed land, soil and erosion assessment (LSEA) with the EIS which will include:

- A description of existing land uses that may be impacted by the project.
- An overview of LSC classes for the site, soil landscapes and soil types likely to be present on-site and commentary on their constraints relevant to erosion risk.
- Soil survey to classify and map soil types present in the project site and their associated characteristics, limitations and capability.

- Assessment of potential impacts to land use and soil capability.
- A detailed erosion hazard analysis.

6.11 Social

A social impact assessment scoping report has been prepared in accordance with the DPE *Social Impact Assessment Guideline for State Significant Projects* (2021), and provided at Appendix D. The preliminary assessment is summarised in this scoping report.

6.11.1 Existing environment

The study area determined for the SIA is based on the description of the project and the community profile, and includes the following areas:

- local area: Rydal, Bowenfels and South Bowenfels
- key urban area: Lithgow city
- regional area: Lithgow local government area
- the State of NSW.

The community profile identifies trends which are likely to influence the community's experience of the Project's potential impacts and benefits. Key trends include a relatively high proportion of socio-economic disadvantage in the local and regional areas, a high local indigenous population and a relatively high number of people experiencing health concerns. The community profile also identifies many businesses likely to rely on local and regional tourism and recreation opportunities.

Community engagement for the Project and SIA found that the following key matters were indicated repeatedly, by groups with varied interests in the Project, as outlined in Chapter 5 of this report:

- Aboriginal cultural heritage
- biodiversity
- employment and training
- local business
- recreation
- surface water
- traffic
- tourism
- visual amenity.

This demonstrates the above matters are of particularly high importance to the community.

6.11.2 Preliminary impact assessment

A preliminary set of potential social impacts and benefits of the project has been identified (see Table 6.5). These impacts have been based on the SIA scoping assessment, including the outcomes of the community survey, community and stakeholder engagement and completion of the SIA scoping worksheet. This process has been completed in alignment with previous relevant SIAs and EMM Social Scientist's professional judgement.

Table 6.5 SIA Scoping Worksheet summary

Social impact category	Potential impacts on people	Level of assessment for each social impact	Methods and data sources proposed to be used to investigate the impact
Way of life (negative)	Visual impacts of Mt Walker reservoir and supporting infrastructure affecting community sense of place and associated values around the environment and scenery.	Detailed assessment	Local Council Plans and Strategies, Targeted interviews with residents and businesses in the local area, Detailed Design and Project Technical Studies.
Way of life (negative)	Construction noise travelling down Mt Walker resulting in disruption to local residences and businesses.	Standard assessment	Targeted interviews with residents and businesses in the local area, Detailed Design and Project Technical Studies.
Way of life (negative)	Housing and short stay accommodation availability compromised due to competition with non-local workforce.	Standard assessment	Workforce management plan, Targeted interviews with residents and businesses in the local area.
Community (negative)	Community composition and character temporarily altered due to influx of non-local workforce.	Standard assessment	Workforce management plan, Local Council Strategies and Plans, Targeted interviews with residents and businesses in the local area.
Community (negative)	Recreation and amenity impacted by changes to water quality and water levels in Lake Lyell, including the Coxs River arm and Farmer's Creek arm of Lake Lyell (not including biodiversity).	Detailed assessment	Detailed regional analysis and comparison of recreation opportunities, survey of recreational water users, Project Technical Studies.
Access (negative)	Construction increases volume and size of vehicles accessing small local roads, resulting in noise and reduced accessibility through traffic and road quality impacts.	Standard assessment	Workforce management plan, engagement along site access route, identify and target recreational user groups who may be affected, Detailed Design and Project Technical Studies.
Access (positive)	Improved sustainability and stability of the energy network and support for transition to renewable energy, with resulting benefits for climate change.	Detailed assessment	Planning policy context, consultation with key stakeholders with regard to benefits to the NEM, Detailed Design and Project Technical Studies.
Access (negative)	Capacity of services (health, education, community services, local businesses) to support additional construction workforce.	Standard assessment	Social Baseline comparison with Workforce management plan, engagement with relevant service providers.
Access (negative)	Reduced or impeded public access to Lake Lyell and Mt Walker due to construction traffic, works and possible road closures impacting recreation and sense of connection to place.	Standard assessment	Review of historic engagement with Council and Community complaints, engagement along site access route, identify and target recreational user groups who may be affected, Detailed Design and Project Technical Studies.

Table 6.5 SIA Scoping Worksheet summary

Social impact category	Potential impacts on people	Level of assessment for each social impact	Methods and data sources proposed to be used to investigate the impact
Access (positive)	The project may enable continued Lake Lyell operation and maintenance by continuing it's use for energy generation and supply purposes.	Standard assessment	Detailed Design and Project Technical Studies.
Health and wellbeing (negative)	Community safety risks during construction and operation of the reservoir and intake.	Standard assessment	Detailed Design and Project Technical Studies.
Culture (negative)	Direct impacts to material culture for Aboriginal people, including impacts to heritage sites.	Detailed assessment	Regional project context, Engagement with Project Registered Aboriginal Participants through ACHA process, Project Technical Studies.
Culture (negative)	Loss or diminution of traditional attachment to the land or connection to Country and associated cultural obligations to care for Country, or loss of rights to gain spiritual sustenance from the land, including using water for cultural practices.	Standard assessment	Regional project context, ongoing engagement and relationship building with Traditional Owners and engagement with Project Registered Aboriginal Participants through ACHA process, Project Technical Studies.
Livelihoods (positive)	Employment and training opportunities for residents in the regional area.	Standard assessment	Workforce management plan, interviews with relevant service providers and local residents, survey for regional area residents, Project Technical Studies.
Livelihoods (positive)	Business opportunities for residents in the regional area.	Standard assessment	Workforce management plan, ongoing engagement with Lithgow Chamber of Commerce and engage directly with identified affected businesses, Project Technical Studies.
Livelihoods (positive)	Business, employment and training opportunities for indigenous people – IAPP.	Standard assessment	Indigenous/Aboriginal Participation Plan, ongoing engagement with Traditional Owners and interviews with RAPS, Project Technical Studies.
Livelihoods (negative)	Potential for loss of income to tourism businesses reliant on pristine appearance and recreational value of the local landscape.	Detailed assessment	Local Council Plans and Strategies, ongoing engagement with Lithgow Chamber of Commerce and Lithgow City Council, engage directly with tourism and accommodation businesses in the local area, Project Technical Studies.
Livelihoods (positive)	Economic benefit of Project investment in increased indirect employment opportunities and project related spending on local business.	Standard assessment	Social Baseline, ongoing engagement with Lithgow Chamber of Commerce and engage directly with identified affected businesses, Project Technical Studies.
Surroundings (negative)	Biodiversity impacts related to clearing and ongoing management of EnergyAustralia property impacting scenic and recreation values, as well as private property values.	Standard assessment	History of property and local environmental management, interview local environmental and recreation interest groups, Project Technical Studies.

Table 6.5 SIA Scoping Worksheet summary

Social impact category	Potential impacts on people	Level of assessment for each social impact	Methods and data sources proposed to be used to investigate the impact
Surroundings (negative)	Biodiversity impacts related to fluctuation of water levels in Lake Lyell, and the Cox's River arm and Farmers Creek arm of Lake Lyell, impacting environmental and recreational values.	Detailed assessment	Detailed regional analysis and comparison of recreation opportunities, survey of recreational users, interview environmental groups, Project Technical Studies.
Surroundings (negative)	Changes to quality of life caused by amenity impacts affect property prices and residents desire to stay in the area.	Standard assessment	Social Baseline, targeted interviews with residents and businesses in the local area, Project Technical Studies.
Decision-making systems (negative)	Residents ability to access information and be involved in planning and decision making processes, to maintain the sense of connection between the project site and the broader locality.	Standard assessment	Community Engagement Strategy, targeted interviews with residents and businesses in the local and regional areas, Community Engagement Strategy.
Decision-making systems (negative)	Unequal geographic distribution of economic, social and environmental impacts and benefits from the project.	Standard assessment	Social Baseline, Detailed Design and Project Technical Studies.

Potential impacts (negative and positive) that have been identified as requiring a detailed level of assessment under the SIA Guideline (DPE, 2021) framework are:

- Visual impacts of Mt Walker reservoir and supporting infrastructure affecting community sense of place and associated values around the environment and scenery (Impact).
- Recreation and amenity impacted by changes to water quality and water levels in Lake Lyell, including the Cox's River arm and Farmer's Creek arm of Lake Lyell (not including biodiversity) (Impact).
- Improved sustainability and stability of the energy network and support for transition to renewable energy, with resulting benefits for climate change (Benefit).
- Direct impacts to material culture for Aboriginal people, including impacts to heritage sites (Impact).
- Biodiversity impacts related to fluctuation of water levels in Lake Lyell, and the Cox's River arm and Farmers Creek arm of Lake Lyell, impacting environmental and recreational values (Impact).

Other key matters including employment and training, local business, traffic and tourism are also of high importance, but will require less independent social assessment because they will be addressed by other reports, or because their assessment will be provided across multiple impacts.

6.11.3 Proposed approach for EIS

A detailed SIA will be prepared in accordance with the SIA Guideline. The SIA will:

- Build upon the scoping report and engagement undertaken with stakeholders to provide follow-through and affirm that stakeholder views will be fairly addressed and represented throughout the SIA process.
- Confirm the area of social influence through the further development of the social baseline and collection of qualitative and quantitative data.

- Deliver quantitative and qualitative analysis of key project impact pathways.
- Engage with the community and project stakeholders in a targeted manner which collaborates with existing Project and EnergyAustralia opportunities and approaches.
- Use primary and secondary data to predict and analyse the potential direct and indirect impacts (positive and negative) of the Project. This will include research and review of the existing social context through mechanisms consistent with the SIA Guideline (2021).
- Consider the social consequences resulting from the findings of other technical investigations such as investigations into visual impact, biodiversity, surface water and Aboriginal heritage to identify potential amenity impacts as well as the outcomes of the economic assessment.
- Develop appropriate mitigation and enhancement strategies.

6.12 Economic

6.12.1 Existing environment

The economic profile of the Lithgow region includes:

- The largest economic output is from the mining sector, which contributes ~36% of the regions total. Electricity, gas, water and waste services is the next greatest contributor with ~13% of the regions total.
- The largest employers are the health care and social assistance, mining, and public administration and safety industries.

6.12.2 Preliminary impact assessment

Economic considerations span all project phases and will be most significant during the construction phase. It is expected the project will result in an increase in local and regional expenditure for the provision of goods and services and increase local workforce demand. Economic benefits during operation would be considered with regard to overall benefit to the regional economy by contributing to energy reliability and the growth of renewable energy in the NEM. However, this may not be readily quantifiable.

6.12.3 Proposed approach for EIS

The EIS will include a local effects analysis that translates the effects estimated at the State level to the impacts on the communities located near the project (i.e. within the Lithgow LGA). The analysis will consider effects relating to local employment, non-labour project expenditure and social impacts on the local community. The findings will be used to inform consultation with the local community and support the development of mitigation opportunities for any adverse impacts.

6.13 Issues requiring no further assessment

Matters listed in Appendix B of the Scoping Report Guidelines that do not require further assessment in the EIS are listed in Table 6.6.

Table 6.6 Matters requiring no further assessment

Assessment matter	Rationale
Amenity – odour	There are limited odour generating activities or sources of odour that would be encountered during the project.
Built environment	A number of the key issues discussed throughout Chapter 6 are relevant to the built environment. Scoping of these issues are predominantly addressed in Section 6.6 (Traffic and access), 6.7 (Amenity) and Section 6.11 (Social).
Hazard and risks – coastal hazards	There are no coastal hazards within the project area.
Heritage – natural	There are no sites or places of natural heritage within or surrounding the project area. The Greater Blue Mountains Area (GBMA) is a World Heritage listed site and natural heritage place located approximately 30 km south east of the project area (as the crow flies), sufficiently separated from any direct or indirect project impacts. From Lake Lyell, the Cox’s River eventually enters the GBMA approximately 65 km downstream. Water quality impacts downstream from Lake Lyell are not anticipated, and any residual impacts would be negligible before reaching the GBMA.

References

AEMO ISP 2022, *2022 Integrated System Plan for the National Electricity Market*, Australian Energy Market Operator, June 2022

Australian National University (ANU), Stocks, M. Nadolny, A., Stocks, R., Bin Lu, C., Blakers, A. 2022. Bluefield PHES Atlas. Published online and last updated 30 November 2022.

Barry, L., Graham, I., Mooney, S.D., Toms, P.S., Wood, J.C., Williams, A.N. (2020) Crossing a glaciated landscape: Aboriginal movement through the Blue Mountains, Sydney, during the terminal Pleistocene. *Australian Archaeology*, 87(1): 63-74. DOI: 10.1080/03122417.2020.182308.

DPIE 2020, *NSW Electricity Infrastructure Roadmap*, NSW Department of Planning, Industry and Environment, November 2020

LCC 2022, *Our Place Our Future Community Strategic Plan 2035*, Lithgow City Council.

Infrastructure NSW 2022, *Staying Ahead: State Infrastructure Strategy 2022-2042*, Infrastructure NSW, May 2022

Appendix A

Scoping summary table

A.1 Scoping summary table

Level of assessment	Matter	Cumulative Impact Assessment	Engagement	Relevant policies and guidelines	Scoping report reference
Detailed	Water	No	Specific	<ul style="list-style-type: none"> • <i>Australian and New Zealand Guidelines for Fresh and Marine Water Quality</i> (ANZG 2018 & ANZECC 2000) • <i>Australian Rainfall and Runoff</i> (Ball 2019) • <i>NSW Water Quality and River Flow Objectives</i> (DEC 2006) • <i>Managing Urban Stormwater: Soils and Construction</i> Volume 1 (Landcom, 2004) and Volume 2 (Department of Environment and Climate Change, 2008) • <i>Guidelines for controlled activities on waterfront land</i> (NRAR 2018) • <i>Neutral or Beneficial Effect on Water Quality Assessment guideline</i> (WaterNSW 2021). 	Section 6.2
	Amenity – Visual	No	Specific	<ul style="list-style-type: none"> • <i>Guidelines for Landscape and Visual Impact Assessment</i> (United Kingdom Landscape Institute of Environmental Management and Assessment 2013) • <i>Guidance Note for Landscape and Visual Assessment</i> (Australian Institute of Landscape Architects 2018) 	Section 6.7
	Biodiversity	No	Specific	<ul style="list-style-type: none"> • <i>Biodiversity Assessment Method</i> (DPIE 2020) • Commonwealth EPBC 1.1 <i>Significant Impact Guidelines – Matters of National Environmental Significance</i> (Commonwealth of Australia, 2013) • Commonwealth EPBC 1.2 <i>Significant Impact Guidelines – Actions on, or Impacting upon Commonwealth Land and Actions by Commonwealth Agencies</i> (Commonwealth of Australia, 2013) • Commonwealth Department of the Environment – <i>Survey Guidelines for Nationally Threatened Species</i> (various) 	Section 6.3
	Heritage – Aboriginal	Yes	Specific	<ul style="list-style-type: none"> • <i>Guide to investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW</i> (OEH 2011) • <i>Aboriginal Cultural Heritage Consultation Requirements for Proponents</i> (DECCW 2010) • <i>Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales</i> (DECCW 2010) 	Section 6.4
	Social	Yes	Specific	<ul style="list-style-type: none"> • <i>Social Impact Assessment Guideline for State Significant Projects 2021</i> (DPIE 2021) 	Section 6.11
Standard	Hazards and risks	No	General	<ul style="list-style-type: none"> • Hazardous Industry Planning Advisory Paper No. 6 – <i>Guideline for Hazard Analysis</i> (DoP, 2011a) • <i>Multi-Level Risk Assessment</i> (DoP, 2011b) • <i>Hazardous and Offensive Development Application Guidelines: Applying SEPP 33</i> (DoP 2011) 	Section 6.9

Level of assessment	Matter	Cumulative Impact Assessment	Engagement	Relevant policies and guidelines	Scoping report reference
	Heritage – Historical	No	General	<ul style="list-style-type: none"> • <i>Historical Archaeology Code of Practice</i> (Heritage Council 2006) 	Section 6.5
	Land	No	General	<ul style="list-style-type: none"> • <i>Land Use Conflict Risk Assessment Guideline</i> (DPI 2011) • <i>Managing Land Contamination: Planning Guidelines State Environmental Planning Policy No 55 Remediation of land</i> (Department of Urban Affairs and Planning and Environment Protection Authority, 1998) 	Section 6.10
	Amenity – Noise and vibration	No	General	<ul style="list-style-type: none"> • <i>NSW Interim Construction Noise Guideline</i> (DECC 2009) • <i>NSW Noise Policy for Industry</i> (EPA 2017) • <i>NSW Road Noise Policy</i> (DECCW 2011) • <i>Assessing Vibration: A Technical Guideline</i> (DECC 2006) 	Section 6.7
	Traffic	No	General	<ul style="list-style-type: none"> • <i>Guide to Traffic Management – Part 3 Traffic Studies and Analysis</i> (Austroads, 2013) 	Section 6.6
	Air quality	No	General	<ul style="list-style-type: none"> • N/A 	Section 6.8
	Economic	No	General	<ul style="list-style-type: none"> • 	Section 6.12
No further assessment	Air quality – odour	N/A	N/A	<ul style="list-style-type: none"> • N/A 	Section 6.13
	Hazard and risks – coastal hazards	N/A	N/A	<ul style="list-style-type: none"> • N/A 	Section 6.13
	Built environment	N/A	N/A	<ul style="list-style-type: none"> • N/A 	Section 6.13
	Heritage – Natural	N/A	N/A	<ul style="list-style-type: none"> • N/A 	Section 6.13

Appendix B

Preliminary assessments

B.1 Preliminary Terrestrial Biodiversity Assessment

Lake Lyell Pumped Hydro Energy Storage Project Preliminary Terrestrial Biodiversity Assessment

Prepared for Energy Australia

July 2023

Lake Lyell Pumped Hydro Energy Storage Project

Preliminary Terrestrial Biodiversity Assessment

Energy Australia

E220376 LLPHEs Bio

July 2023

Version	Date	Prepared by	Approved by	Comments
0.1	25 October 2022	Paul Rossington	Cecilia Phu	Draft for PM review
1	1 November 2022	Paul Rossington	Christopher Holloway	Draft for client review
2	1 December 2022	Paul Rossington	Christopher Holloway	Final
3	19 December 2022	Paul Rossington	Christopher Holloway	Final – minor revision
4	17 February 2023	Paul Rossington	Christopher Holloway	Final – for lodgement
5	21 July 2023	Paul Rossington	Christopher Holloway	Updated Final

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This report has been prepared in accordance with the brief provided by Energy Australia and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of Energy Australia and no responsibility will be taken for its use by other parties. Energy Australia may, at its discretion, use the report to inform regulators and the public.

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1 Introduction

1.1 Project overview

EnergyAustralia NSW Pty Ltd (EnergyAustralia) is investigating the development of a 335 megawatt (MW) Pumped Hydro Energy Storage (PHES) at Lake Lyell approximately 15 kilometres (km) south of the existing Mount Piper Power Station, within the Lithgow Local Government Area (LGA). The PHES involves creating a new reservoir adjacent to the southern shoulder of Mount Walker (upper reservoir) and connecting it with the Farmers Creek arm of Lake Lyell (lower reservoir) through a series of tunnels and an underground power station. A new switchyard will feed electricity generated from the power station to the grid via existing high voltage transmission lines.

Once constructed, the operation of the Project will allow hydroelectricity to be generated as water is transferred from the upper reservoir to the lower reservoir via the connecting tunnels and turbine located in the underground power house. The reversible turbine will also be able to act as a pump, allowing water to be pumped to the top reservoir during periods of peak renewable energy availability.

The Project will operate as an open loop system, with Lake Lyell remaining largely unchanged although water levels will fluctuate by approximately two metres during each pumping and generating cycle. There is expected to be one pumping and generating cycle each day.

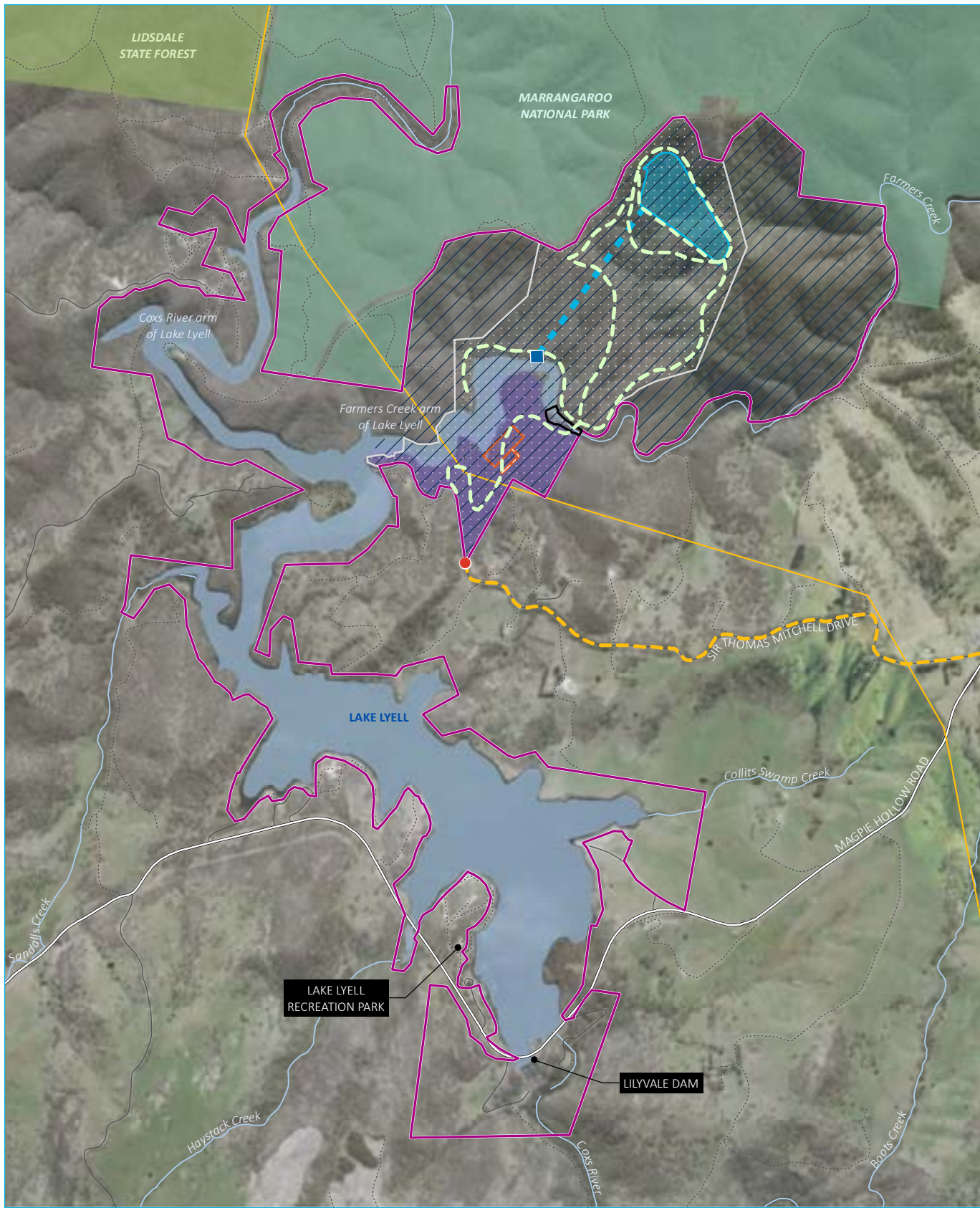
1.2 Purpose of this preliminary biodiversity assessment

The purpose of this preliminary biodiversity assessment is to:

- Identify the terrestrial and semi-aquatic biodiversity values potentially impacted by the project through a desktop study and the author's understanding of the Project area based on other studies undertaken in the locality.
- Undertake a preliminary assessment of possible impacts requiring consideration.
- Assign a risk rating to threatened entities and areas of the project site in terms of the potential project impacts.
- Provide data to inform an EPBC Act referral.
- Outline a recommended approach for future assessment of impacts and the development of impact avoidance and mitigation measures.

1.3 Study area

The study area considered here includes the entire Project area as defined in the body of the Scoping Report. It comprises the Main Works area (approximately 317 ha) where most of the direct impact would occur and the waterbody of Lake Lyell and surrounding land owned and managed by EA where other impacts may occur predominantly due to changes to hydrological conditions. An indicative disturbance footprint is also indicated and is approximately 167 ha in area. The indicative disturbance footprint has been determined based on very early design reviews and is likely to change as the design and constructability of the project is developed and assessed. The study area is shown in Figure 1.1.



Source: EMM (2023); DFSI (2020, 2021); GA (2011); Metromap (2022)

KEY

- Project area
- Main works
- Primary site access
- Internal site access road
- Primary site access route
- Indicative power waterway
- Indicative transmission line connection
- Upper reservoir
- Indicative disturbance footprint
- Indicative location of intake
- Indicative location for bridge crossing
- Indicative HV switchyard location
- Ancillary works area
- Major road
- Minor road
- Vehicular track
- Named watercourse
- 330kV transmission line
- Named waterbody
- NPWS reserve
- State forest

Project areas and key design elements

Lake Lyell PHES Project
Figure 1.1



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2 Legislative context

2.1 NSW Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) and Environmental Planning and Assessment Regulation 2000 (EP&A Regulation) form the statutory framework for environmental assessment and planning approval in NSW. Implementation of the EP&A Act is the responsibility of the Minister for Planning and Homes, statutory authorities and local councils.

The project is classified as State Significant Development (SSD) pursuant to the Section 2.6(1) of the *State Environmental Planning Policy (Planning Systems) 2021*, and approval is required under Part 4, Division 47, of the EP&A Act.

The SSD application for the project is required to be accompanied by an environmental impact statement (EIS) that will be prepared to address Secretary's Environmental Assessment Requirements (SEARs) issued by the Department of Planning and Environment (DPE).

Under Section 7.9 of the *Biodiversity Conservation Act 2016* (BC Act) an application for approval under Division 4.7 of the EP&A Act to carry out SSD must be accompanied by a biodiversity development assessment report (BDAR) unless a BDAR waiver is sought, and the Planning Agency Head and the Environment Agency Head determine that the proposed development is not likely to have any significant impact on biodiversity values.

This ecological constraint assessment identifies potential ecological values that may require consideration during preparation of a BDAR and the EIS.

2.2 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities, heritage places and water resources which are defined as matters of national environmental significance (MNES) under the EPBC Act. These are:

- world heritage properties
- places listed on the National Heritage Register
- Ramsar wetlands of international significance
- threatened flora and fauna species and ecological communities
- migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining)
- water resources, in relation to coal seam gas or large coal mining development.

Under the EPBC Act, a person proposing to take an action that may, or will, have a significant impact on MNES must refer the action to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) for determination as to whether or not it is a 'controlled action'. The *Significant Impact Guidelines 1.1: Matters of National Environmental Significance* (DoEE 2013), outline a 'self-assessment' process including detailed criteria to assist persons or corporations in deciding whether a referral may be required, and if the proposed action may have a significant impact on MNES. If deemed a controlled action, the project is assessed under the EPBC Act and a decision made by the Commonwealth Minister for the Environment as to whether to grant approval.

The bilateral agreement between the Commonwealth of Australia and the State of New South Wales relating to environmental assessment (the assessment bilateral agreement), allows the Commonwealth Minister for the Environment to rely on specified environmental impact assessment processes of the State of New South Wales in assessing actions under the EPBC Act.

DCCEEW has endorsed the NSW Biodiversity Offsets Scheme (BOS) which includes the Biodiversity Assessment Method (BAM). Endorsement of the BOS applies to all NSW projects that require EPBC Act approval.

The project was referred to DCCEEW under the EPBC Act (EPBC number: 2022/09445), due to uncertainty regarding impacts on threatened species and has been deemed a controlled action. The Minister, or their delegate, has also made a decision that the project will be assessed using the bilateral agreement.

EPBC Act listed biodiversity is addressed in this report except for fish species. Fish are addressed in a separate aquatic biodiversity assessment.

2.3 NSW Biodiversity Conservation Act 2016

The NSW *Biodiversity Conservation Act 2016* (BC Act) is the legislation responsible for the conservation of biodiversity in NSW through the protection of threatened flora and fauna species, populations and ecological communities. The BC Act, together with the Biodiversity Conservation Regulation 2017 (BC Regulation), established the Biodiversity Offsets Scheme (BOS).

The BOS includes establishment of the Biodiversity Assessment Method (the BAM, DPIE 2020) for use by accredited persons in biodiversity assessment under the scheme. The purpose of the BAM is to assess the impact of actions on threatened species and threatened ecological communities, and their habitats and determine offset requirements. For major projects, use of the BAM is mandatory, unless a BDAR waiver is granted.

The BAM sets out the requirements for a repeatable and transparent assessment of terrestrial biodiversity values on land in order to:

- identify the biodiversity values on land subject to proposed development area
- determine the impacts of a proposed development, following all measures to avoid, minimise and mitigate impacts
- quantify and describe the biodiversity credits required to offset the residual impacts of proposed development on biodiversity values.

Under Section 7.9 of the BC Act, an application for approval under Division 4.7 of the EP&A Act to carry out SSD must be accompanied by a BDAR unless a BDAR waiver is sought, and the Planning Agency Head and the Environment Agency Head determine that the proposed development is not likely to have any significant impact on biodiversity values.

3 Methods

3.1 Desktop assessment

Information regarding vegetation communities, flora and fauna species was obtained from publicly available databases to inform this assessment.

A review of ecological databases, background information and ecological records have been undertaken to determine the likelihood of occurrence of threatened species and communities within the study area. Data sources included:

- Regional vegetation mapping, including *State Vegetation Type Map: Central Tablelands Region Version 1.0. VIS_ID 4778* (OEH 2016) and the new state-wide *State Vegetation Type Map Version C1.1.M1* (DPE 2022). Plant community types (PCTs) mapped within the study area were reviewed to determine potential alignment with threatened ecological communities (TECs) listed under the EPBC Act or BC Act.
- Protected Matters Search Tool, managed by DCCEEW, for biodiversity MNES protected by the EPBC Act predicted to occur in the locality (refer Appendix A).
- BioNet Atlas of NSW Wildlife for records of threatened species listed under the BC Act or EPBC Act.
- Threatened species associations with the PCTs likely to be present based on data in the BioNet Threatened Biodiversity Data Collection (TBDC) and Bionet Vegetation Classification.
- Atlas of Living Australia for threatened species records.
- Relevant reports for the area.

A review of threatened species geographic (bioregion) and habitat (plant community type) associations was also undertaken using the NSW Bionet TBDC and Bionet Vegetation Classification to generate a list of species, populations and ecological communities required to be considered for further assessment during development of a BDAR.

3.2 Likelihood of occurrence assessment

The criteria for assessing likelihood of occurrence for threatened species, used to inform the assessments Appendix Bis listed in Table 3.1.

Table 3.1 Likelihood of occurrence criteria

Likelihood	Description	Likelihood that detailed assessment will be required
Negligible	<ul style="list-style-type: none">• The potential for the species to occur in the study area is considered so low as to not be worth considering.	Negligible
Low	<ul style="list-style-type: none">• Based on data available the species is unlikely to occur in the study area on anything but a very sporadic basis, or• Species is considered vagrant in the bioregion and is thus considered unlikely to occur in the study area, or• Habitat in the study is likely to be somewhat degraded and/or considered suboptimal due to biophysical conditions and the study area is well outside of the species' known distribution.	Possible Dependent on the characteristics of the species and habitat present.

Table 3.1 Likelihood of occurrence criteria

Likelihood	Description	Likelihood that detailed assessment will be required
Moderate	<ul style="list-style-type: none"> The species is known or predicted to occur in the bioregion but the habitat in the study is likely to be somewhat degraded and/or considered suboptimal due to biophysical conditions, or the study area is well outside of the species known distribution. 	Probable Dependent on the characteristics of the habitat present.
High	<ul style="list-style-type: none"> The species is known to occur in the bioregion, has been recorded in the locality and the study area supports potential habitat for the species that is likely to be in good condition. 	Definite
Known	<ul style="list-style-type: none"> The species has been recorded recently in the study area. The species has been recorded historically in the study area and there has not been any change in habitat values since this time. 	Definite

3.3 Impact risk assessment

The following factors were assessed to determine the potential risk of significant impacts on threatened species and for the prioritisation of impact avoidance:

- the likelihood that the species occurs in the study area based on the criteria in Table 3.1
- the status of the species under the BC Act and/or EPBC Act – if present, Endangered and Critically Endangered species are typically at higher risk of significant impacts than species listed as Vulnerable
- whether or not the species is listed an entity at risk of Serious and Irreversible Impacts (SAIL) in accordance with the BC Act
- whether important habitat features for the species (e.g. breeding sites or roosting habitat) or critical habitat as defined under the EPBC Act is likely to be present
- whether any population of a Vulnerable species that may be present would likely constitute an important population as defined under the EPBC Act
- whether the species is likely to be highly susceptible to any indirect impacts of the project.

4 Potential impacts

4.1 Construction phase

Impacts to terrestrial biodiversity during the construction phase would include direct, indirect and prescribed impacts. The construction of new access roads, the reservoir and associated facilities for the operation of the Project would require clearing of vegetation and limited reshaping of the topography and landscape. These activities may result in a direct and long-term impact on the extent and coverage of native vegetation, habitat for threatened species and possibly TECs. Direct impacts to threatened flora species could also occur from clearing and changes in landscape.

Short-term direct impacts may also occur where areas of land are cleared for establishing the compound sites, cement batching plant, material storage and other construction staging facilities. Post construction these areas would be rehabilitated and revegetated. However, the successful recovery and re-establishment of plant communities would be slow and may be limited by biophysical constraints. Changes in surface hydrology, if any, may directly impact on drainage lines and waterways.

The indirect impact may relate to alteration of vegetation and associated habitat for native flora and fauna due to issues such as edge effects on moisture and light availability. Loss of habitat connectivity and potentially habitat fragmentation may also occur.

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

4.2 Operation phase

Impacts to terrestrial biodiversity during operation would be limited to the margins of Lake Lyell that would be subject to short-term fluctuations in water levels. As Lake Lyell is an artificial waterbody, most of the surrounding native vegetation is unlikely to be reliant on water levels in the lake for its health. Such areas would only be at substantial risk of impacts if they are subject to increased inundation frequency or duration.

Remnant riparian vegetation in the upstream reaches of the Coxs River and Farmers Creek may be more susceptible to changes however, these areas are likely to have already been impacted by historical changes to flow regimes and are likely to be adapted to variable flows including temporary inundation.

In shallower areas where silt has accumulated around the margins of the lake, particularly around the larger tributaries, native emergent aquatic vegetation is likely to have developed. While this vegetation is unlikely to represent a naturally-occurring plant community, it may provide habitat for native animals, including common and threatened species of waterbirds, frogs and migratory waders. The project may affect the potential suitability of this habitat for some of these species.

Increased vehicle traffic within and adjacent to woodland and forest areas may present a roadkill risk to animal populations and may be a source of weed introduction.

5 Existing environment and species-specific impacts

5.1 Landscape context

The Project area is located in the South Eastern Highlands Interim Biogeographic Regionalisation for Australia (IBRA) region and crosses two IBRA subregions: Hill End subregion and Bathurst subregion. The main works area falls entirely within the Hill End IBRA subregion (refer Figure 5.1). The Project is in proximity to the Marrangaroo National Park, with the Project area located to the south of the Park's boundary.

Much of the Project area contains undulating and steep terrain ranging from approximately 780 m to around 1,140 m above sea level that is heavily vegetated. It also contains the water body of Lake Lyell, and parts of streams leading into the lake, including sections of the Coxs River and Farmers Creek. However small areas, predominately restricted to areas fringing Lake Lyell, appear to have been previously cleared for agricultural and other purposes. Selective logging is also likely to have occurred historically within the Project area.

Some vegetation within the Project area forms part of a contiguous area of forest and woodland vegetation that is linked to Marrangaroo National Park and Lidsdale State Forest. While limited to no survey has been completed within the project area or the surrounding areas (including Marrangaroo National Park), the large expanse of woodland and forest, encompassing national park, state forest and parts of the project area is likely to support a wide range of flora and fauna species.

5.2 Native vegetation

The primary vegetation classes mapped within the Project area are:

- Southern Tableland Grassy Woodlands
- Southern Tableland Dry Sclerophyll Forests
- Southern Escarpment Wet Sclerophyll Forests.

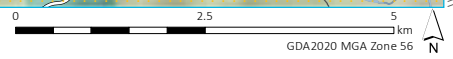
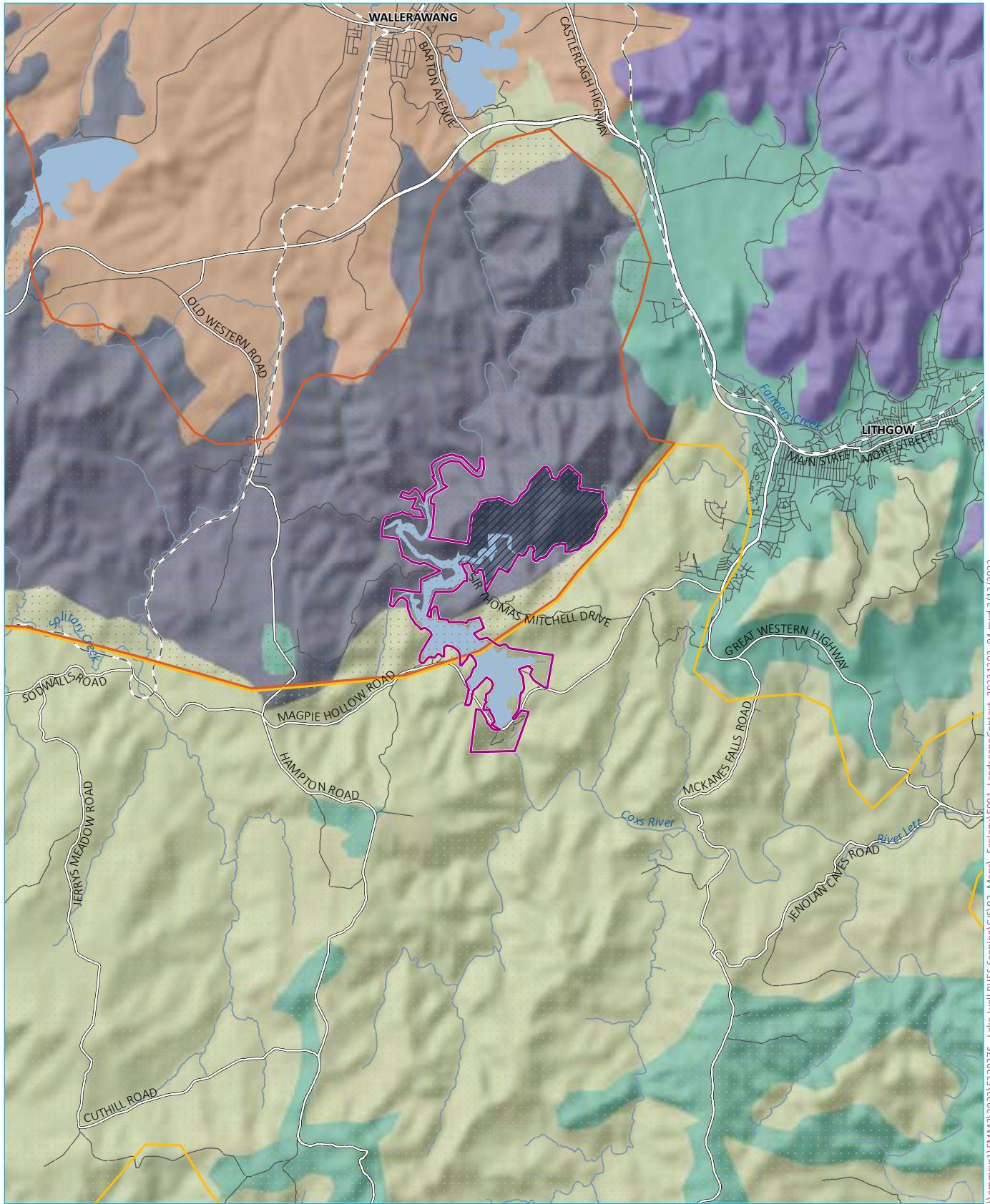
Smaller areas of Eastern Riverine Forests, Subalpine Woodlands, Tableland Clay Grassy Woodlands, Southern Tableland Wet Sclerophyll Forests, South East Dry Sclerophyll Forests, Upper Riverina Dry Sclerophyll Forests, and Montane Bogs and Fens are also mapped in the Project area.

The Plant Community Types (PCTs) present on a site are key to determining the possible presence of threatened species, populations and ecological communities in accordance with the BC Act.

The PCT classification system in NSW is currently transitioning from a qualitative to a quantitative system of classification and hence there are two PCT classifications currently available for the Project area. These two classifications differ substantially in the mapping of vegetation in the Project area. Our experience on the site to date, and with other projects, has indicated that neither the current nor new classifications are likely to reliably represent the actual vegetation in the Project area. For the purposes of this assessment, both classifications have been considered and a conservative approach has been taken to predicting which threatened species, populations and ecological communities (threatened entities) may be present. However, it should be noted that the suite of potentially affected threatened entities may change once the actual PCTs on the site are confirmed.

Based on the current qualitative PCT mapping (State Vegetation Type Map: Central Tablelands Region Version 1.0), the following eight PCTs (as mapped in Figure 5.2) may occur in the project area, three of which are associated with TECs as shown in Table 5.1. Narrow-leaved Peppermint – Mountain Gum – Brown Barrel moist open forest on high altitude ranges, northern South Eastern Highlands Bioregion (PCT 963) is associated with the BC Act listed TEC Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions and the corresponding EPBC Act listed TEC, Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion. Geotechnical investigations to date have not indicated the presence of any basalt or basalt-like volcanic rocks, such as amphibolite in the project area and the likelihood that either of these TECs occurs on the site is low. PCT 1191 and PCT 1197 are both associated with the Werriwa Tablelands Cool Temperate Grassy Woodland in the South Eastern Highlands and South East Corner Bioregions TEC listed under the BC Act. This community is considered moderately likely to occur in the Project area.

Based on the new quantitative PCT mapping, fifteen PCTs (as mapped in Figure 5.3) and listed in Table 5.2 may occur in the project area, none of which area associated with threatened ecological communities (TECs) in the TBDC.



KEY

- Project area
- Main works
- Rail line
- Major road
- Minor road
- Named watercourse
- Named waterbody

- Mitchell landscape**
- Bathurst Granites
 - Capertee Plateau
 - Mount Horrible Plateau
 - Newnes Plateau
 - Sydney Basin Western Escarpment

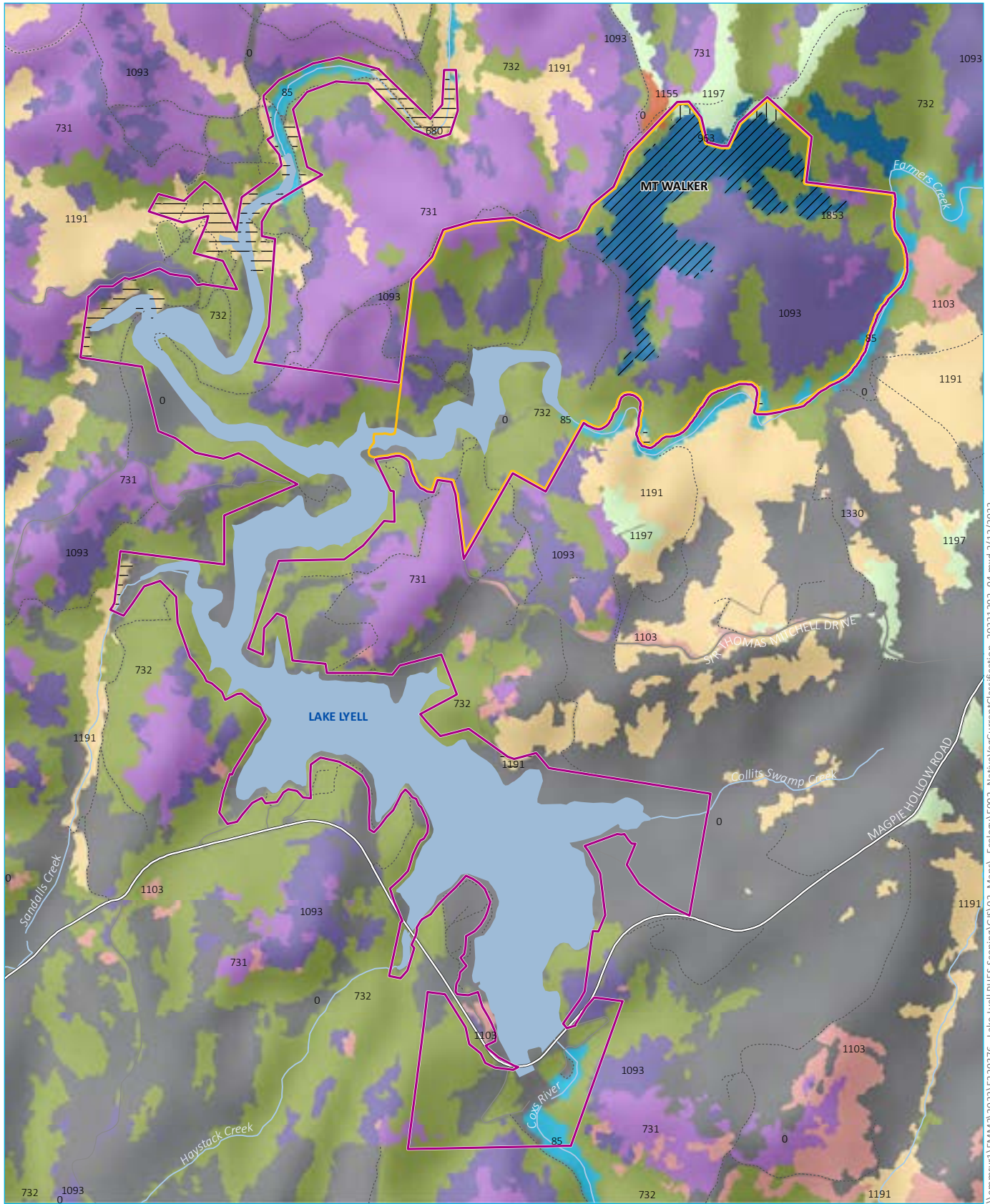
- South Eastern Highlands bioregion**
- Bathurst subregion
 - Hill End subregion

Landscape context

Lake Lyell pumped hydro energy storage project
 Preliminary terrestrial biodiversity assessment
 Figure 5.1



\\emmsvr1\EMM\2022\E220376 - Lake Lyell PHES Scoping\GIS\02_Maps\Ecology\EM003_LandscapeContext_20221202_04.mxd 2/12/2022



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

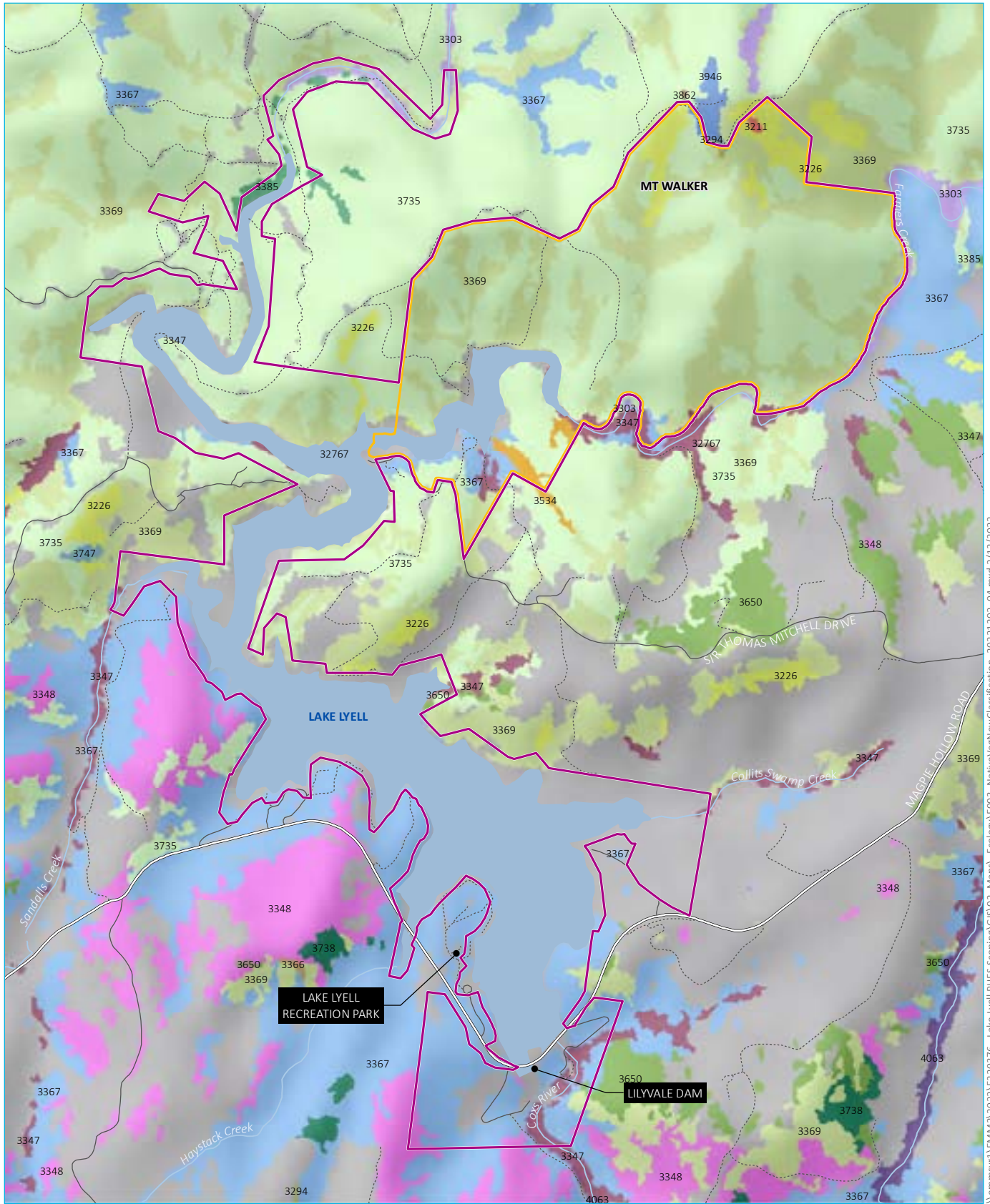
KEY

<ul style="list-style-type: none"> Project area Main works Major road Minor road Vehicular track Named watercourse Named waterbody Non native vegetation Areas mapped as PCTs associated with threatened ecological communities in the project area PCT1191 (BC Act) PCT1197 (BC Act) PCT963 (BC Act and EPBC Act) 	<ul style="list-style-type: none"> 85 River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion 680 Black Sallee - Tussock Grass open woodland of the South Eastern Highlands Bioregion 731 Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills; South Eastern Highlands Bioregion 732 Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion 963 Narrow-leaved Peppermint - Mountain Gum - Brown Barrel moist open forest on high altitude ranges; northern South Eastern Highlands Bioregion 1093 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands; South Eastern Highlands Bioregion 1103 Ribbon Gum - Yellow Box grassy woodland on undulating terrain of the eastern tablelands; South Eastern Highlands Bioregion 1155 Silvertop Ash - Narrow-leaved Peppermint open forest on ridges of the eastern tableland; South Eastern Highlands Bioregion and South East Corner Bioregion 1191 Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes; South Eastern Highlands Bioregion 1197 Snow Gum - Mountain Gum tussock grass-herb forest of the South Eastern Highlands Bioregion 1330 Yellow Box - Blakelys Red Gum grassy woodland on the tablelands; South Eastern Highlands Bioregion 1853 Blue Mountains Gorges Grey Gum Sheltered Forest
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Native vegetation based on current vegetation classification

Lake Lyell
Preliminary terrestrial biodiversity assessment
Figure 5.2

\\emmsvr1\EMM\2022\220376 - Lake Lyell PHES Scoping\GIS\02_Maps\Ecology\VE002_NativeVegCurrentClassification_20221202_04.mxd 2/12/2022



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

0 0.5 1 km
GDA2020 MGA Zone 56

KEY

- Project area
- Main works
- Major road
- Minor road
- Vehicular track
- Named watercourse
- Named waterbody
- Non native vegetation
- Areas mapped as PCTs associated with threatened ecological communities:
- None mapped in project area

Plant community type (ID Name)	
 3211 Central Tableland Montane Wet Forest	 3366 Central Tableland Clay Apple Box Grassy Forest
 3226 Western Blue Mountains Montane Wet Fern Forest	 3367 Central Tableland Granites Grassy Box Woodland
 3294 Central Tableland Peppermint-Gum Montane Forest	 3369 Central Tableland Ranges Peppermint-Gum Grassy Forest
 3303 Central Tableland Ribbon Gum Sheltered Forest	 3385 Southern Tableland Creekflat Swamp Woodland
 3347 Southern Tableland Creekflat Ribbon Gum Forest	 3534 Central West Stony Hills Stringybark-Box Forest
 3348 Southern Tableland Granites Ribbon Gum Grassy Forest	 3650 Goulburn-Lithgow Ranges Silvertop Ash Forest
	 3735 Central Tableland Peppermint Shrub-Grassy Forest
	 3738 Goulburn-Lithgow Tableland Hills Grassy Forest
	 3747 Southern Tableland Western Hills Scribbly Gum Forest
	 3862 Newnes Plateau Rockplate Heath
	 3946 Newnes Plateau Swamp Woodland
	 4063 Central and Southern Tableland River Oak Forest
	 32767 Unattributed

Native vegetation based on new vegetation classification

Lake Lyell
Preliminary terrestrial biodiversity assessment
Figure 5.3



\\hemisvr1\EMM\2022\220376 - Lake Lyell PHES Scoping\GIS\02_Maps\Ecology\EC003_NativeVegNewClassification_20221202_04.mxd 2/12/2022

Table 5.1 Plant Community Types mapped within the study area based on the State Vegetation Type Map: Central Tablelands Region Version 1.0

Plant Community Type (PCT)	Conservation status	
	EPBC Act	BC Act
River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion (PCT 85)	-	-
Broad-leaved Peppermint – Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion (PCT 731)	-	-
Broad-leaved Peppermint – Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion (PCT 732)	-	-
Snow Gum – Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion (1191)	-	CEEC
Red Stringybark – Brittle Gum – Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion (PCT 1093)	-	-
Snow Gum – Mountain Gum tussock grass-herb forest of the South Eastern Highlands Bioregion (PCT 1197)	-	CEEC
Silvertop Ash – Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands Bioregion and South East Corner Bioregion (PCT 1155)	-	-
Narrow-leaved Peppermint – Mountain Gum – Brown Barrel moist open forest on high altitude ranges, northern South Eastern Highlands Bioregion (PCT 963) (Decommissioned)	EEC	EEC

Table 5.2 Plant Community Types mapped within the study area based on the State Vegetation Type Map Version C1.1.M1

Plant Community Type (PCT)	Conservation status	
	EPBC Act	BC Act
Central and Southern Tableland River Oak Forest (PCT 4063)	-	-
Central Tableland Granites Grassy Box Woodland (PCT 3367)	-	-
Central Tableland Montane Wet Forest (PCT 3211)	-	-
Central Tableland Peppermint Shrub-Grass Forest (PCT 3735)	-	-
Central Tableland Peppermint-Gum Montane Forest (PCT 3294)	-	-
Central Tableland Ranges Peppermint-Gum Grassy Forest (PCT 3369)	-	-
Central Tableland Ribbon Gum Sheltered Forest (PCT 3303)	-	-
Central West Stony Hills Stringybark-Box Forest (PCT 3534)	-	-
Goulburn-Lithgow Ranges Silvertop Ash Forest (PCT 3650)	-	-
Goulburn-Lithgow Tableland Hills Grassy Forest (PCT 3738)	-	-
Newnes Plateau Swamp Woodland (PCT 3946)	-	-

Table 5.2 Plant Community Types mapped within the study area based on the State Vegetation Type Map Version C1.1.M1

Plant Community Type (PCT)	Conservation status	
	EPBC Act	BC Act
Southern Tableland Creekflat Ribbon Gum Forest (PCT 3347)	-	-
Southern Tableland Creekflat Swamp Woodland (PCT 3385)	-	-
Southern Tableland Granites Ribbon Gum Grassy Forest (PCT 3348)	-	-
Southern Tableland Western Hills Scribbly Gum Forest (PCT 3747) (Not mapped in project area but mapped nearby and considered likely to occur based on previous studies).	-	-

5.3 Threatened species

5.3.1 Threatened fauna

Background research identified 62 threatened animal species (under the BC Act and/or EPBC Act) predicted to occur and/or previously recorded within 10 km of the study area. A likelihood of occurrence and risk assessment was undertaken to evaluate the likelihood of each of these species occurring in the study area based on the PCTs and associated habitats likely to be present and assessment of the species habitat and distribution, and the potential risk of significant impacts associated with the project (see Appendix B).

This assessment identified 13 animal species at moderate or higher risk of being significantly impacted by the project (refer Table 5.3). Additional species are also likely to be impacted by the project but would be at lower risk of significant impacts. Further consideration will likely be required for the species listed in Table 5.3 and other species listed Appendix B that have higher than a negligible likelihood of occurrence.

Table 5.3 Threatened animal species at highest risk of being significantly impacted by the project

Scientific name	Common name	Conservation status		Risk of significant impacts
		EPBC Act ¹	BC Act ²	
Birds – hollow-dependent parrots that breed in NSW				
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	E	V	Moderate to High Possible loss of breeding sites in hollow trees. Large hollow-bearing trees used by these species are relatively scarce and may limit population size.
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V	V	
Birds – owls				
<i>Ninox connivens</i>	Barking Owl	-	V	Moderate to High – possible loss of breeding sites in hollow trees. Large hollow-bearing trees used by these species are relatively scarce and may limit population size.
<i>Ninox strenua</i>	Powerful Owl	-	V	
<i>Tyto novaehollandiae</i>	Masked Owl	-	V	

Table 5.3 Threatened animal species at highest risk of being significantly impacted by the project

Scientific name	Common name	Conservation status		Risk of significant impacts
		EPBC Act ¹	BC Act ²	
Birds – raptors				
<i>Hieraetus morphnoides</i>	Little Eagle	-	V	Moderate to High. Possible loss of breeding sites in large trees. Large trees suitable for use by these species are relatively scarce and may limit population size.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	Ma	V	
<i>Lophoictinia isura</i>	Square-tailed Kite	-	V	
Invertebrates				
<i>Paralucia spinifera</i>	Bathurst Copper Butterfly	V	E	High Breeding habitat for the species (Blackthorn (<i>Bursaria spinosa</i> subsp. <i>lasiophylla</i>) dominated understorey with associated ant species) is likely to occur in parts of the study area and is likely to be impacted.
Mammals – moderate to large gliders				
<i>Petauroides volans</i>	Greater Glider	V	-	Moderate to High. Possible loss of breeding sites in hollow trees. Large hollow-bearing trees used by these species are relatively scarce and may limit population size. Possible mortality of animals during clearing.
<i>Petaurus australis</i>	Yellow-bellied Glider	V	V	
Mammals – cave-dwelling bats				
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Moderate to High. Possible loss of roosting and/or breeding sites in caves or cave-like structures. Roosting and particularly breeding used by these species are relatively scarce and may limit the species' populations.
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	-	V	

Notes:

1. V = Vulnerable, E = Endangered, Ma = species listed as marine under the EPBC Act; impact significance criteria for marine species relate exclusively to impacts within Commonwealth marine areas.
2. V = Vulnerable, E = Endangered

5.3.2 Threatened flora

Background research identified 34 threatened plant species (listed under the BC Act and/or EPBC Act) that have been predicted to occur and/or have previously been recorded within 10 km of the study area. A likelihood of occurrence and risk assessment was undertaken to evaluate the likelihood of each of these species occurring in the study area based on the PCTs and associated habitats likely to be present and assessment of the species habitat and distribution, and the potential risk of significant impacts associated with the project (see Appendix B). This assessment identified seven plant species at moderate or higher risk of being significantly impacted by the project (Table 5.4). Additional species are also likely to be impacted by the project but would be at lower risk of significant impacts. Further consideration will likely be required for the species listed in Table 5.4 and other species listed in Appendix B that have higher than a negligible likelihood of occurrence.

Table 5.4 **Threatened plant species at risk of being impacted by the project**

Scientific name	Common name	Conservation status		Risk of significant impacts
		EPBC Act ¹	BC Act ²	
<i>Acacia meiantha</i>	-	E	E	<p>Moderate to High</p> <p>The species is only associated with a few of the PCTs predicted to occur within the study area. No records occur within the surrounding area and the species is known only from a limited distribution at three disjunct locations, the closest being 20 km to the east at Clarence. If the species is present, it would represent a range extension and may be considered an important population.</p>
<i>Caladenia attenuata</i>	Duramana Fingers	CE	CE	<p>Moderate to High</p> <p>The species is associated with only one of the PCTs predicted to occur within the study area. Additionally, the species has not been recorded within the surrounding area and has a highly restricted distribution. While the likelihood that the species occupies the study area is relatively low, if it were found it would be the only known extant site and would hence be of very high conservation significance.</p>
<i>Grevillea divaricata</i>	-	-	E	<p>Moderate to High</p> <p>The species is associated with only a few PCTs predicted to occur within the study area. No individuals been recorded within the surrounding area which is outside of the species' known range. The species is only known from one record (1823) from the Bathurst region. While the likelihood that the species occupies the study area is relatively low, if it were found it would be the only known extant site and would hence be of very high conservation significance.</p>
<i>Leucochrysum albicans subsp. tricolor</i>	Hoary Sunray	E	-	<p>Moderate to High</p> <p>The species is associated with several of the PCTs predicted to occur in the study area and was considered likely to occur within the area by the PMST. It has not been recorded in the locality. While the likelihood that the species occupies the study area is relatively low, if it were found it would represent a range extension and may hence be of high conservation significance.</p>
<i>Pomaderris cotoneaster</i>	Cotoneaster Pomaderris	E	E	<p>Moderate</p> <p>The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area. However, the habitat preferences of the species are not well understood and suitable habitat may be present. While the likelihood that the species occupies the study area is relatively low, if it were found it would be would represent a range extension and may hence be of high conservation significance.</p>
<i>Rhizanthella slateri</i>	Eastern Australian Underground Orchid	E	V	<p>Moderate</p> <p>The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area. However, the habitat preferences of the species are not well understood and suitable habitat may be present. While the likelihood that the species occupies the study area is relatively low, if it were found it would be would represent a range extension and may hence be of high conservation significance.</p>

Table 5.4 **Threatened plant species at risk of being impacted by the project**

Scientific name	Common name	Conservation status		Risk of significant impacts
		EPBC Act ¹	BC Act ²	
<i>Zieria obcordata</i>	Granite Zieria	E	E	<p>Moderate</p> <p>The species is associated with only one of the PCTs predicted to occur within the study area. No individuals been recorded within the surrounding area. While the likelihood that the species occupies the study area is relatively low, if it were found it would be would represent a range extension and may hence be of high conservation significance.</p>

Notes:

1. V = Vulnerable, E= Endangered, CE = Critically Endangered.
2. V = Vulnerable, E= Endangered, CE = Critically Endangered.

5.4 Migratory species

Background research identified eight migratory species listed under the EPBC Act as predicted to occur within the study area in addition to the migratory species that are also listed as threatened species (refer Table 5.3). A risk assessment was undertaken to evaluate the likelihood of each of these migratory species occurring in the terrestrial study area and the risk of significant impacts based on the PCTs and other habitats likely to be present (Table 5.5). The assessment concluded the risk of migratory species being significantly impacted by the project is low.

Table 5.5 **Migratory species considered to be at risk of impacts from the project**

Scientific name	Common name	EPBC Act status	Risk of significant impacts
<i>Actitis hypoleucos</i>	Common Sandpiper	Mi	<p>Low</p> <p>This species does not breed in Australia. The species may forage infrequently and sporadically on the muddy fringes of Lake Lyell. The habitat present is unlikely to be important to the species.</p>
<i>Apus pacificus</i>	Fork-tailed Swift	Mi	<p>Low</p> <p>This species does not breed in Australia. The species may forage in air spaces over the study area. The habitat modification resulting from the project is unlikely to significantly affect foraging habitat for the species.</p>
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	Mi	<p>Low</p> <p>This species does not breed in Australia. The species may forage infrequently and sporadically on the muddy fringes of Lake Lyell where aquatic vegetation fringes the lake. The habitat present is unlikely to be important to the species.</p>
<i>Gallinago hardwickii</i>	Lathams Snipe	Mi	<p>Low</p> <p>This species does not breed in Australia. The species has been recorded at Lake Lyell and may forage seasonally on the muddy fringes of Lake Lyell and adjacent grassy areas. The habitat present is unlikely to be important to the species.</p>

Table 5.5 Migratory species considered to be at risk of impacts from the project

Scientific name	Common name	EPBC Act status	Risk of significant impacts
<i>Monarcha melanopsis</i>	Black-faced Monarch	Mi	Low This species may forage and breed in the project area. There are few records of the species in the locality of the project area, which is unlikely to be important habitat for the species.
<i>Motacilla flava</i>	Yellow Wagtail	Mi	Low This species does not breed in Australia. This species does not breed in Australia. The species has not been recorded locally but may forage infrequently and sporadically on the muddy fringes of Lake Lyell where aquatic vegetation fringes the lake. The habitat present is unlikely to be important to the species.
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	Mi	Low This species may forage and breed in the project area. There are few records of the species in the locality of the project area, which is unlikely to be important habitat for the species.
<i>Rhipidura rufifrons</i>	Rufous Fantail	Mi	Low This species may forage and breed in the project area. There are few records of the species in the locality of the project area, which is unlikely to be important habitat for the species.

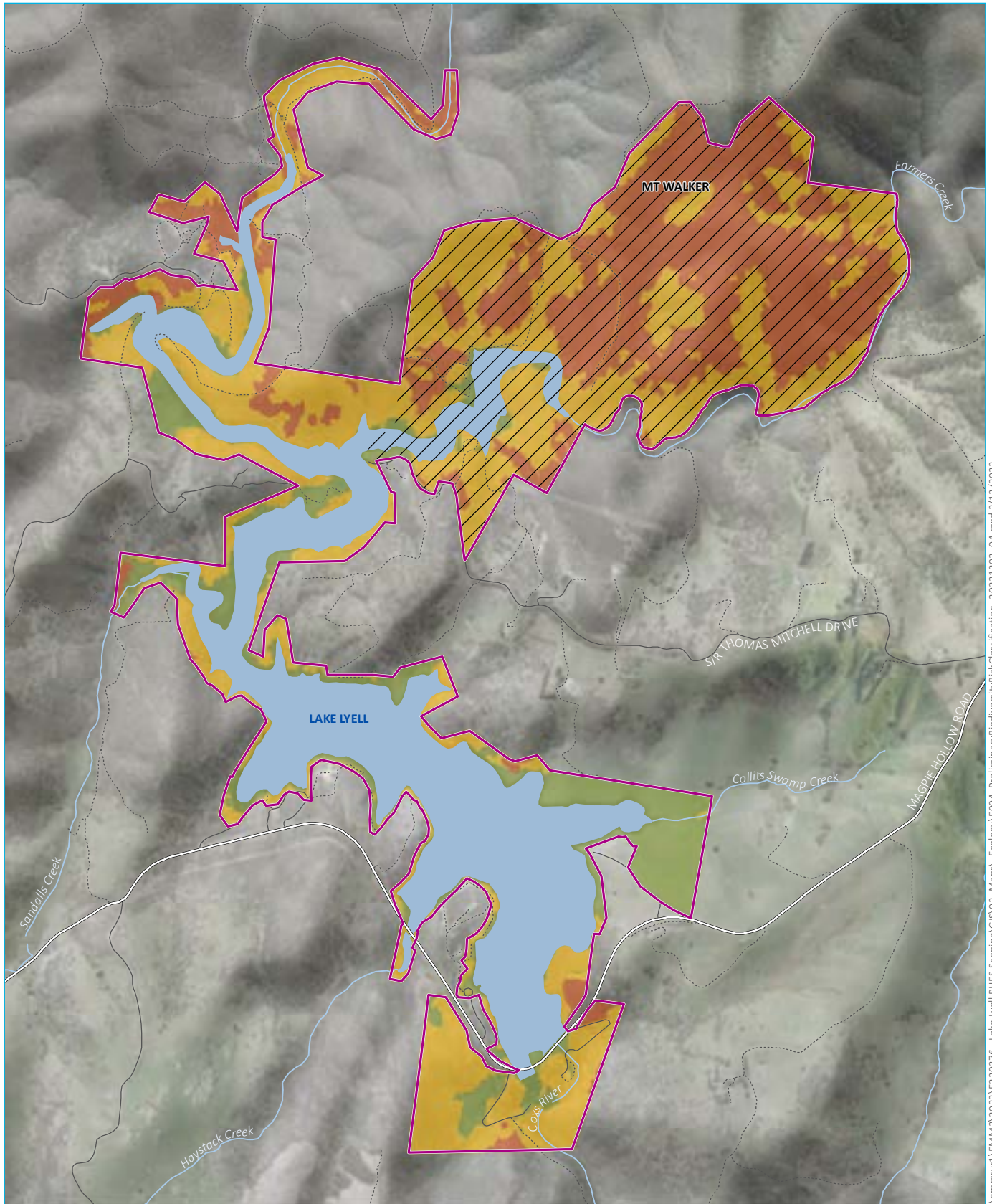
Note: Mi = Migratory

5.5 Preliminary terrestrial biodiversity risk classification and mapping

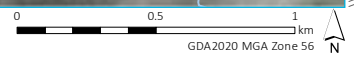
A preliminary biodiversity risk classification mapping exercise has been undertaken to guide the avoidance and minimisation of potential impacts on biodiversity. Preliminary risk classification mapping categories and associated recommendations for the management of potential impacts are described in Table 5.6. Mapping of preliminary risk classification is provided in Figure 5.4. The potential for indirect impacts to the Marrangaroo National Park will be considered and included in avoidance and mitigation measures during the detailed design, and assessed as part of the EIS.

Table 5.6 Preliminary risk classification mapping and mitigation recommendations

Risk mapping category	Features included in category	Recommended actions associated with mapped areas
High	<ul style="list-style-type: none"> • Areas mapped as PCTs that are associated with TECs. • Areas mapped as PCTs that are associated with the threatened species considered most at risk of significant impacts. 	<ul style="list-style-type: none"> • Prioritise assessment in areas where there is greatest design flexibility followed by any other areas of High risk. • Undertake vegetation zone mapping to confirm the identity and condition of the PCTs present and determine if any areas conform to TEC definitions. • Assess the suitability of habitats in these areas for threatened species, prioritising those species considered most at risk of significant impacts if they occur in the project area (refer Table 5.3 and Table 5.4).
Moderate to High	<ul style="list-style-type: none"> • Areas mapped as containing native vegetation communities that are not included in the High constraint category. 	<ul style="list-style-type: none"> • Undertake targeted surveys as soon as possible for those species considered most at risk of significant impacts and other species that may be surveyed concurrently.
Low to Moderate	<ul style="list-style-type: none"> • Areas mapped as non-native vegetation 	<ul style="list-style-type: none"> • Undertake PCT mapping to confirm whether these areas contain native vegetation and determine the condition and distribution of any native vegetation present. • Where non-native vegetation or very poor condition native vegetation is found, prioritise these areas for the placement of infrastructure.



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



KEY

- Project area
- Main works
- Major road
- Minor road
- Vehicular track
- Named watercourse
- Named waterbody

Preliminary biodiversity risk classification

- Low to moderate
- Moderate to high
- High

Preliminary terrestrial biodiversity risk classification

Lake Lyell
Preliminary terrestrial biodiversity assessment
Figure 5.4



\\emmsvr1\EMM\2022\E220376 - Lake Lyell PHES Scoping\GIS\02_Maps\Ecology\EC004_PreliminaryBiodiversityRiskClassification_20221202_04.mxd 2/12/2022

References

- Atlas of Living Australia* ((National Collaborative Research Infrastructure Strategy (NCRIS) and CSIRO))
- DAWE (Australian Government Department of Agriculture, Water and the Environment) 2005a. *Directory of Important Wetlands: Nationally Important Wetlands*. <https://www.environment.gov.au/cgi-bin/wetlands/search.pl?smode=DOIW>.
- 2022b. *Protected Matters Search Tool*. <https://www.environment.gov.au/webgis-framework/apps/pmst/pmst.jsf>.
- 2022c. *Species Profile and Threats Database*. <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>.
- DPE (Department of Planning and Environment) 2022a, *Bionet Atlas of NSW Wildlife*.
- 2022b, *Bionet Threatened Biodiversity Profile Data Collection*.
- DPIE (Department of Planning, Industry and Environment) 2020, *Biodiversity Offset Method*.

Appendix A

Protected matters search tool results



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 20-Sep-2022

[Summary](#)

[Details](#)

[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)

Summary

Matters of National Environment Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar)	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	57
Listed Migratory Species:	12

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Lands:	41
Commonwealth Heritage Places:	None
Listed Marine Species:	19
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	2
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	9
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	1
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar Wetlands) [[Resource Information](#)]

Ramsar Site Name	Proximity	Buffer Status
Banrock station wetland complex	800 - 900km upstream from Ramsar site	In buffer area only
Riverland	800 - 900km upstream from Ramsar site	In buffer area only
The coorong, and lakes alexandrina and albert wetland	900 - 1000km upstream from Ramsar site	In buffer area only
The macquarie marshes	300 - 400km upstream from Ramsar site	In buffer area only

Listed Threatened Ecological Communities [[Resource Information](#)]

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

Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Natural Temperate Grassland of the South Eastern Highlands	Critically Endangered	Community may occur within area	In feature area
Temperate Highland Peat Swamps on Sandstone	Endangered	Community may occur within area	In buffer area only
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion	Endangered	Community may occur within area	In buffer area only
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area	In feature area

Listed Threatened Species [[Resource Information](#)]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.

Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Callocephalon fimbriatum Gang-gang Cockatoo [768]	Endangered	Species or species habitat known to occur within area	In feature area
Calyptorhynchus lathami lathami South-eastern Glossy Black-Cockatoo [67036]	Vulnerable	Species or species habitat known to occur within area	In feature area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat may occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Polytelis swainsonii Superb Parrot [738]	Vulnerable	Species or species habitat known to occur within area	In feature area
Pycnoptilus floccosus Pilotbird [525]	Vulnerable	Species or species habitat known to occur within area	In feature area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area
FISH			
Maccullochella peelii Murray Cod [66633]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Macquaria australasica Macquarie Perch [66632]	Endangered	Species or species habitat known to occur within area	In feature area
Prototroctes maraena Australian Grayling [26179]	Vulnerable	Species or species habitat may occur within area	In feature area
FROG			
Heleioporus australiacus Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Litoria booroolongensis Booroolong Frog [1844]	Endangered	Species or species habitat likely to occur within area	In feature area
Litoria littlejohni Littlejohn's Tree Frog, Heath Frog [64733]	Endangered	Species or species habitat may occur within area	In buffer area only
Mixophyes balbus Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat may occur within area	In buffer area only

INSECT

Scientific Name	Threatened Category	Presence Text	Buffer Status
Paralucia spinifera Bathurst Copper Butterfly, Purple Copper Butterfly, Bathurst Copper, Bathurst Copper Wing, Bathurst-Lithgow Copper, Purple Copper [26335]	Vulnerable	Species or species habitat known to occur within area	In feature area

MAMMAL

Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area	In feature area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area	In feature area
Petauroides volans Greater Glider (southern and central) [254]	Endangered	Species or species habitat known to occur within area	In feature area
Petaurus australis australis Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area	In feature area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Endangered	Species or species habitat known to occur within area	In feature area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour may occur within area	In feature area

PLANT

Acacia bynoeana Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat may occur within area	In feature area
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Scientific Name	Threatened Category	Presence Text	Buffer Status
Acacia flocktoniae Flockton Wattle [3134]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Boronia deanei Deane's Boronia [8397]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Eucalyptus aggregata Black Gum [20890]	Vulnerable	Species or species habitat known to occur within area	In feature area
Eucalyptus pulverulenta Silver-leaved Mountain Gum, Silver-leaved Gum [21537]	Vulnerable	Species or species habitat known to occur within area	In feature area
Euphrasia arguta [4325]	Critically Endangered	Species or species habitat may occur within area	In feature area
Haloragodendron lucasii Hal [6480]	Endangered	Species or species habitat may occur within area	In buffer area only
Kunzea cambagei [11420]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Leionema lachnaeoides [64924]	Endangered	Species or species habitat may occur within area	In buffer area only
Lepidium hyssopifolium Basalt Pepper-cress, Peppercress, Rubble Pepper-cress, Pepperweed [16542]	Endangered	Species or species habitat may occur within area	In buffer area only
Leucochrysum albicans subsp. tricolor Hoary Sunray, Grassland Paper-daisy [89104]	Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Persoonia acerosa Needle Geebung [7232]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Persoonia marginata Clandulla Geebung [10852]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Pomaderris brunnea Rufous Pomaderris, Brown Pomaderris [16845]	Vulnerable	Species or species habitat may occur within area	In feature area
Pomaderris cotoneaster Cotoneaster Pomaderris [2043]	Endangered	Species or species habitat likely to occur within area	In feature area
Prasophyllum petilum Tarengo Leek Orchid [55144]	Endangered	Species or species habitat may occur within area	In feature area
Prasophyllum sp. Wybong (C.Phelps ORG 5269) a leek-orchid [81964]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
Pultenaea glabra Smooth Bush-pea, Swamp Bush-pea [11887]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Pultenaea parrisiae [56699]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Rhizanthella slateri Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within area	In feature area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Velleia perfoliata [17190]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Xerochrysum palustre Swamp Everlasting, Swamp Paper Daisy [76215]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only

REPTILE

Aprasia parapulchella Pink-tailed Worm-lizard, Pink-tailed Legless Lizard [1665]	Vulnerable	Species or species habitat may occur within area	In feature area
Eulamprus leuraensis Blue Mountains Water Skink [59199]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Hoplocephalus bungaroides Broad-headed Snake [1182]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only

Listed Migratory Species

[[Resource Information](#)]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area

Migratory Terrestrial Species

Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area	In feature area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area	In feature area

Migratory Wetlands Species

Scientific Name	Threatened Category	Presence Text	Buffer Status
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area

Other Matters Protected by the EPBC Act

Commonwealth Lands [\[Resource Information \]](#)

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State	Buffer Status
Commonwealth Bank of Australia		
Commonwealth Land - Commonwealth Bank of Australia [12454]	NSW	In buffer area only
Commonwealth Land - Commonwealth Bank of Australia [12459]	NSW	In buffer area only
Communications, Information Technology and the Arts - Telstra Corporation Limited		
Commonwealth Land - Australian Telecommunications Commission [12476]	NSW	In buffer area only
Commonwealth Land - Australian Telecommunications Commission [12452]	NSW	In buffer area only
Commonwealth Land - Australian Telecommunications Commission [12453]	NSW	In buffer area only
Commonwealth Land - Australian Telecommunications Commission [12474]	NSW	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - Australian Telecommunications Corporation [12389]	NSW	In buffer area only
Commonwealth Land - Telstra Corporation Limited [12477]	NSW	In buffer area only
Defence		
Defence - LITHGOW TRAINING DEPOT - SPDU FOR DISPOSAL [10060]	NSW	In buffer area only
Defence - MARRANGAROO [10108]	NSW	In buffer area only
Defence - MARRANGAROO [10107]	NSW	In buffer area only
Defence - MARRANGAROO [10104]	NSW	In buffer area only
Defence - MARRANGAROO [10106]	NSW	In buffer area only
Defence - MARRANGAROO [10105]	NSW	In buffer area only
Defence - MARRANGAROO [10103]	NSW	In buffer area only
Defence - MARRANGAROO [10102]	NSW	In buffer area only
Defence - MARRANGAROO [10101]	NSW	In buffer area only
Defence - MARRANGAROO [10100]	NSW	In buffer area only
Defence - Defence Housing Authority		
Commonwealth Land - Director of War Service Homes [12451]	NSW	In buffer area only
Unknown		
Commonwealth Land - [12462]	NSW	In buffer area only
Commonwealth Land - [12463]	NSW	In buffer area only
Commonwealth Land - [12460]	NSW	In buffer area only
Commonwealth Land - [12461]	NSW	In buffer area only
Commonwealth Land - [12473]	NSW	In buffer area only
Commonwealth Land - [12470]	NSW	In buffer area only
Commonwealth Land - [12471]	NSW	In buffer area only
Commonwealth Land - [12457]	NSW	In buffer area only
Commonwealth Land - [12458]	NSW	In buffer area only
Commonwealth Land - [12469]	NSW	In buffer area only
Commonwealth Land - [12449]	NSW	In buffer area only
Commonwealth Land - [12468]	NSW	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - [12467]	NSW	In buffer area only
Commonwealth Land - [12466]	NSW	In buffer area only
Commonwealth Land - [12465]	NSW	In buffer area only
Commonwealth Land - [12464]	NSW	In buffer area only
Commonwealth Land - [12450]	NSW	In buffer area only
Commonwealth Land - [12448]	NSW	In buffer area only
Commonwealth Land - [12472]	NSW	In buffer area only
Commonwealth Land - [12455]	NSW	In buffer area only
Commonwealth Land - [12475]	NSW	In buffer area only
Commonwealth Land - [12456]	NSW	In buffer area only

Listed Marine Species [[Resource Information](#)]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis			
Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata			
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In feature area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area overfly marine area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area overfly marine area	In feature area
Neophema chrysostoma Blue-winged Parrot [726]		Species or species habitat may occur within area overfly marine area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area overfly marine area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Marrangaroo	National Park	NSW	In feature area
Snow Gum	Flora Reserve	NSW	In buffer area only

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
Great Western Highway Upgrade - Mount Victoria to Lithgow	2013/6804	Controlled Action	Post-Approval	In buffer area only
Hartley Quarry Stage 2, NSW	2013/6967	Controlled Action	Post-Approval	In buffer area only
Springvale Longwall Mine Extension Project, NSW	2013/6881	Controlled Action	Post-Approval	In buffer area only
Stage 2 Extension of the Pine Dale Coal Mine	2012/6326	Controlled Action	Completed	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Hard rock quarry	2002/814	Not Controlled Action	Completed	In buffer area only
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
Marrangaroo Quarry extraction extension, 4km NW Lthgow, NSW	2014/7297	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
Aerial baiting for wild dog control	2006/2713	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Referral decision				
Clarence Colliery Coal Mining Lease Extension	2001/238	Referral Decision	Completed	In buffer area only
Bioregional Assessments				
SubRegion	BioRegion	Website	Buffer Status	
Sydney	Sydney Basin	BA website	In buffer area only	

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

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

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

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

Please feel free to provide feedback via the [Contact Us](#) page.

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Appendix B

Likelihood of occurrence and risk assessment for
threatened species

B.1 Likelihood of occurrence and risk assessment for threatened animals

Table B.1 Likelihood of occurrence and risk assessment for threatened animals

Scientific name	Common name	Conservation status		Likelihood of occurrence	Risk of significant impact if species present	Risk rating
		EPBC Act ¹	BC Act ²			
Birds – locally hollow-dependent parrots						
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	E	V	High	Moderate Possible loss of breeding sites in hollow trees. Large hollow-bearing trees used by these species are relatively scarce and may limit population size.	Moderate to High
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo	V	V			
<i>Neophema pulchella</i>	Turquoise Parrot	-	V	Moderate	Low Possible loss of breeding sites in hollow trees. Small hollow-bearing trees used by these species are relatively abundant.	Low to Moderate
<i>Polytelis swainsonii</i>	Superb Parrot	V	V	Low. While the species is associated with most of the PCTs predicted to occur within the study area which is within the PMST predicted distribution, no individuals have been recorded in the surrounding area and it is not associated with the relevant IBRA subregion in the TSPD.	Low It is only likely to occur sporadically in the locality.	Low

Table B.1 Likelihood of occurrence and risk assessment for threatened animals

Scientific name	Common name	Conservation status		Likelihood of occurrence	Risk of significant impact if species present	Risk rating
		EPBC Act ¹	BC Act ²			
Birds – owls						
<i>Ninox strenua</i>	Powerful Owl	-	V	High	Moderate Possible loss of breeding sites in hollow trees. Large hollow-bearing trees used by these species are relatively scarce and may limit population size.	Moderate to High
<i>Tyto novaehollandiae</i>	Masked Owl	-	V	Moderate		Moderate
<i>Ninox connivens</i>	Barking Owl	-	V			
Birds – nomadic blossom-feeding species						
<i>Grantiella picta</i>	Painted Honeyeater	V	V	Moderate Species has not been regularly recorded in the locality.	Low Only loss of potential foraging habitat likely.	Low to Moderate
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	CE	Moderate The site is not within mapped important habitat areas and the species have not been frequently recorded in the locality.	Low Only loss of foraging habitat likely.	Low to Moderate
<i>Lathamus discolor</i>	Swift Parrot	CE	E			

Table B.1 Likelihood of occurrence and risk assessment for threatened animals

Scientific name	Common name	Conservation status		Likelihood of occurrence	Risk of significant impact if species present	Risk rating
		EPBC Act ¹	BC Act ²			
Birds – sedentary insectivores						
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	-	V	Moderate.	Low Loss of potential foraging and breeding habitat likely however the species have less specific breeding requirements.	Low to Moderate
<i>Daphoenositta chrysoptera</i>	Varied Sittella	-	V			
<i>Chthonicola sagittata</i>	Speckled Warbler	-	V			
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	-	V			
<i>Pycnoptilus floccosus</i>	Pilotbird	-	V	Low The site is not within the modelled possible distribution of the species in the PMST and is not associated with any PCTs predicted to occur within the study area. It has only been recorded once in the locality. .	Low	Low

Table B.1 Likelihood of occurrence and risk assessment for threatened animals

Scientific name	Common name	Conservation status		Likelihood of occurrence	Risk of significant impact if species present	Risk rating
		EPBC Act ¹	BC Act ²			
Birds – migratory insectivores						
<i>Hirundapus caudacutus</i>	White-throated Needletail	V, Mi	-	High	Low Only loss or modification of foraging habitat likely. The species does not breed in Australia and forages over a wide variety of natural and modified habitats.	Low
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	-	V	High	Low Loss of foraging and breeding habitat likely however the species has less specific breeding requirements.	Low to Moderate
<i>Stagonopleura guttata</i>	Diamond Firetail	-	V	Moderate	Loss of foraging and breeding habitat likely however the species has less specific breeding requirements.	Low to Moderate
<i>Petroica boodang</i>	Scarlet Robin	-	V	Moderate	Low These species breed in upland or high-altitude forest and woodlands in spring and summer. As seasonal altitudinal migrants, they move to the lower coast, tableland and slopes areas in autumn and winter. Loss of foraging and breeding habitat likely however the species have less specific breeding requirements.	Low to Moderate
<i>Petroica phoenicea</i>	Flame Robin	-	V			
Birds – raptors						
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	Ma	V	High	Low Possible loss of breeding sites in large trees. Large trees suitable for use by these species are relatively scarce and may limit population size. However, likely breeding sites are most likely to be found around the shore of Lake Lyell and to be avoidable.	Moderate
<i>Hieraetus morphnoides</i>	Little Eagle	-	V		Moderate Possible loss of breeding sites in large trees. Large trees suitable for use by these species are relatively scarce and may limit population size.	Moderate to High
<i>Lophoictinia isura</i>	Square-tailed Kite	-	V			

Table B.1 Likelihood of occurrence and risk assessment for threatened animals

Scientific name	Common name	Conservation status		Likelihood of occurrence	Risk of significant impact if species present	Risk rating
		EPBC Act ¹	BC Act ²			
<i>Erythrotriorchis radiatus</i>	Red Goshawk	E	CE	Low	Low The site is within the modelled possible distribution of the species in the PMST. However, the species are not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area. The species are only likely to occur as occasional vagrants.	Low
<i>Falco hypoleucos</i>	Grey Falcon	V	E			
<i>Falco subniger</i>	Black Falcon	-	V	Moderate	Low While the species are associated with several of the PCTs predicted to occur within the study area, no individuals have been recorded in the surrounding area. These species may occur sporadically in the study area but are unlikely to breed in the locality.	Low to Moderate
<i>Circus assimilis</i>	Spotted Harrier	-	V			
Birds – waterbirds and waders						
<i>Botaurus poiciloptilus</i>	Australasian Bittern	E	E	Moderate While the species is associated with one of the PCTs predicted to occur within the study area, no individuals have been recorded in the surrounding area.	Low The species may occur sporadically in the study area, including in larger patches of emergent aquatic vegetation around Lake Lyell, but is unlikely to breed in the locality. Only loss or modification of marginal foraging habitat likely.	Low to Moderate
<i>Calidris ferruginea</i>	Curlew Sandpiper	CE	CE	Low The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area. Non-PCT habitat (muddy lake margins) may provide marginal foraging habitat.		

Table B.1 Likelihood of occurrence and risk assessment for threatened animals

Scientific name	Common name	Conservation status		Likelihood of occurrence	Risk of significant impact if species present	Risk rating
		EPBC Act ¹	BC Act ²			
<i>Numenius madagascariensis</i>	Eastern Curlew	CE	-	Negligible The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area.	Not applicable.	Negligible
<i>Rostratula australis</i>	Australian Painted Snipe	E	E	Moderate	Low. While the species is associated with one of the PCTs predicted to occur within the study area, no individuals have been recorded in the surrounding area. The species may occur sporadically in the study area, including in larger patches of mud and emergent aquatic vegetation around Lake Lyell, but is unlikely to breed in the locality. Only loss or modification of marginal foraging habitat likely.	Low to Moderate
<i>Oxyura australis</i>	Blue-billed Duck	-	V	High	Low The species is not associated with one of the PCTs predicted to occur within the study area but it has been recorded on Lake Lyell. The species may occur sporadically in the study area on Lake Lyell and around and emergent aquatic vegetation on the lake edge but is unlikely to breed in the locality. Only loss or modification of marginal foraging habitat likely.	Low to Moderate
Birds – Bush Stone-curlew						
<i>Burhinus grallarius</i>	Bush Stone-curlew	-	E	Moderate	Low Loss of foraging and breeding habitat possible however the species has not been recorded locally and has less specific breeding habitat requirements.	Low to Moderate

Table B.1 Likelihood of occurrence and risk assessment for threatened animals

Scientific name	Common name	Conservation status		Likelihood of occurrence	Risk of significant impact if species present	Risk rating
		EPBC Act ¹	BC Act ²			
Invertebrates						
<i>Paralucia spinifera</i>	Bathurst Copper Butterfly	V	E	High	High Breeding habitat for the species (Blackthorn (<i>Bursaria spinosa subsp. lasiophylla</i>) dominated understorey with associated ant species) is likely to occur in parts of the study area and is likely to be impacted.	High
Mammals – moderate to large gliders						
<i>Petauroides volans</i>	Greater Glider	V	-	Moderate	Moderate. Possible loss of breeding sites in hollow trees. Large hollow-bearing trees used by these species are relatively scarce and may limit population size.	Moderate
<i>Petaurus australis</i>	Yellow-bellied Glider	V	V			
Mammals – small gliders and possums						
<i>Petaurus norfolcensis</i>	Squirrel Glider	-	V	Moderate	Low Possible loss of breeding sites in hollow trees. Small to moderate-sized hollow-bearing trees used by these species are relatively abundant and less likely to limit the species' populations.	Low to Moderate
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	-	V			
Mammals – cave-dwelling bats						
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	High	Moderate Possible loss of roosting and/or breeding sites in caves or cave-like structures. Roosting and particularly breeding used by these species are relatively scarce and may limit the species' populations.	Moderate to High
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	-	V			

Table B.1 Likelihood of occurrence and risk assessment for threatened animals

Scientific name	Common name	Conservation status		Likelihood of occurrence	Risk of significant impact if species present	Risk rating
		EPBC Act ¹	BC Act ²			
Mammals – hollow-dwelling bats						
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	-	V	Moderate	Low	Low to Moderate
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat	-	V		Possible loss of breeding sites in hollow trees. Small to moderate-sized hollow-bearing trees used by these species are relatively abundant and less likely to limit the species' populations.	
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	-	V			
Mammals – other mammals						
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	V	V	Low	Low	Low
<i>Phascolarctos cinereus</i>	Koala	E	E	Moderate	Low	Low to Moderate
<i>Pseudomys novaehollandiae</i>	New Holland Mouse	V	-	Low	Low	Low

Table B.1 Likelihood of occurrence and risk assessment for threatened animals

Scientific name	Common name	Conservation status		Likelihood of occurrence	Risk of significant impact if species present	Risk rating
		EPBC Act ¹	BC Act ²			
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	E	V	Moderate	Low The species is associated with most of the PCTs predicted to occur within the study area and has been infrequently recorded in the surrounding area. It may occur intermittently or at low density in the study area.	Low to Moderate
Grey-headed Flying-fox	Grey-headed Flying-fox	V	V	Moderate	Low The species is associated with most of the PCTs predicted to occur within the study area and has been infrequently recorded in the surrounding area. It may occur intermittently or at low density in the study area but is unlikely to breed there. There is a low likelihood that any population present would be considered an important population.	Low to Moderate
Reptiles						
<i>Aprasia parapulchella</i>	Pink-tailed Legless Lizard	V	V	Moderate.	The species is associated with several of the PCTs predicted to occur within the study area but has not been recorded in the surrounding area.	
<i>Eulamprus leuraensis</i>	Blue Mountains Water Skink	E	E	Negligible The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area.	Not applicable.	Negligible
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	E	V	Low	Moderate The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area. Species only likely to occur very infrequently and intermittently during dispersal between populations in the broader region.	Low to Moderate

Table B.1 Likelihood of occurrence and risk assessment for threatened animals

Scientific name	Common name	Conservation status		Likelihood of occurrence	Risk of significant impact if species present	Risk rating
		EPBC Act ¹	BC Act ²			
<i>Varanus rosenbergi</i>	Rosenberg's Goanna	-	V	Moderate	Low While the species is associated with most of the PCTs predicted to occur within the study area, no individuals have been recorded in the surrounding area. There is a low risk that a significant proportion of any local population would be impacted.	Low to Moderate
Frogs						
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V	Low	Low The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area. Species only likely to occur very infrequently and intermittently during dispersal between populations in the broader region.	Low
<i>Litoria aurea</i>	Green and Golden Bell Frog	V	E	Moderate	Low The species is associated with several of the PCTs predicted to occur within the study area. It has not been recorded in the surrounding area but could occur around the margins of Lake Lyell in areas of emergent aquatic vegetation. The species is only likely to utilise habitat around the fringes of the lake. Potential impacts to the species, if present, are likely to be manageable.	Low to Moderate
<i>Litoria booroolongensis</i>	Booroolong Frog	E	E	Moderate	Low The species is associated with most of the PCTs predicted to occur within the study area. It has only been recorded in the surrounding area historically and infrequently. It may occur in the upper reaches of the Coxs River. Habitat in the study area is likely to be marginal and to constitute only a small proportion of the habitat for any local population that may persist in the Coxs River.	Low to Moderate

Table B.1 Likelihood of occurrence and risk assessment for threatened animals

Scientific name	Common name	Conservation status		Likelihood of occurrence	Risk of significant impact if species present	Risk rating
		EPBC Act ¹	BC Act ²			
<i>Litoria castanea</i>	Yellow-spotted Tree Frog	E	CE	Low	Moderate The species is associated with several of the PCTs predicted to occur within the study area. It has not been recorded in the surrounding area but potential habitat could occur around the margins of Lake Lyell in areas of emergent aquatic vegetation. The species is only likely to utilise habitat around the fringes of the lake. Potential impacts to the species, if present, are likely to be manageable.	Low to Moderate
<i>Litoria littlejohni</i>	Littlejohn's Tree Frog	V	V	Negligible The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area.	Not applicable.	Negligible
<i>Mixophyes balbus</i>	Stuttering Frog	V	E	Negligible The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area.	Not applicable.	Negligible

Notes:

1. V = Vulnerable, E= Endangered, CE = Critically Endangered, Mi = Migratory, Ma = species listed as marine under the EPBC Act; impact significance criteria for marine species relate exclusively to impacts within Commonwealth marine areas.

2. V = Vulnerable, E= Endangered, CE = Critically Endangered

B.2 Likelihood of occurrence and risk assessment for threatened plants

Table B.2 Likelihood of occurrence and risk assessment for threatened plants

Scientific name	Common name	Conservation status		Likelihood of occurrence	Risk of significant impact if species present	Risk rating
		EPBC Act ¹	BC Act ²			
<i>Acacia ausfeldii</i>	Ausfeld's Wattle	-	V	Low The species is associated with one PCT predicted to occur within the study area. The species has not been recorded within the surrounding area, which sits outside its known range which is centred around Dubbo.	Moderate If the species is present, it would represent a range extension and may be considered an important population.	Low to Moderate
<i>Acacia bynoeana</i>	Bynoe's Wattle	V	E	Negligible The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area.	Not applicable.	Negligible
<i>Acacia flocktoniae</i>	Flockton Wattle	V	V	Negligible The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area.	Not applicable.	Negligible
<i>Acacia meiantha</i>	-	E	E	Moderate The species is only associated with a few of the PCTs predicted to occur within the study area. No records occur within the surrounding area and the species is known only from a limited distribution at three disjunct locations, the closest being 20 km to the east at Clarence.	High If the species is present, it would represent a range extension and would likely be considered an important population.	Moderate to High

Table B.2 Likelihood of occurrence and risk assessment for threatened plants

Scientific name	Common name	Conservation status		Likelihood of occurrence	Risk of significant impact if species present	Risk rating
		EPBC Act ¹	BC Act ²			
<i>Boronia deanei</i>	Deane's Boronia	V	V	Negligible The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area. Nearest records are around 15 km to the northeast.	Not applicable.	Negligible
<i>Caladenia attenuata</i>	Duramana Fingers	CE	CE	Low to Moderate The species is associated with only one of the PCTs predicted to occur within the study area. Additionally, the species has not been recorded within the surrounding area and has a highly restricted distribution.	Very High While the likelihood that the species occupies the study area is relatively low, if it were found it would be the only known extant site and would hence be of very high conservation significance.	Moderate to High
<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	V	V	Negligible The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area.	Not applicable.	Negligible
<i>Eucalyptus aggregata</i>	Black Gum	V	V	Moderate. While the species is associated with a few of the PCTs predicted to occur within the study area, the species has not been recorded in the immediate vicinity. Some potential habitat may occur in low-lying areas around the margins of Lake Lyell and along the Coxs River.	Low The species is only likely to occur in low-lying areas around Laker Lyell and substantial impacts are likely to be largely avoidable.	Low to Moderate

Table B.2 Likelihood of occurrence and risk assessment for threatened plants

Scientific name	Common name	Conservation status		Likelihood of occurrence	Risk of significant impact if species present	Risk rating
		EPBC Act ¹	BC Act ²			
<i>Eucalyptus cannonii</i>	Capertee Stringybark	-	V	Low to Moderate The species is associated with several of the PCTs predicted to occur within the surrounding area. The study area is outside of the known range of the species which begins around 10 km to the north of the study area.	Low to Moderate If the species is present, it would represent a range extension and may be considered an important population.	Low to Moderate
<i>Eucalyptus pulverulenta</i>	Silver-leafed Gum	V	V	High The species is associated with several of the PCTs predicted to occur within the surrounding area and has been recorded in several locations in the immediate vicinity of Lake Lyell.	Low The species is only likely to occur in low-lying areas around Laker Lyell and substantial impacts are likely to be largely avoidable.	Low to Moderate
<i>Eucalyptus robertsonii</i> subsp. <i>hemisphaerica</i>	Robertson's Peppermint	V	V	Low to Moderate The species is associated with only a few PCTs predicted to occur within the study area. No individuals been recorded within the surrounding area which is outside of the species' known range.	Low to Moderate If the species is present, it would represent a range extension and may be considered an important population.	Low to Moderate
<i>Euphrasia arguta</i>	-	CE	CE	Negligible The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area.	Not applicable.	Negligible
<i>Genoplesium superbum</i>	Superb Midge Orchid	-	E	Negligible The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area. The nearest record is around 10 km away.	Not applicable.	Negligible

Table B.2 Likelihood of occurrence and risk assessment for threatened plants

Scientific name	Common name	Conservation status		Likelihood of occurrence	Risk of significant impact if species present	Risk rating
		EPBC Act ¹	BC Act ²			
<i>Grevillea divaricata</i>	-	-	E	Low to Moderate The species is associated with only a few PCTs predicted to occur within the study area. No individuals been recorded within the surrounding area which is outside of the species' known range. The species is only known from one record (1823) from the Bathurst region.	Very High While the likelihood that the species occupies the study area is relatively low, if it were found it would be the only known extant site and would hence be of very high conservation significance.	Moderate to High
<i>Haloragodendron lucasii</i>	-	E	E	Negligible The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area. The known locations of this species are confined to a very narrow distribution on the north shore of Sydney.	Not applicable.	Negligible
<i>Kunzea cabbagei</i>	Cabbage Kunzea	V	V	Low	The species is associated with only a few PCTs predicted to occur within the study area but is not associated with the relevant IBRA subregion. No individuals been recorded within the surrounding area which is outside of the species' known range.	
<i>Leionema lachnaeoides</i>	-	E	E	Negligible The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area. The species is generally confined to habitats farther east between Blackheath and Katoomba.	Not applicable.	Negligible

Table B.2 Likelihood of occurrence and risk assessment for threatened plants

Scientific name	Common name	Conservation status		Likelihood of occurrence	Risk of significant impact if species present	Risk rating
		EPBC Act ¹	BC Act ²			
<i>Lepidium hyssopifolium</i>	Aromatic Peppergrass	E	E	Negligible The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area. The nearest population of this species occurs at Bathurst.	Not applicable.	Negligible
<i>Leucochrysum albicans subsp. tricolor</i>	Hoary Sunray	E	-	Moderate The species is associated with several of the PCTs predicted to occur in the study area and was considered likely to occur within the area by the PMST. It has not been recorded in the locality	Moderate While the likelihood that the species occupies the study area is relatively low, if it were found it would represent a range extension and may hence be of moderate to high conservation significance.	Moderate
<i>Persoonia acerosa</i>	Needle Geebung	V	V	Negligible The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area.	Not applicable.	Negligible
<i>Persoonia marginata</i>	Clandulla Geebung	V	V	Moderate	While the species is associated with several of the PCTs predicted to occur within the study area, the species has been infrequently recorded in the surrounding area	
<i>Pomaderris brunnea</i>	Brown Pomaderris	V	E	Negligible The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area.	Not applicable.	Negligible

Table B.2 Likelihood of occurrence and risk assessment for threatened plants

Scientific name	Common name	Conservation status		Likelihood of occurrence	Risk of significant impact if species present	Risk rating
		EPBC Act ¹	BC Act ²			
<i>Pomaderris cotoneaster</i>	Cotoneaster Pomaderris	E	E	Low to Moderate The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area. However, the habitat preferences of the species are not well understood and suitable habitat may be present.	High While the likelihood that the species occupies the study area is relatively low, if it were found it would be would represent a range extension and may hence be of high conservation significance.	Moderate
<i>Prasophyllum petilum</i>	Tarengo Leek Orchid	E	E	Negligible The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area.	Not applicable.	Negligible
<i>Prasophyllum sp. Wybong</i>	-	CE	-	Negligible The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area.	Not applicable.	Negligible
<i>Pultenaea glabra</i>	Smooth Bush-Pea	V	V	Negligible The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area.	Not applicable.	Negligible
<i>Pultenaea parrisiae</i>	Parris' Bush-pea	V	V	Negligible The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area.	Not applicable.	Negligible

Table B.2 Likelihood of occurrence and risk assessment for threatened plants

Scientific name	Common name	Conservation status		Likelihood of occurrence	Risk of significant impact if species present	Risk rating
		EPBC Act ¹	BC Act ²			
<i>Rhizanthella slateri</i>	Eastern Australian Underground Orchid	E	V	Low to Moderate	High The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area. However, the habitat preferences of the species are not well understood and suitable habitat may be present. While the likelihood that the species occupies the study area is relatively low, if it were found it would be would represent a range extension and may hence be of very high conservation significance.	Moderate
<i>Rhodamnia rubescens</i>	Scrub Turpentine	CE	CE	Negligible The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area in the preceding century. The species is generally confined to coastal habitats.	Not applicable.	Negligible
<i>Swainsona sericea</i>	Silky Swainson-pea	-	V	Low to Moderate The species is associated with only one of the PCTs predicted to occur within the study area. No individuals been recorded within the surrounding area.	Low to Moderate If present, any population of the species may represent a range extension and could be of moderate importance to the species.	Low to Moderate
<i>Thesium australe</i>	Austral Toadflax	V	V	Negligible The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area.	Not applicable.	Negligible

Table B.2 Likelihood of occurrence and risk assessment for threatened plants

Scientific name	Common name	Conservation status		Likelihood of occurrence	Risk of significant impact if species present	Risk rating
		EPBC Act ¹	BC Act ²			
<i>Velleia perfoliata</i>	-	V	V	Negligible The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area.	Not applicable.	Negligible
<i>Veronica blakelyi</i>	-	-	V	Low to Moderate The species is associated with only one of the PCTs predicted to occur within the study area. No individuals been recorded within the surrounding area.	Low to Moderate If present, any population of the species may represent a range extension and could be of moderate importance to the species.	Low to Moderate
<i>Xerochrysum palustre</i>	Swamp Everlasting	V	-	Negligible The species is not associated with any PCTs predicted to occur within the study area, nor have any individuals been recorded within the surrounding area.	Not applicable.	Negligible
<i>Zieria obcordata</i>	Granite Zieria	E	E	Low to Moderate The species is associated with only one of the PCTs predicted to occur within the study area. No individuals been recorded within the surrounding area.	High While the likelihood that the species occupies the study area is relatively low, if it were found it would be would represent a range extension and may hence be of very high conservation significance.	Moderate

Notes:

1. V = Vulnerable, E= Endangered, CE = Critically Endangered

2. V = Vulnerable, E= Endangered, CE = Critically Endangered

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B.2 Aquatic ecology scoping review

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Lake Lyell Pumped Hydro Energy Storage Project – Aquatic Ecology Review

- Aquatic Ecology Review
- July 2023

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Lake Lyell Pumped Hydro Energy Storage Project – Aquatic Ecology Review

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Abbreviations

The following abbreviations have been used:

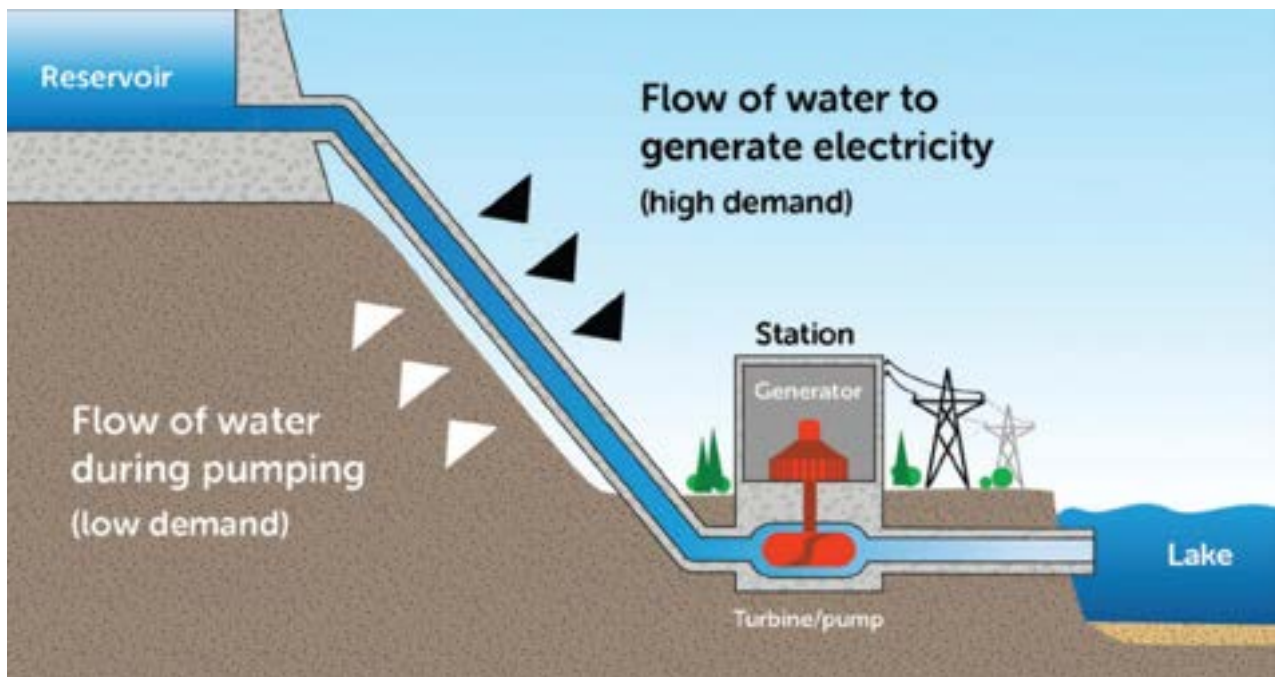
Austral	Austral Research & Consulting
BoM	Bureau of Meteorology
BDAR	Biodiversity development assessment report
cm	Centimetre
DCCEEW	Commonwealth's Department of Climate Change, Energy, the Environment and Water
DPE	Department of Planning and Environment
DPI	Department of Primary Industries
eDNA	Environmental deoxyribonucleic acid
EA	Energy Australia
ECI	Early contractor involvement
EIS	Environmental Impact Statement
EPBC act	Environment Protection and Biodiversity Conservation Act 1999
FM	Fisheries Management
ha	hectares
HV	High voltage
km	kilometre
kV	Kilo Volts
KFH	Key Fish Habitat
IBRA	Interim Biogeographic Regionalisation for Australia
l	Litre
LoO	Likelihood of occurrence
MNES	Matters of National Environmental Significance
m	Metre
MW	Mega Watt
NSW	New South Wales
NEM	National Energy Market
PHES	Pumped Hydro Energy Storage
STP	Sewage treatment plant
WM Act	NSW Water Management Act 2000

1. Introduction

This section provides a brief description of the project as it currently stands. A detailed description is provided in Lake Lyell Pumped Hydro Energy Storage Project: Scoping Report (EMM, 2023)

The Project will comprise an upper reservoir constructed adjacent to the southern shoulder of Mt Walker, connected to the Farmers Creek arm of Lake Lyell, which would act as the lower reservoir for the pumped hydro scheme. The two reservoirs will be connected via a series of tunnels and an underground power house.

Once constructed, the operation of the Project will allow hydroelectricity to be generated as water is transferred from the upper reservoir to the lower reservoir via the connecting tunnels and turbine located in the underground power house. The reversible turbine will also be able to act as a pump, allowing water to be pumped to the top reservoir during periods of peak renewable energy availability. A generalised image of the process is shown in Figure 1.



■ Figure 1: Pumped hydro process

The Project will operate as an open loop system, with Lake Lyell remaining largely unchanged although water levels will fluctuate by approximately two metres during each pumping and generating cycle. There is expected to be one pumping and generating cycle each day (24 hours). The speed of the cycle is not currently known.

Energy generated by the Project will be distributed to the National Electricity Market (NEM) via a new switchyard that will connect to the existing 330 kilo Volt (kV) transmission lines that pass through the Project area to the south of Mt Walker.

The Project is intended to operate with a round trip efficiency of approximately 77%. Current estimations suggest that its design will allow 300-350 Mega Watt (MW) of electricity production, equivalent to

powering approximately 150,000 households, for approximately 8 hours during peak demand. It could also be operated to provide 225 MW of power over 12 hours at similar levels of efficiency. The anticipated life of the Project is approximately 80 years.

1.1. Key project elements

Key elements of the Project outlined in Table 1 are required for the operation of the Project and form the basis of this Scoping Report and subsequent Environmental Impact Assessment (EIS).

■ Table 1: Project key elements

Project component	Description
Key project elements – operational infrastructure:	<ul style="list-style-type: none"> • a rockfill gully dam on Mt Walker acting as an upper reservoir, complete with an intake structure; • an intake/outake structure in the Farmers Creek arm of Lake Lyell that will allow Lake Lyell to act as a lower reservoir; • existing spillway to manage the release of water from the lower reservoir; • a power waterway consisting of tunnels between the reservoirs; • an underground powerhouse including a transformer and at least one pump-turbine unit; • access tunnels between the surface and the powerhouse; • new roads to access the site, switchyard, powerhouse and upper reservoir. This includes a new bridge crossing across the Farmers Creek arm of Lake Lyell; • a high-voltage switchyard; • a transmission line between the powerhouse and the nearby existing 330 kV transmission, via the high voltage switchyard; • an administration building; and • a dredged channel within the Farmers Creek arm of Lake Lyell.
To support the construction of operational infrastructure, the following elements and activities are needed and are referred to as construction elements:	<ul style="list-style-type: none"> • Supporting services infrastructure, including: <ul style="list-style-type: none"> - construction power supply; - potable water supplies; - waste and wastewater management; - communications infrastructure; and - site control infrastructure; • emergency infrastructure, including water tanks for fire control;

Project component	Description
	<ul style="list-style-type: none">• management of excavated spoil, cleared soils, vegetation and overburden;• spoil management areas; and• construction facilities including a laydown area.

1.2. Project areas

The Project area is shown in Figure 2. It comprises land owned and managed by EnergyAustralia (EA) and is intended to encompass the land and waterbody directly impacted by the Project.

The Main Works area (Figure 2) is located within the Project area and includes for the construction of all operational infrastructure listed previously in Table 1.

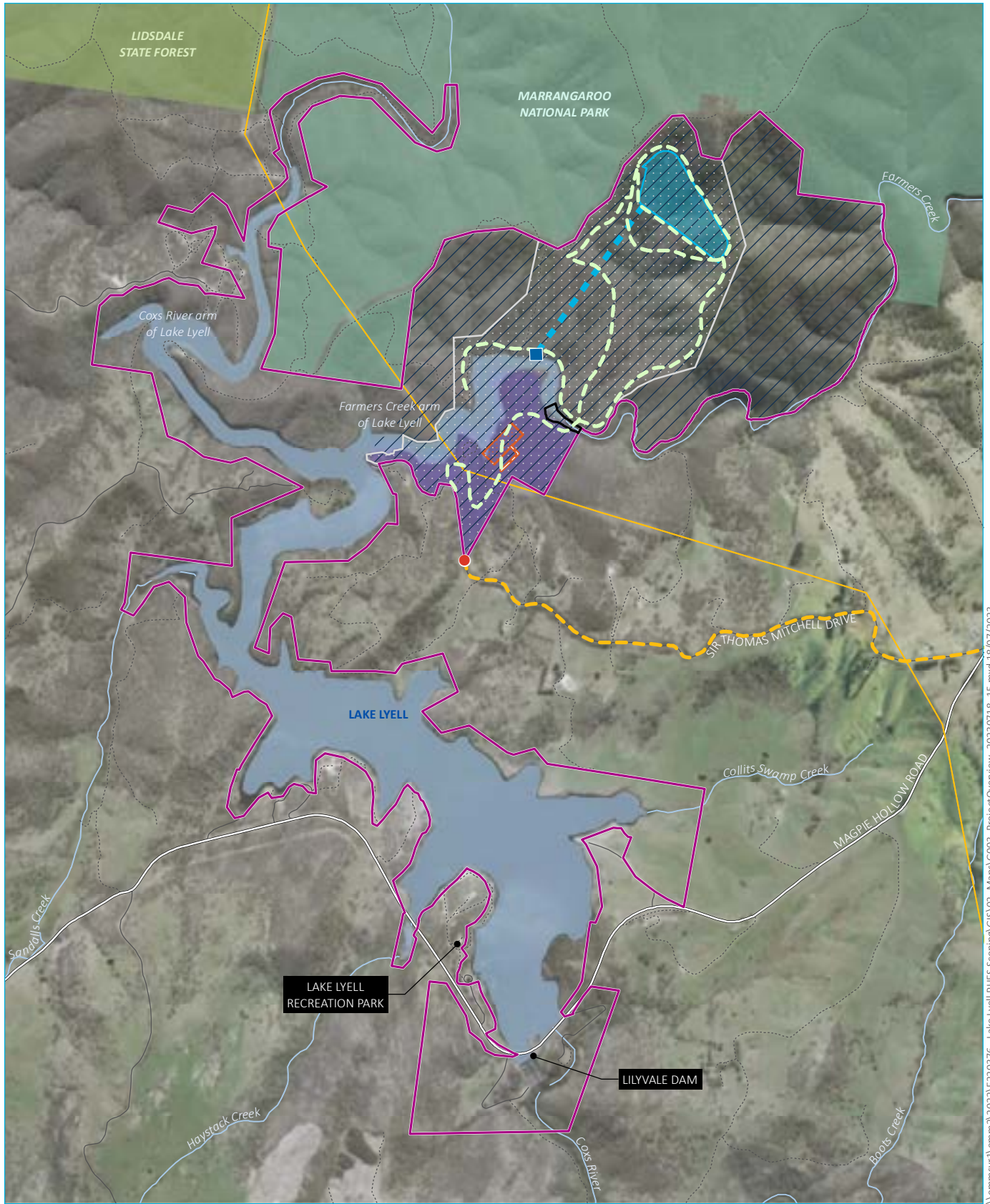
Lake Lyell is an impounded water body that extends from Lilyvale Dam wall at the south of the Project Area, to the Coxs Creek arm of Lake Lyell to the north, and the Farmers Creek arm to the east. The impoundment up to the full supply level is a modified lake, with natural creeks and rivers extending beyond the impounded regions. Reference to the relevant impounded or natural sections of waterways is also shown on Figure 2.

1.3. Design options and early contractor involvement

The Project is still in an early stage with the development of a feasible design that is still subject to further advancement. As such there are elements that may change or be optimised as the design continues to be developed and refined. This includes the powerhouse and penstocks and their underground or above ground location, and final location of the bridge crossing and switchyard. This would also determine access requirements.

This report presents a brief description of the design concepts in their current form. The Lake Lyell Pumped Hydro Energy Storage Project: Scoping Report (EMM, 2023) highlights where alternatives are being considered. Any alternatives considered are expected to occur within the currently defined Main Works area.

Early contractor involvement (ECI), including a detailed design process, will be undertaken during the design phase to ensure construction scope and impacts are fully understood. Once completed, the ECI will provide additional detail into the nature of the construction works, which will be reported in the EIS.



Source: EMM (2023); DFSI (2020, 2021); GA (2011); Metromap (2022)

KEY

- | | | |
|---|---|-------------------------|
| Project area | Upper reservoir | Major road |
| Main works | Indicative disturbance footprint | Minor road |
| Primary site access | Indicative location of intake | Vehicular track |
| Internal site access road | Indicative location for bridge crossing | Named watercourse |
| Primary site access route | Indicative HV switchyard location | 330kV transmission line |
| Indicative power waterway | Ancillary works area | Named waterbody |
| Indicative transmission line connection | | NPWS reserve |
| | | State forest |

Project areas and key design elements

Lake Lyell PHES Project
Figure 2



\\lemmsvr1\lemm2\2022\220376 - Lake Lyell PHES Scoping\GIS\02_Maps\G003_ProjectOverview_20230718_15.mxd 18/07/2023

2. Purpose of this document

The purpose of this preliminary aquatic ecology review is to:

- establish existing aquatic values and within the project area based on a desktop review;
- undertake a preliminary assessment of the project design elements and likely impacts requiring consideration; and
- provide recommendations for future aquatic assessments required for the project.

This review considers potential impacts on aquatic species Listed under the *Fisheries Management Act 1994* (FM Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Potential impacts to terrestrial species and semi-aquatic species (eg waterbirds, turtles and frogs) and vegetation communities listed under the *Biodiversity Conservation Act 2016* (BC Act) and/or the EPBC Act are considered in the *Preliminary Terrestrial Biodiversity Assessment* (EMM, 2022)

3. Legislative Context

3.1. Fisheries Management Act 1994

The NSW *Fisheries Management Act 1994* (FM Act), administered by the NSW Department of Primary Industries (DPI) Fisheries, provides for the sustainable management of fish and fish habitats, and outlines approval processes for activities that may impact on threatened fish species and habitats. It also contains provisions for the conservation of fish stocks, key fish habitat (KFH), biodiversity, and threatened aquatic species, populations and ecological communities. It regulates the conservation of fish, aquatic vegetation and some aquatic macroinvertebrates, and the development and sharing of the fishery resources of NSW for present and future generations. The FM Act lists threatened aquatic species, populations and ecological communities, key threatening processes and declared critical habitat. Assessment guidelines to determine whether a significant impact is expected are detailed in s 220ZZ and s 220ZZA of the FM Act.

3.2. Water Management Act 2000

The NSW *Water Management Act 2000* (WM Act), administered by the NSW Department of Planning and Environment (DPE) Water, governs the sustainable and integrated management of NSW's water for the benefit of both present and future generations. In the context of aquatic ecology, the WM Act provides the physical definition of a waterway, and other waterbodies, pertinent to this assessment:

'watercourse means a river, creek or other natural stream of water (whether modified or not) flowing in a defined channel, or between banks, notwithstanding that the flow may be intermittent or seasonal or the banks not clearly or sharply defined, and includes –

- (a) a dam that collects water flowing in any such stream; and
- (b) a lake through which water flows; and
- (c) a channel into which the water of any such stream has been diverted; and
- (d) part of any such stream; and
- (e) the floodplain of any such stream –...'

The WM Act also provides guidance on controlled actions undertaken within the riparian zone of a waterway, with assessment of the potential impact of any controlled activity to be undertaken to ensure that minimal impacts will occur to "waterfront land".

3.3. Environmental Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act), administered by the Commonwealth's Department of Climate Change, Energy, the Environment and Water (DCCEE), is the primary piece of Commonwealth legislation that may be relevant to the assessment of aquatic ecology, providing a framework for the protection of the Australian environment,

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including its biodiversity and its natural and culturally significant places. The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities, heritage places and water resources which are defined as Matters of National Environmental Significance (MNES) under the EPBC Act. These are:

- world heritage properties;
- places listed on the National Heritage Register;
- Ramsar wetlands of international significance;
- threatened flora and fauna species and ecological communities;
- migratory species;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park;
- nuclear actions (including uranium mining); and
- water resources, in relation to coal seam gas or large coal mining development.

The EPBC Act also facilitates a streamlined national environmental assessment and approvals process between the Commonwealth, and the States and Territories.

Under the EPBC Act, an action that may have a significant impact on a MNES is deemed to be a 'controlled action' and can only proceed with the approval of the Commonwealth Minister for the Environment. An action that may potentially have a significant impact on a MNES is to be referred to the DCCEEW for determination as to whether or not it is a controlled action. If deemed a controlled action, the project is assessed under the EPBC Act and a decision made as to whether or not to grant approval.

4. Methods

4.1. Database searches

Database searches were undertaken to compile background information and to assess the likelihood of occurrence of threatened aquatic habitat, communities, species or populations that may inhabit waterways with the potential to be impacted by the project. State and Commonwealth database resources searched included:

- Freshwater threatened species distribution maps (DPI Fisheries; October 2022);
- Threatened species lists (DPI Fisheries; October 2022);
- KFH maps (DPI Fisheries; October 2022);
- Fish stocking (DPI Fisheries; October 2022);
- Fisheries NSW Spatial Data Portal (DPI Fisheries; October 2022);
- BioNet Atlas (DPIE; September 2022);
- Australian Museum (September 2022);
- Protected Matters Search Tool (PMST) (DCCEEW; September 2022);
- Provisional list of animals requiring urgent management intervention (DCCEEW; September 2022);
- Australian Ramsar Wetlands: Internationally Important Wetlands (DCCEEW; October 2022);
- Directory of Important Wetlands: Nationally Important Wetlands (DCCEEW; October 2022);
- Groundwater Dependent Ecosystems Atlas (Bureau of Meteorology (BoM); October 2022); and,
- Climate data online (BoM; October 2022).

Database searches for aquatic species were completed for the locality, defined as an area within a 50 km buffer of the study area (Lake Lyell). Database searches were also completed for the Hawkesbury-Nepean Catchment as the study area appears to be under-surveyed, and to determine whether aquatic species in the broader region were likely to move through the study area.

4.2. Literature review

A review of publicly available literature relating to aquatic environments in the Hawkesbury-Nepean Catchment was undertaken to investigate the occurrence of communities and taxa of conservation

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significance. Information was compiled from reports, books, journals, and relevant government, university or regulatory publications. A limited number of subterranean fauna (to within 200 km of the project) assessments have been undertaken in the vicinity of the project.

Existing information was gathered from publicly available information and government databases (listed above). Information was also taken from the document below, where applicable:

- Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011 (Department of Primary Industries, 2018).

5. Existing Environment

5.1. Landscape Features

The project is located in central eastern NSW within the South Eastern Highlands bioregion as described by the Interim Biogeographic Regionalisation for Australia (IBRA) and the Hill End subregion (National Parks and Wildlife Service, 2003; Thackway & Cresswell, 1995). The South Eastern Highlands bioregion is located across two states, NSW and Victoria, and within NSW is bounded by the South Western Slopes bioregion to the north and west, Sydney Basin and South East Corner bioregions to the east (Thackway & Cresswell, 1995; National Parks and Wildlife Service, 2003). The bioregion covers approximately 8 749 155 ha, of which 55.9% lies within New South Wales. Major urban centres within the bioregion include Orange, Bathurst and Lithgow in the north, Goulburn, Queanbeyan and Yass in the centre and Cooma, Jindabyne and Bombala in the south (National Parks and Wildlife Service, 2003). The Lachlan, Macquarie, Murray, Murrumbidgee, Shoalhaven and Snowy Rivers all flow across the bioregion (National Parks and Wildlife Service, 2003).

5.2. Aquatic Ecology and Habitats

The Upper Coxs River catchment sits within the broader Hawkesbury-Nepean catchment and within the Warragamba drinking water catchment. The Hawkesbury-Nepean catchment covers an area of approximately 21 400 square kilometres (Department of Planning and the Environment, 2022). The region contains a number of wetland types such as upland lakes and wetlands, coastal floodplains and coastal swamps of which 495 are considered to be of regional significance (P and J Smith Ecological Consultants, 1996). A total of 187 of these regionally significant wetlands occur within the Coxs River catchment (P and J Smith Ecological Consultants, 1996). The State of the Catchment report (2010a) states that the condition of fauna and threatened species within the Hawkesbury-Nepean catchment is 'very poor' and that pressure on fauna and threatened species is 'very high'. Wetland condition is 'very poor' and pressure on wetlands within the catchment is 'very high' with the risk from invasive species considered 'very high' (Department of Planning and the Environment, 2010a). The report also states that seven freshwater pest fish are emerging within the catchment (Department of Planning and the Environment, 2010a). The greatest pressure on wetlands in the region is from habitat disturbance caused by grazing, feral animals and roads crossing or adjoining wetlands (Department of Planning and the Environment, 2010a).

The Coxs River catchment has mainly formed on fluvial sediments and metasediments and much of this area is dominated by low hills, rises and extensive alluvial plains (Department of Planning, Industry and Environment, 2020). The condition of Groundwater Dependant Ecosystems (GDEs) within the Coxs River catchment is not currently known as they are not monitored directly and are yet to be fully identified and mapped (Department of Planning and the Environment, 2010a) however the Bureau of Meteorology Groundwater Dependent Ecosystems Atlas reports that both high potential and low potential aquatic GDEs occur in the vicinity of the study area (Bureau of Meteorology, 2022). A limited number of stygofauna assessments have been undertaken in the region. One stygofauna assessment undertaken within the Coxs River catchment reported stygofauna were present within bores in the form

of cyclopoid copepods, harpacticoid copepods, copepod nauplii and bathynellid syncarids. Four possible stygofauna taxa (Rotifera, Acarina, Tardigrada and phreatoicid isopods) were also recorded. Macroinvertebrate condition in the region of the Coxs River and Lake Lyell is reported as ‘moderate – good’ and fish condition is considered to be ‘extremely poor’ (Department of Planning and the Environment, 2010b). Land use within the Hawkesbury-Nepean catchment includes urban and residential development, mining, quarrying, power generation, industry, tourism and recreation, forestry, and a wide range of agricultural industries (Department of Planning and the Environment, 2010a). The Coxs River passes through forests before impounding at Lake Lyell but the lake receives urban runoff and sewage treatment plant (STP) effluent from Lithgow City via Farmer’s Creek (Jones, 1992). Reports state that much of the riparian zone of the Coxs River has been modified or cleared however areas of intact riparian vegetation remain. River Oak (*Casuarina cunninghamiana*) is reported as dominating the overstorey of remnant riparian vegetation (Young, et al., 2000). Willows, mainly *Salix fragilis*, are reported as having invaded the channel and riparian zone, forming dense stands in some areas. The mid and understorey are reportedly dominated by *Acacia* sp., *Callistemon* sp., *Leptospermum* sp., *Lomatia* sp. and *Bursaria* sp., but invasion by alien species such as Blackberry (*Rubus fruticosus*) and Broom (*Genista* sp.) is common. Emergent and fringing vegetation reportedly consists of *Carex* sp., *Cyperus* sp., *Juncus* sp., *Lomandra* sp., *Phragmites* sp., *Schoenoplectus* sp. and *Typha* sp. (Young, et al., 2000).

Lake Lyell was constructed in 1982 for the purpose of supplying water to the Mt Piper and Wallerawang Power stations and has a capacity of approximately 32 000 ML. The lake is also a well known recreational destination and is used for swimming, sailing, wind surfing, fishing, water skiing, picnicking and camping (Birch & Siaka, 2001). Lake Lyell is reported as having a higher salinity level than surrounding streams although the lake can still be considered fresh (Judge, 2013). Nutrient loading within Lake Lyell is considered comparable with surrounding streams although Lake Lyell supported a higher nitrogen loading than other sites which likely influenced the low SIGNAL2 score attributed to the lake (Judge, 2013). DPI Fisheries’ Spatial data portal reports that Lake Lyell, and all waterways intersecting Lake Lyell are considered to be KFH (Department of Primary Industries, 2022a).

5.3. Wetlands of International Importance (Ramsar Wetlands)

A review of the DCCEEW (2022) revealed that five Ramsar Wetlands occur upstream of the study area with the nearest being the Macquarie Marshes (Ramsar site #28) which occurs 300-400 km upstream (Department of Climate Change, Energy, the Environment and Water, 2019). No Ramsar wetlands will be impacted by the project.

5.4. Threatened Aquatic Fauna

The results of the desktop assessment indicate that a total of six threatened aquatic species, listed under the FM Act and/or the EPBC Act, and Platypus have the potential to occur in waterways associated with the Hawkesbury-Nepean catchment:

- Flathead galaxias (*Galaxias rostratus*);

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- Southern Purple-spotted gudgeon (*Mogurnda adspersa*);
- Macquarie perch (*Macquaria australasica*);
- Murray cod (*Maccullochella peelii*);
- Trout cod (*Maccullochella macquariensis*); and
- Australian grayling (*Prototroctes maraena*).

An assessment was undertaken to evaluate the likelihood of each of these threatened aquatic species occurring within waterways intersecting Lake Lyell, or downstream of the project, based on the aquatic habitats likely to be present as well as existing literature and DPI Fisheries datasets (Department of Primary Industries, 2022b). Of the five species, none are known to occur within waterways intersecting the study area. Habitat for the Southern Purple-spotted gudgeon is modelled to occur within Solitary Creek to the west however there is no obvious connectivity between Solitary Creek and Lake Lyell, or waterways intersecting Lake Lyell (Department of Primary Industries, 2022b). The Macquarie perch is reported as having once occurred in the area but is no longer present and Warragamba Dam impedes the upstream migration of diadromous fish species such as Australian grayling (Young, et al., 2000). Platypus (*Ornithorhynchus anatinus*) are known to occur within waterways intersecting Lake Lyell and have the potential to be impacted by the project. A summary of these threatened aquatic species status and likelihood of occurrence (LoO) is provided in Table 2.

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- **Table 2: Threatened species with the potential to occur in, or adjacent to, the project area including the status and likelihood of occurrence.**

Family	Common name	Scientific name	Data source					LoO
			DPI	BioNet	PMST	FM Act	EPBC Act	
Fish								
Galaxiidae	Flathead galaxias	<i>Galaxias rostratus</i>			✓	CE	CE	Unlikely
Eleotridae	Southern Purple-spotted gudgeon	<i>Mogurnda adspersa</i>	✓				E	Unlikely
Percichthyidae	Macquarie perch	<i>Macquaria australasica</i>		✓	✓	E	E	Unlikely
Percichthyidae	Murray cod	<i>Maccullochella peelii</i>			✓		V	Unlikely
Percichthyidae	Trout cod	<i>Maccullochella macquariensis</i>			✓	E	E	Unlikely
Retropinnidae	Australian grayling	<i>Prototroctes maraena</i>			✓	E	V	Unlikely
Mammal								
Ornithorhynchidae	Platypus	<i>Ornithorhynchus anatinus</i>		✓			PL	Known

Note LoO = Likelihood of occurrence; CE = Critically Endangered, E = Endangered, EP = Endangered population, V = Vulnerable, PL = DCCEEW (2000) provisional management list.

5.5. Fish

The results of the desktop assessment revealed that no native fish species Listed under the EPBC Act or FM Act have been reported within the vicinity of the study area (Department of Planning and Environment, 2022). It is considered unlikely that these species will occur within the study area given the lack of records in the area, barriers to fish passage and lack of connectivity to existing known records. However, despite the lack of records, appropriate habitat for Listed species may occur within the vicinity of the study area and aquatic surveys should be undertaken to confirm presence/absence of any Listed species. Limited information was available on native fish species known to occur within Lake Lyell and associated waterways and tributaries. Previous monitoring reports document Mountain galaxias (*Galaxius olidus*) and Flathead gudgeon (*Philypnodon grandiceps*) in tributaries with connectivity to Lake Lyell (Cardno, 2021). Other reports state that the diversity of freshwater fish in the area is low but list Longfin eel (*Anguilla reinhardtii*) as occurring in the area in addition to the previously mentioned species (Young, et al., 2000). The same report states that Macquarie perch may have been present in the area previously but are no longer present (Young, et al., 2000). Warragamba Dam impedes the upstream migration of diadromous fish species such as Australian grayling (Young, et al., 2000). The Department of Primary Industries' Fish Stocking database (2022c) shows that Lake Lyell is regularly stocked with both native and exotic species that are considered desirable by anglers. Australian bass (*Macquaria novemaculeata*), Brown trout (*Salmo trutta*), Rainbow trout (*Oncorhynchus mykiss*) and Tiger trout (*Salmo trutta* × *Salvelinus fontinalis*) were all stocked in Lake Lyell in 2021 with Australian bass, Brown trout and Rainbow trout stocked regularly going back as far as 2019 (Department of Primary Industries, 2022c). Brown trout and Rainbow trout are also stocked in the Coxs River and tributaries associated with Lake Lyell (Department of Primary Industries, 2022c)

5.6. Platypus

The Platypus is not currently listed under the Commonwealth EPBC Act or the NSW *Biodiversity Conservation Act 2016*, and mammals are not listed under the FM Act. However, there is currently a lack of knowledge regarding Platypus abundance at a local catchment level (Australian Museum, 2022) and the species is subject to similar impacts as threatened fish, including waterway bank erosion, channel sedimentation, regulated waterways, barriers to water flow (eg dams and weirs), riparian zone degradation and loss of riparian vegetation (Bino, et al., 2019; Temple-Smith & Grant, 2003). The Platypus was included on the DCCEEW provisional list of animal species identified as requiring immediate urgent management intervention in February 2020, following the 2019/2020 bushfire season in southern and eastern Australia (20 March 2020) (Department of Climate Change, Energy, the Environment and Water, 2021).

A high number of records for Platypus occur within the Upper Coxs River catchment with a number occurring within the Coxs River and tributaries associated with Lake Lyell. Previous monitoring in the Upper Coxs catchment has also detected Platypus in the area (Department of Planning and Environment, 2022; Judge, 2013). Targeted Platypus Surveys incorporating environmental

a u s t r a l

research and consulting

deoxyribonucleic acid (eDNA) analysis and habitat assessment should be undertaken within the study area and associated rivers and tributaries to determine abundance and distribution of the species

6. Potential Impacts

Potential impacts to Listed aquatic species and the Platypus include:

- Significant and regular fluctuation in water height within Lake Lyell as part of the operation of the PHES;
- Physical removal of habitat associated with scouring of the lake floor; and,
- Impacts to water quality as a result of construction and operation.

The key considerations for Listed species that are known, or have the potential to occur are:

- Fluctuations in water height: fluctuations in water height have the potential to expose nesting habitat for Platypus and spawning and foraging habitat for Listed fish species. If present, riparian vegetation and vegetation within the littoral zone may be negatively impacted by fluctuating water levels. A rising and falling water height may impact water temperatures within the littoral zone within Lake Lyell. Alterations to temperature may be minor however native fish species typically rely on temperature cues to induce spawning. Should changes to temperature occur and prove significant there may be a loss of spawning habitat for Listed fish species;
- Physical removal of habitat associated with scouring of the lake floor: Should scouring of the lake floor occur this will result in a direct loss of KFH; and,
- Impacts to water quality as a result of construction: Sedimentation, hydrocarbon spills and run off all have the potential to occur and enter Lake Lyell and the associated tributaries during construction. A decrease in water quality can negatively impact a wide range of aquatic species. Aquatic species are known to avoid areas of decreased water quality when given the opportunity to move into cleaner waters (Water Quality Australia, 2018). Should water quality decrease sufficiently mass fish mortality events can occur.

Table 3 summarises the key legislated items known or considered as having potential to occur within the study area and then discusses the key constraints or opportunities associated with the item.

■ **Table 3: Key biodiversity constraints and opportunities**

Item	Discussion
Threatened aquatic species and the Platypus	A review of the databases and available literature revealed that six Listed aquatic species and Platypus are known or modelled to occur within the Hawkesbury-Nepean catchment (Department of Climate Change, Energy, the Environment and Water, 2022; Department of Planning and Environment, 2022). Given the lack of records and lack of connectivity to existing records, the six Listed aquatic species are considered unlikely to occur within the study area (Table 2). Aquatic surveys and

eDNA analysis should be undertaken to confirm presence/absence of these species and a Significant Impact Assessment undertaken should they be identified during surveys. The Platypus is known to occur within the study area. eDNA analysis and a habitat assessment will inform on abundance and distribution of Platypus within the study area. A Significant Impact Assessment should be undertaken to determine impacts to Platypus. Due consideration of all impacts will be given to each species that is identified within the study area as part of the EIS process.

7. Future Assessments

To adequately inform on aquatic ecological values within Lake Lyell and associated waterways and tributaries, and to inform on potential impacts to those aquatic values the following assessments will be undertaken (Table 4):

■ **Table 4: Future Assessments**

Assessment Type	Scope of work
Fish surveys	Fish surveys will be undertaken in accordance with the <i>Survey guidelines for Australia's threatened fish: Guidelines for detecting fish listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999</i> (Department of Sustainability, Environment, Water, Population and Communities, 2011). Methods will include electrofishing and various methods of netting. These assessments will inform on abundance and distribution of those species known to occur within the Lake Lyell and associated waterways and tributaries and will determine presence/absence, abundance and distribution for those species that may occur. Impacts of the proposed action will be considered for all species.
eDNA assessment	eDNA assessments will inform on the abundance and distribution of key Listed species and the Platypus through analysis of trace DNA within the aquatic environment.
Key fish habitat assessments	Key fish habitat assessments will be undertaken as part of the comprehensive aquatic ecology assessment in accordance with (Department of Primary Industries, 2013). Key fish habitat is currently mapped conservatively and does not account for variation within a waterway that would be available from field assessments. In-field characterisation, in combination with examination of existing stream order data, will be required to be undertaken (in accordance with DPI (Fisheries) policy) by assessing "waterway type" and "waterway class".
Assessment of other biotic and abiotic components	Assessment of other biotic and abiotic components such as water quality, riparian vegetation, algae (phytoplankton, periphyton), macroinvertebrates and sediment quality should be undertaken. The results from these assessments will further inform on the current ecological values within the study area.

8. References

- Aurecon. (2021). *Preliminary assessment of implications of the proposed change in the operations of Lyell Dam*. Unpublished.
- Australian Museum. (2022). *Platypus*. Retrieved from <https://australianmuseum.net.au/learn/animals/mammals/platypus/>
- Bino, et al. (2019). The platypus: evolutionary history, biology, and an uncertain future. *Journal of Mammalogy*, 308-327.
- Birch, G. F., & Siaka, I. M. (2001). The Source of Anthropogenic Heavy Metals in Fluvial Sediments of a Rural Catchment: Coxs River, Australia. *Water Air and Soil Pollution*, 13-35.
- Bureau of Meteorology. (2022). *Groundwater Dependent Ecosystems Atlas*. Retrieved from <http://www.bom.gov.au/water/groundwater/gde/map.shtml>
- Cardno. (2014). *Aquatic Ecology and Stygofauna Assessment: Springvale Mine Extension Project*. Unpublished.
- Cardno. (2021). *Wangcol Creek Ecological Monitoring Program: Wangcol Creek EMP Spring 2012 to Spring 2020*. Unpublished.
- Department of Agriculture, Water and the Environment. (2022). *Directory of Important Wetlands*. Retrieved from <https://www.environment.gov.au/cgi-bin/wetlands/report.pl>
- Department of Climate Change, Energy, the Environment and Water. (2019). Retrieved from Australian Wetlands Database: <http://www.environment.gov.au/cgi-bin/wetlands/ramsardetails.pl?refcode=28>
- Department of Climate Change, Energy, the Environment and Water. (2021). *Wildlife and threatened species bushfire recovery research and resources*. Retrieved from <https://www.environment.gov.au/biodiversity/bushfire-recovery/research-and-resources>
- Department of Climate Change, Energy, the Environment and Water. (2022). Retrieved from Protected Matters Search Tool: <https://pmst.awe.gov.au/#/map?lng=131.50634765625003&lat=-28.6905876542507&zoom=5&baseLayers=Imagery>
- Department of Planning and Environment. (2022). *BioNet*. Retrieved from <https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/nsw-bionet>
- Department of Planning and the Environment. (2010a). *State of the Catchments 2010: Wetlands - Hawkesbury - Nepean Region*. Retrieved from

<https://www.environment.nsw.gov.au/resources/soc/hawkesburynepean/10453HAWKNEPwetlands.pdf>

Department of Planning and the Environment. (2010b). *State of the Catchments 2010 - Riverine Ecosystems, Hawkesbury-Nepean region*. Department of Planning and the Environment.

Department of Planning and the Environment. (2022). *Water in New South Wales*. Retrieved from <https://www.industry.nsw.gov.au/water/basins-catchments/snapshots/hawkesbury-nepean#:~:text=Located%20on%20the%20NSW%20Central,per%20cent%20of%20flat%20terrain.>

Department of Planning, Industry and Environment. (2020). *Hydrogeological Landscapes of the Capertee and Coxs River Valleys*. Parramatta: Department of Planning, Industry and Environment.

Department of Primary Industries. (2013). *Policy and guidelines for fish habitat conservation and management*. Sydney: NSW Department of Primary Industries.

Department of Primary Industries. (2018). *NSW Legislation: Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011*. Retrieved from <https://legislation.nsw.gov.au/view/whole/html/inforce/current/sl-2011-0112>

Department of Primary Industries. (2022a). *Fisheries NSW Spatial Data Portal*. Retrieved from https://webmap.industry.nsw.gov.au/Html5Viewer/index.html?viewer=Fisheries_Data_Portal

Department of Primary Industries. (2022b). *Threatened species distribution maps*. Retrieved from <https://www.dpi.nsw.gov.au/fishing/threatened-species/threatened-species-distributions-in-nsw>

Department of Primary Industries. (2022c). *Fish Stocking*. Retrieved from <https://www.dpi.nsw.gov.au/fishing/recreational/resources/stocking>

Department of Sustainability, Environment, Water, Population and Communities. (2011). *Survey guidelines for Australia's threatened fish*. Retrieved from <https://www.awe.gov.au/sites/default/files/documents/survey-guidelines-fish.pdf>

EMM. (2023). *Lake Lyell Pumped Hydro Energy Storage Project: Scoping Report*. Unpublished.

EMM. (2022). *Preliminary Biodiversity Assessment*. Unpublished.

Green, D., Petrovic, J., Moss, P., & Burrell, M. (2011). *Water resources and management overview: Namoi Catchment*. Sydney: NSW Office of Water.

Jones, H. (1992). *Water Quality of Cox's River and Tributaries 1962-1990*. West Ryde: Science and Environmental Division, Australian Water Technologies.

Judge, S. M. (2013). *Fauna of the Upper Coxs River catchment: An assessment of common freshwater species in a high- demand landscape*. University of Western Sydney.

National Parks and Wildlife Service. (2003). *The Bioregions of New South Wales, their biodiversity, conservation and history*. Hurstville: NSW National Parks and Wildlife Service.

P and J Smith Ecological Consultants. (1996). *Regionally Significant Wetlands of the Hawkesbury-Nepean Catchment for Sydney Regional Environmental Plan 20*. P and J Smith Ecological Consultants.

Strahler, A. (1952). Dynamic Basis of Geomorphology. *Geological Society of America Bulletin*, 63, 923-938.

Temple-Smith, P. D., & Grant, T. R. (2003). Conservation of the platypus, *Ornithorhynchus anatinus*: Threats and challenges. *Aquatic Ecosystem Health and Management*, 5-18.

Thackway, R., & Cresswell, I. D. (1995). *An Interim Biogeographic Regionalisation for Australia*. Canberra: Australian Nature Conservation Agency.

Water Quality Australia. (2018). *Australian and New Zealand Guidelines for Fresh & Marine Water Quality*. Retrieved from <https://www.waterquality.gov.au/anz-guidelines>

Young, W. J., Brock, M. A., Chessman, B. C., Gehrke, P. C., Maher, W. A., Marr, A., . . . Wamer, R. F. (2000). *Assessments of river condition under the current flow regime and proposed flow regimes in the lower Coxs River, New South Wales*. Canberra: CSIRO LAND and WATER.

Appendix C

Cumulative impact assessment scoping table

C.1 Cumulative impact assessment scoping table

Key	
Detailed assessment	<p>The project may result in significant impacts on the matter, including cumulative impacts. Detailed assessment is characterised by:</p> <ul style="list-style-type: none">• Potential overlap in impacts between a future project and the proposed project.• Potential for significant cumulative impacts as a result of the overlap, requiring detailed technical studies to assess the impacts.• Sufficient data is available on the future project to allow a detailed assessment of cumulative impacts with the proposed project for the relevant matter.• Uncertainties exist with respect to data, mitigation, assessment methods and criteria
Standard assessment	<p>The project is unlikely to result in significant impacts on the matter, including cumulative impacts. Standard assessments are characterised by:</p> <ul style="list-style-type: none">• Impacts are well understood.• Impacts are relatively easy to predict using standard methods.• Impacts are capable of being mitigated to comply with relevant standards or performance measures.• The assessment is unlikely to involve any significant uncertainties or require any detailed cumulative impact assessment.
N/A	<ul style="list-style-type: none">• No potential overlap in impacts between a future project and the proposed project that would warrant any consideration in the cumulative impact assessment.

Table C.1 Cumulative impact scoping table

Relevant future projects	Approximate distance to project	Project status	Potential overlap between impact of project on assessment matter and impact of other project on the same assessment matter						
			Water	Aquatic biodiversity	Terrestrial biodiversity	Aboriginal heritage	Amenity	Social	Economic
Wallerawang Battery Energy Storage System	9.5 km	<ul style="list-style-type: none"> Approved (08/2022) ~3 year construction 							
Study area:			<ul style="list-style-type: none"> Coxs River catchment 	<ul style="list-style-type: none"> Coxs River catchment 	<ul style="list-style-type: none"> No overlap in bioregion 	<ul style="list-style-type: none"> Regional context 	<ul style="list-style-type: none"> Projects have sufficient separation distance 	<ul style="list-style-type: none"> No overlap 	<ul style="list-style-type: none"> Potential employment Regional benefits/NEM contribution
Great Western Highway Blackheath to Little Hartley	14 km	<ul style="list-style-type: none"> SEARs issued EIS currently being prepared 4–5 year construction 							
Study area:			<ul style="list-style-type: none"> Projects have sufficient separation distance 	<ul style="list-style-type: none"> Projects have sufficient separation distance 	<ul style="list-style-type: none"> No overlap in bioregion 	<ul style="list-style-type: none"> Regional context 	<ul style="list-style-type: none"> Traffic generation and access 	<ul style="list-style-type: none"> Construction workforce 	<ul style="list-style-type: none"> Construction workforce
Mt Piper Battery Energy Storage System (BESS)	15 km	Request for SEARs							
Study area:			<ul style="list-style-type: none"> Coxs River catchment 	<ul style="list-style-type: none"> Coxs River catchment 	<ul style="list-style-type: none"> No overlap in bioregion 	<ul style="list-style-type: none"> Regional context 	<ul style="list-style-type: none"> Projects have sufficient separation distance 	<ul style="list-style-type: none"> Potential construction workforce 	<ul style="list-style-type: none"> Potential employment
McPhillamys Gold Project	> 50 km	<ul style="list-style-type: none"> SEARs issued EIS is currently under assessment 							
Study area:			<ul style="list-style-type: none"> Projects have sufficient separation distance 	<ul style="list-style-type: none"> Projects have sufficient separation distance 	<ul style="list-style-type: none"> No overlap in bioregion 	<ul style="list-style-type: none"> Projects have sufficient separation distance 	<ul style="list-style-type: none"> Projects have sufficient separation distance 	<ul style="list-style-type: none"> Projects have sufficient separation distance 	<ul style="list-style-type: none"> No economic overlap

Table C.1 Cumulative impact scoping table

Relevant future projects	Approximate distance to project	Project status	Potential overlap between impact of project on assessment matter and impact of other project on the same assessment matter						
			Water	Aquatic biodiversity	Terrestrial biodiversity	Aboriginal heritage	Amenity	Social	Economic
Angus Place West	15 km	<ul style="list-style-type: none"> SEARs issued EIS currently being prepared 							
Study area:			<ul style="list-style-type: none"> Coxs River catchment 	<ul style="list-style-type: none"> Coxs River catchment 	<ul style="list-style-type: none"> No overlap in bioregion 	<ul style="list-style-type: none"> Regional context 	<ul style="list-style-type: none"> Projects have sufficient separation distance 	<ul style="list-style-type: none"> Construction workforce 	<ul style="list-style-type: none"> No economic overlap
Great Western Battery Energy Storage System	9.5 km	<ul style="list-style-type: none"> SEARs issued EIS response to submissions 							
Study area:			<ul style="list-style-type: none"> Coxs River catchment 	<ul style="list-style-type: none"> Coxs River catchment 	<ul style="list-style-type: none"> No overlap in bioregion 	<ul style="list-style-type: none"> Regional context 	<ul style="list-style-type: none"> Projects have sufficient separation distance 	<ul style="list-style-type: none"> Construction workforce 	<ul style="list-style-type: none"> Potential employment Regional benefits/NEM contribution

Appendix D

SIA scoping report

Lake Lyell PHES

Social Impact Assessment Scoping Report

Prepared for EnergyAustralia

July 2023

Lake Lyell PHES

Social Impact Assessment Scoping Report

EnergyAustralia

E220376 LLPHES_SIA

July 2023

Version	Date	Prepared by	Approved by	Comments
1	16 November 2022	Breannan Dent	Chris Mahoney	Draft for EnergyAustralia review
2	1 December 2022	Breannan Dent	Chris Mahoney	Final for Scoping Report
3	21 July 2023	Breannan Dent	Chris Mahoney	Updated Final

Approved by



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This report has been prepared in accordance with the brief provided by EnergyAustralia and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of EnergyAustralia and no responsibility will be taken for its use by other parties. EnergyAustralia may, at its discretion, use the report to inform regulators and the public.

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Executive Summary

EMM Consulting have been engaged by EnergyAustralia to prepare a Social Impact Assessment (SIA) scoping report for the Lake Lyell Pumped Hydro Energy Storage Project (the Project), in accordance with the Department of Planning and Environment's *Social Impact Assessment Guideline for State Significant Projects* (2021).

The Project involves creating a new reservoir adjacent to the southern shoulder of Mount Walker (upper reservoir) and connecting it with the Farmers Creek arm of Lake Lyell (lower reservoir) through a series of tunnels and an underground power station. A new switchyard will feed electricity generated from the power station to the grid via existing high voltage transmission lines.

This SIA scoping report supports the request for Secretary's Environmental Assessment Requirements (SEARs) for the Project.

The study area determined for the SIA is based on the description of the project and the community profile, and includes the following areas:

- local area: Rydal, Bowenfels and South Bowenfels
- key urban area: Lithgow city
- regional area: Lithgow local government area
- the State of NSW.

The community profile identifies trends which are likely to influence the community's experience of the Project's potential impacts and benefits. Key trends include a relatively high proportion of socio-economic disadvantage in the local and regional areas, a high local indigenous population and a relatively high number of people experiencing health concerns. The community profile also identifies many businesses likely to rely on local and regional tourism and recreation opportunities.

Community engagement for the Project and SIA found that the following key matters were indicated repeatedly, by groups with varied interests in the Project, as outlined in Chapter 5 of this report:

- Aboriginal cultural heritage
- biodiversity
- employment and training
- local business
- recreation
- surface water
- traffic
- tourism
- visual amenity.

This demonstrates the above matters are of particularly high importance to the community.

The SIA Scoping Worksheet (Appendix B) uses the findings of the community profile and SIA fieldwork to identify projected impacts and benefits of the Project. Potential impacts (negative and positive) that have been identified as requiring a detailed level of assessment under the SIA Guideline (DPE, 2021) framework are:

- Visual impacts of Mt Walker reservoir and supporting infrastructure affecting community sense of place and associated values around the environment and scenery (Impact).
- Recreation and amenity impacted by changes to water quality and water levels in Lake Lyell, including the Coxs River arm and Farmer's Creek arm of Lake Lyell (not including biodiversity) (Impact).
- Improved sustainability and stability of the energy network and support for transition to renewable energy, with resulting benefits for climate change (Benefit).
- Direct impacts to material culture for Aboriginal people, including impacts to heritage sites (Impact).
- Biodiversity impacts related to fluctuation of water levels in Lake Lyell, and the Cox's River arm and Farmers Creek arm of Lake Lyell, impacting environmental and recreational values (Impact).

Other key matters including employment and training, local business, traffic and tourism are also of high importance, but will require less independent social assessment because they will be addressed by other reports, or because their assessment will be provided across multiple impacts.

Chapter 6 of this report outlines the proposed scope and methodology for the future SIA to support the EIS, and recommends detailed assessment of, and effective responses to, the possible impacts and benefits of the Project.

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1 Introduction

1.1 Project overview

EnergyAustralia NSW Pty Ltd (EnergyAustralia) is investigating the development of a 335 megawatt (MW) Pumped Hydro Energy Storage (PHES) at Lake Lyell approximately 15 kilometres (km) south of the existing Mount Piper Power Station, within the Lithgow Local Government Area (LGA). The PHES involves creating a new reservoir adjacent to the southern shoulder of Mount Walker (upper reservoir) and connecting it with the Farmers Creek arm of Lake Lyell (lower reservoir) through a series of tunnels and an underground power station. A new switchyard will feed electricity generated from the power station to the grid via existing high voltage transmission lines.

Once constructed, the operation of the Project will allow hydroelectricity to be generated as water is transferred from the upper reservoir to the lower reservoir via the connecting tunnels and turbine located in the underground power house. The reversible turbine will also be able to act as a pump, allowing water to be pumped to the top reservoir during periods of peak renewable energy availability.

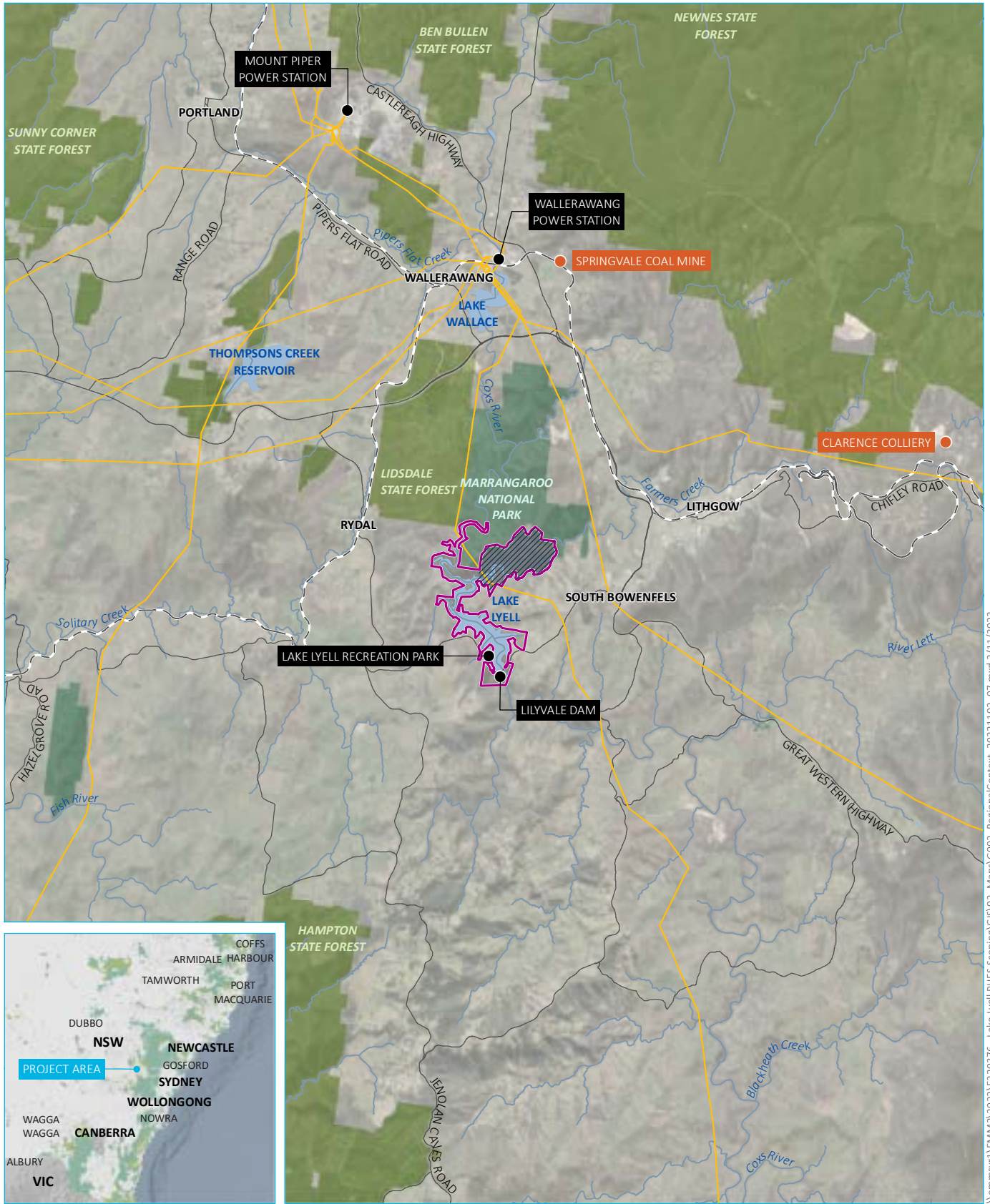
The Project will operate as an open loop system, with Lake Lyell remaining largely unchanged although water levels will fluctuate by approximately two metres during each pumping and generating cycle. There is expected to be one pumping and generating cycle each day.

A comprehensive list of the elements of the Project is provided in Chapter 3 of the Scoping Report (EMM 2023). The Project is anticipated to employ up to 600 workers during the construction period, and up to 20 during operation. However, a detailed design and early contractor involvement process will be carried out to confirm the construction methodology and operational regime of the Project, including employment requirements.

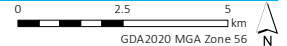
A Project area has been defined for the purposes of estimating an area where direct impacts of the project could occur. The Project area is shown in Figure 1.1, with regard to its regional context.

The Project is a State Significant Development (SSD) pursuant to the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP), and approval for the Project is required under Part 4, Division 4.7 of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act). An Environmental Impact Statement (EIS) will be required to accompany the SSD application.

This report presents an initial assessment of potential social impacts and serves to define the proposed scope of the Social Impact Assessment (SIA) to be prepared as part of the future EIS.



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



KEY

- | | | |
|-------------------------|-------------------|--------------|
| Project area | Named watercourse | NPWS reserve |
| Main works | Named waterbody | NPWS reserve |
| Mine | State forest | NPWS reserve |
| 330kV transmission line | State forest | NPWS reserve |
| Rail line | | |
| Major road | | |

- INSET KEY**
- | | |
|--------------|--------------|
| Major road | NPWS reserve |
| NPWS reserve | NPWS reserve |
| NPWS reserve | NPWS reserve |

Regional context

Lake Lyell PHES Project
Scoping report
Figure 1.1



\\emmsvr1\EMM\2022\220376 - Lake Lyell PHES Scoping\GIS\02_Maps\G002_RegionalContext_20221102_07.mxd 2/11/2022

1.2 Purpose of the social impact assessment scoping report

The purpose of this SIA scoping report is to:

- identify and understand the social locality (i.e. study area) applicable to the SIA
- identify and characterise potentially affected people
- identify the likely potential negative and positive social impacts for further investigation
- determine the level of assessment required for potential social impacts.

The SIA scoping report will accompany the EIS Scoping Report that requests and informs the content of the Secretary's Environmental Assessment Requirements (SEARs) for the Project.

The SEARs will identify the requirements and level of environmental assessment required to accompany the SSD application for the Project and associated EIS.

This report has been prepared by EMM Consulting Pty Limited (EMM) on behalf of EnergyAustralia in accordance with the *Social Impact Assessment Guideline for State Significant Projects* (SIA Guideline) (DPE 2021).

The authors declare that this SIA scoping report:

- was completed on 1 December 2022 and updated in July 2023
- has been prepared in accordance with the EIS process under the *Environmental Planning and Assessment Act 1979*
- has been prepared in accordance with the SIA Guideline (2021)
- contains all reasonably available project information relevant to the SIA
- as far as EMM is aware, contains information that is neither false nor misleading.

2 Scoping methodology

The phases of the SIA methodology are described in the SIA Guideline (2021) and shown in Figure 2.1. The SIA process for the Project is currently in Phase 1 (Scoping and initial assessment). The relevant steps completed for the Project in this phase of the SIA process is described in this section.

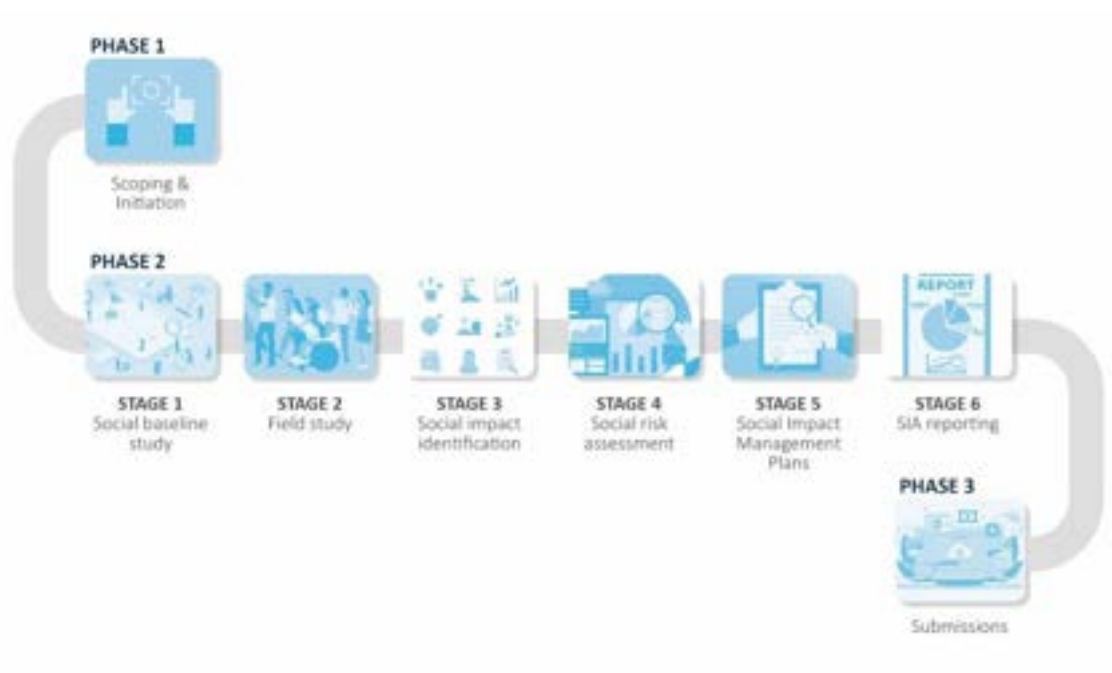


Figure 2.1 Phases of the SIA methodology

2.1 Community profile review

A review of the description of the Project and its proximity to and interaction with residents, businesses, and services, along with Australian Bureau of Statistics (ABS) demographic and economic data was used to identify and characterise potentially affected communities and key stakeholders, and to define the SIA study area.

2.2 Identification of the study area

The SIA study area was mapped to include the identified surrounding potentially affected communities and stakeholders (including directly or indirectly affected by the Project). This includes landholders, residents, businesses and social services.

2.3 Stakeholder engagement

The SIA Scoping assessment has been directly informed by community and stakeholder engagement completed specifically for the Project. Feedback was generated through the following activities:

- Project stakeholder briefings
- SIA community survey
- community information sessions.

Information generated has been used to:

- validate community profile data and assumptions
- identify/test impacts that may be experienced by nearby neighbours and the broader community
- identify potential impacts and potential management strategies
- provide communities with opportunities to express any concerns.

EnergyAustralia will continue to ensure there are opportunities for community members to comment on the Project as it progresses through the approvals process.

2.4 SIA scoping worksheet

Preparation of the scoping worksheet as per the SIA Guideline (2021) was completed, drawing on primary and secondary data along with the findings of other preliminary technical studies completed in the preparation of the EIS Scoping Report (EMM 2022).

2.5 SIA scoping report

The SIA Scoping Report summarises the findings of the SIA scoping process and informs next steps for completion of a comprehensive SIA report required in accordance with the SIA Guideline (2021).

3 SIA Study Area

3.1 Identification of the SIA study area

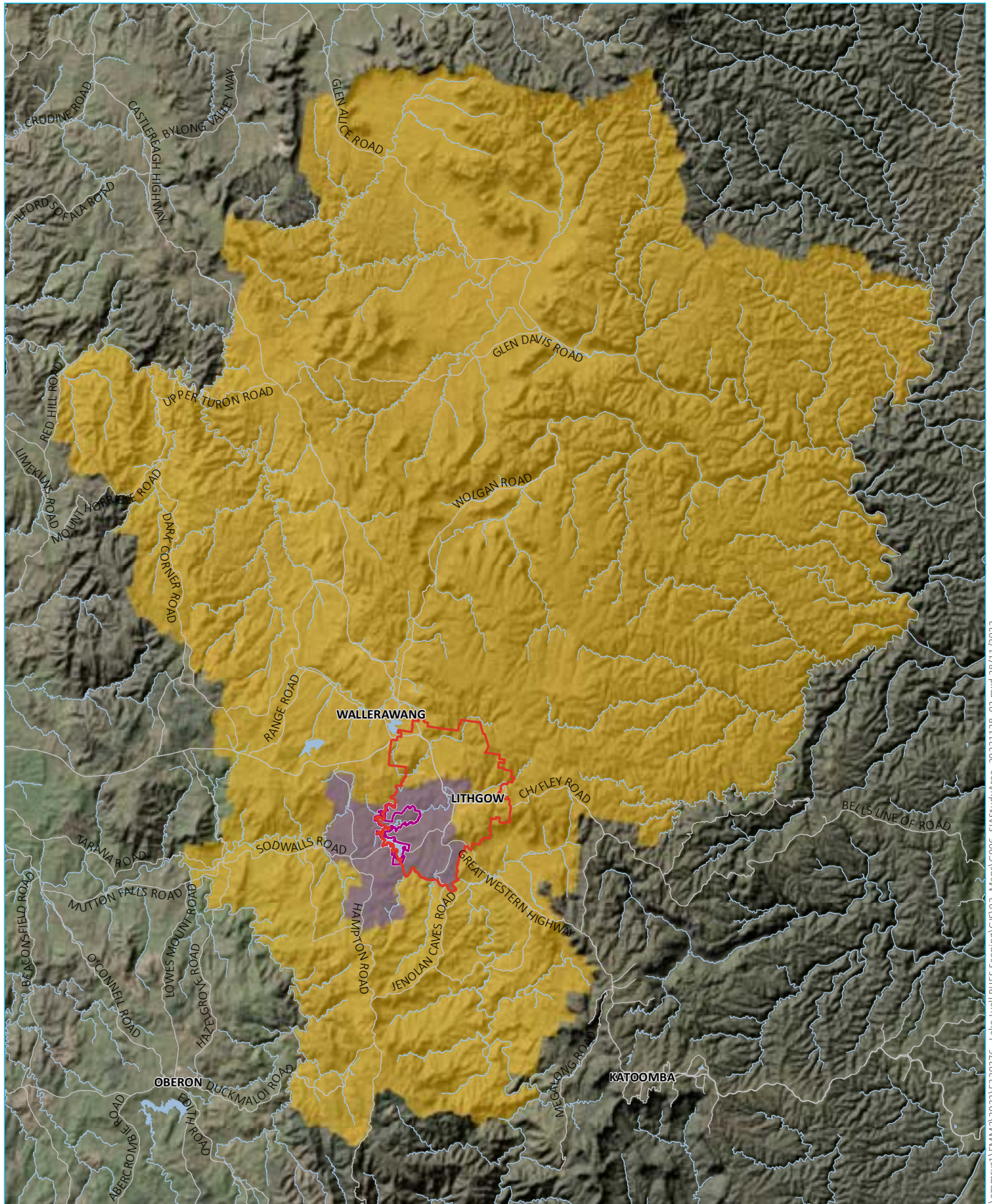
The SIA study area was mapped (refer to Figure 3.1) to identify surrounding stakeholders who would potentially be directly or indirectly affected by the Project. This includes landholders, residents, businesses and social services who may have an interest in the Project and who would be potentially impacted.

The SIA study area considers local communities proximal to the site as well as those communities located within a broader, regional area. This allows the SIA to consider the local, direct impacts as well as regional, indirect impacts that may result from the Project, as these impacts would be experienced differently.

The SIA study area is summarised in Table 3.1 below, identifying the relevant suburbs, towns and regions. Each of the locations are mapped to respective ABS statistical geographies shown in Table 3.1 and will be used to develop the community profile and social baseline.

Table 3.1 Locations within the SIA study area mapped to ABS categories

Study area	Geographic area	ABS statistical geography
Local area	Rydal suburb	Rydal SAL
	Bowenfels suburb	Bowenfels SAL
	South Bowenfels suburb	South Bowenfels SAL
Key urban area	Lithgow city	Lithgow SA2
Regional area	Lithgow local government area	Lithgow LGA
NSW	State of NSW	New South Wales STE



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

KEY

- Project area
- Key urban area
- Local area
- Regional area
- Major road
- Watercourse
- Named waterbody

0 5 10
km
GDA2020 MGA Zone 56
N
Area of social influence

Lake Lyell PHES Project
Figure 3.1

\\emmsvr1\EMM\2022\220376 - Lake Lyell PHES Scoping\GIS\02_Maps\G006_SIAStudyArea_20221128_03.mxd 28/11/2022

3.2 Geographical considerations

Rydal Suburb and Locality (SAL), Bowenfels SAL, and South Bowenfels SAL are on the outskirts of the city of Lithgow, are nearest to the Project and are likely to include the communities with potential to be directly impacted by the Project.

The geographic extent of the local study area does exclude certain communities which may in the future be reconsidered, for the following reasons:

- The Project Description (EIS Scoping Report, EMM 2022) suggests that downstream water flows and quality impacts are unlikely, so the Hartley SAL has not been included in the Project's local area.
- It is unlikely that direct impacts will occur to private property in, or recreational areas of Marrangaroo SAL or Wallerawang SAL, based on the current Project description and scoping assessment. These areas have been excluded from the Project's local area and are captured within the regional area.
- It is noted that visual impacts of the Project may be far-reaching, but are highly dependent on vantage points. As such, some outlying potentially impacted SALs have been excluded from the Project's local area and are captured within the regional area.

The above elements determining the SIA study area should be reviewed in response to detailed design and the findings of technical studies supporting the EIS, once available.

3.3 Potentially directly affected people

Potentially directly impacted people include:

- landholders, business owners and residents of Rydal SAL, Bowenfels SAL, and South Bowenfels SAL
- service providers and businesses in the regional area of Lithgow LGA
- residents of Lithgow SA2
- Aboriginal stakeholders
- local, regional and state visitors and recreational users of Lake Lyell
- employees of the Lake Lyell PHES.

4 Community Profile

4.1 Overview

This section provides a brief overview of social baseline characteristics of local communities, key urban areas and the broader region in which the Project will operate. As outlined above, the SIA study areas are the suburb and localities (SAL) of Rydal, Bowenfels, and South Bowenfels (local area), the city of Lithgow (key urban area) and the LGA of Lithgow (regional area).

4.2 Demographic profile

At the time of the ABS 2021 Census of Population and Housing, the local area had a total population of 3,538 people. The distribution of this population across the local area is quite varied, with Bowenfels SAL hosting 2,049 people, while Rydal SAL is home to just 163 people. The key urban area of Lithgow SA2 had a total population of 12,385 people, and the regional area (Lithgow LGA) had a total population of 20,842 people.

Table 4.1 Population summary, 2021

Area	Population	Male (%)	Female (%)
Local area			
Rydal SAL	163	50.3%	49.7%
Bowenfels SAL	2,049	49.7%	50.3%
South Bowenfels SAL	1,326	48.1%	51.9%
Totals	3,538	49.1%	50.8%
Key urban area			
Lithgow SA2	12,385	50.3%	49.7%
Regional area			
Lithgow LGA	20,842	50.5%	49.5%
NSW			
New South Wales	8,072,161	49.4%	50.6%

Source: ABS 2021a, Census of Population and Housing: General Community Profiles; ABS 2021b Census of Population and Housing: Quickstats

The gender distribution across the local and regional areas is consistent, with the local area having 49.1% males and 50.8% females, and the regional area having 50.5% males and 49.5% females. Both these proportions are comparable to the gender distribution across NSW, with 49.4% males and 50.6% females.

The local area has a slightly older average population compared to NSW, with the two largest age categories in the local area being 55–64 years (12.3%) and 65–74 years (12.7%), and the two largest age categories across NSW being 25–34 years (14.2%) and 45–54 years (12.6%). This can be reflected by the median ages of the local area (53 in Rydal SAL, 41 in Bowenfels SAL, 48 in South Bowenfels SAL), which are all notably higher than the median age of NSW, at 39.

This trend may reflect the tendency for young adults (20–34 years) to leave regional areas in order to pursue tertiary education and employment opportunities. Further, the proportion of the local area's population in the older age distributions may have implications for housing, health care, and service delivery. For instance, this may explain the low levels of labour force participation in the local area (see Table 4.4).

Table 4.2 Age group distribution, 2021

Area	0–4 years	5–14 years	15–19 years	20–24 years	25–34 years	35–44 years	45–54 years	55–64 years	65–74 years	75–84 years	85 years and older	Median age
Local area												
Rydal SAL	3.1%	8.1%	8.7%	1.9%	10.0%	6.9%	14.9%	15.5%	19.2%	9.9%	1.9%	53
Bowenfels SAL	5.7%	15.1%	6.7%	4.9%	10.1%	10.6%	13.1%	12.5%	10.4%	7.4%	3.5%	41
South Bowenfels SAL	6.2%	12.3%	4.9%	3.5%	10.2%	9.6%	9.6%	11.7%	15.5%	12.2%	4.3%	48
Totals	5.8%	10.2%	6.1%	4.2%	10.1%	10.0%	11.8%	12.3%	12.7%	9.3%	3.8%	–
Key urban area												
Lithgow SA2	4.6%	11.4%	5.2%	5.1%	11.8%	10.3%	11.9%	14.1%	11.8%	8.9%	3.1%	46
Regional area												
Lithgow LGA	4.6%	11.8%	5.3%	4.8%	10.9%	10.3%	12.5%	15.2%	13.9%	8.0%	2.6%	46
NSW												
NSW	5.8%	12.4%	5.7%	6.1%	14.2%	13.7%	12.6%	11.9%	9.8%	5.6%	2.3%	39

Source: ABS 2021a, Census of Population and Housing: General Community Profiles; ABS 2021b Census of Population and Housing: Quickstats

4.2.1 Aboriginal and/or Torres Strait Islander peoples

The local area has a significantly higher proportion of Aboriginal and/or Torres Strait Islander people (8.7%) than the proportion across NSW (3.4%). This can be attributed to particular suburbs and localities which are home to larger populations of Aboriginal and/or Torres Strait Islander people, such as Bowenfels SAL with 234 Aboriginal and/or Torres Strait Islander peoples, comprising 11.4% of their total population.

Table 4.3 shows the proportion of persons who identify as Aboriginal and/or Torres Strait Islander.

Table 4.3 Summary Aboriginal and/or Torres Strait Islander status

Area	Aboriginal and/or Torres Strait Islander population	Aboriginal and/or Torres Strait Islander population (% total)	Male (%)	Female (%)	Median age
Local area					
Rydal SAL	11	6.7%	60.0%	40.0%	18
Bowenfels SAL	234	11.4%	50.0%	50.0%	23
South Bowenfels SAL	64	4.3%	47.5%	52.5%	24
Totals	309	8.7%	48.1%	48.4%	–
Key urban area					
Lithgow SA2	1033	8.3%	53.9%	46.1%	27
Regional area					
Lithgow LGA	1621	7.8%	53.1%	46.9%	26
NSW					
NSW	278,043	3.4%	49.7%	50.3%	23

Source: ABS 2021a, Census of Population and Housing: General Community Profiles; ABS 2021b Census of Population and Housing: Quickstats

4.2.2 Socio-economic advantage and disadvantage

The level of disadvantage or advantage in the population is indicated in the Socio-Economic Indexes for Areas (SEIFA) which focuses on low-income earners, relatively lower education attainment, high unemployment and dwellings without motor vehicles. SEIFA is a suite of four summary measures that were created from 2016 Census data, including:

- the Index of Relative Socio-Economic Disadvantage (IRSD)
- the Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD)
- the Index of Education and Occupation (IEO)
- the Index of Economic Resources (IER).

Each index is a summary of a different subset of Census variables and focuses on a different aspect of socio-economic advantage and disadvantage. Low rankings are deemed most disadvantaged and high rankings least disadvantaged within a decile ranking system where the lowest 10% of areas within Australia are given a decile number of 1 and the highest 10% of areas are given a decile number of 10.

The SEIFA index for the key urban area (Lithgow SA2) and the regional area (Lithgow LGA) are shown respectively in Figure 4.1 and Figure 4.2.

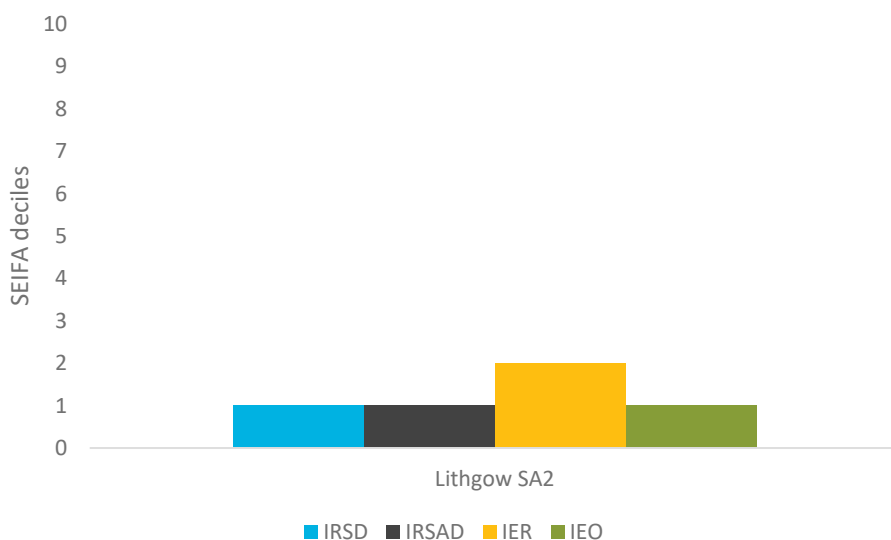


Figure 4.1 SEIFA indexes in key urban area, 2016

According to the 2016 SEIFA, Lithgow SA2 experiences relatively high levels of socio-economic disadvantage. With a ranking of 1 in the Index of Relative Socio-Economic Disadvantage (IRSD), Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD), and Index of Education and Occupation (IEO), Lithgow SA2 ranks in the bottom 10% of key urban areas across NSW in terms of levels of advantage and disadvantage.

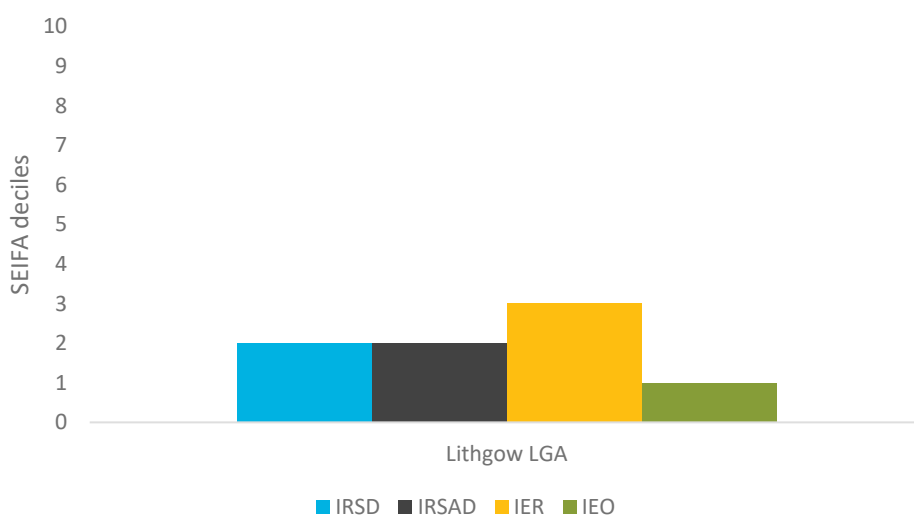


Figure 4.2 SEIFA deciles in the regional area, 2016

Lithgow LGA also experiences high levels of socio-economic disadvantage, though slightly higher than those in Lithgow SA2. With a 3 in the Index of Economic Resources (IER), Lithgow LGA is in the bottom 30% across NSW with regard to relative socio-economic advantage.

4.2.3 Employment

There is notable variation of unemployment rates within the study area, with some areas as low as 2.4% (South Bowenfels SAL), and others as high as 10.4% (Bowenfels SAL). Across the local area, the total unemployment rate is 2.5%, which is notably lower than in the key urban area (Lithgow SA2 at 6.5%), regional area (Lithgow LGA at 5.5%), and NSW (4.9%).

There is also significant variation in the local area's labour force participation rates, with Rydal SAL at 55.1%, Bowenfels SAL at 40.5%, South Bowenfels SAL at 53.2%, creating a total labour force participation rate of 37.1%. This proportion is significantly lower than both the regional area's labour force participation rate (50.4%), as well as the labour force participation rate across NSW (58.7%). This can be partly attributed to the notably high proportion of unemployment in some areas, such as 10.8% in Bowenfels SAL, which results in a lower labour force participation rate.

The unemployment and labour force participation rates are presented in Table 4.4.

Table 4.4 Unemployment and labour force participation rates, 2021

Area	Unemployment rate	Labour force participation rate (15 years and older)
Local area		
Rydal SAL	6.2%	55.1%
Bowenfels SAL	10.8%	40.5%
South Bowenfels SAL	2.4%	53.2%
Totals	2.5%	37.1%
Key urban area		
Lithgow SA2	6.5%	47.8%
Regional area		
Lithgow LGA	5.5%	50.4%
NSW		
NSW	4.9%	58.7%

Source: ABS 2021a, Census of Population and Housing: General Community Profiles; ABS 2021b Census of Population and Housing: Quickstats

Coal mining is the top industry of employment across the local area (Rydal SAL at 16%, Bowenfels SAL at 9.9%, South Bowenfels SAL at 12.1%), key urban area (7.3%), and regional area (6.9%). Other top industries include Aged care residential services, which is the second top employing industry in the key urban area (3.8%) and regional area (3.4%). Within the local area, there is some variation regarding the top employment industries, such as Accommodation which comprises 12% of employment in Rydal SAL but does not rank in the top three of the other SALs.

The top industries of employment are shown in Table 4.5.

Table 4.5 Top three industries of employment, 2021

Area	First	%	Second	%	Third	%
Local area						
Rydal SAL	Coal mining	16.0%	Accommodation	12.0%	Tiling and carpeting services	8.0%
Bowenfels SAL	Coal mining	9.9%	Takeaway food services	5.3%	Aged care residential services	4.8%
South Bowenfels SAL	Coal mining	12.1%	Hospitals	4%	Local Government administration	4.0%
Key urban area						
Lithgow SA2	Coal mining	7.3%	Aged care residential services	3.8%	Supermarket and grocery stores	3.5%
Regional area						
Lithgow LGA	Coal mining	6.9%	Aged care residential services	3.4%	Supermarket and grocery stores	3.1%

Source: ABS 2021a, Census of Population and Housing: General Community Profiles; ABS 2021b Census of Population and Housing: Quickstats

4.2.4 Local business

The 2021 Census recorded 1,342 registered businesses in the Lithgow LGA, of which the most common industry was Construction, which accounted for 263, or 19.6%, of registered businesses. The second most common industry was Agriculture, Forestry and Fishing, which accounted for 249, or 18.6%, of total registered businesses in Lithgow LGA. Most businesses were low employing, with 801 businesses with no employees, and 515 businesses with 1–19 employees. As such, only 31 businesses in the Lithgow LGA had over 20 employees.

The largest business turnover is concentrated between \$200,000 and less than two million dollars annually with 443 businesses in Lithgow LGA, closely followed by those making between \$50,000 and less than \$200,000 per year, comprising 420 of the total businesses in the area.

Figure 4.1 shows the numbers of businesses in each industry within Lithgow LGA.

Figure 4.2 shows the total business turnover of businesses in Lithgow LGA.

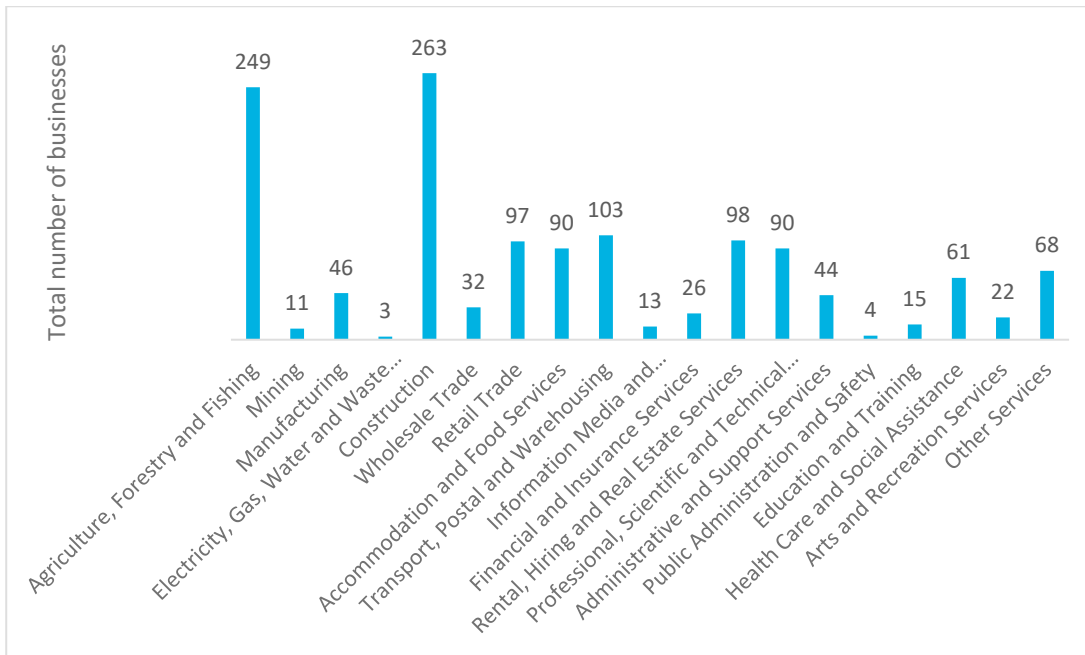


Figure 4.3 Total number of businesses by industry

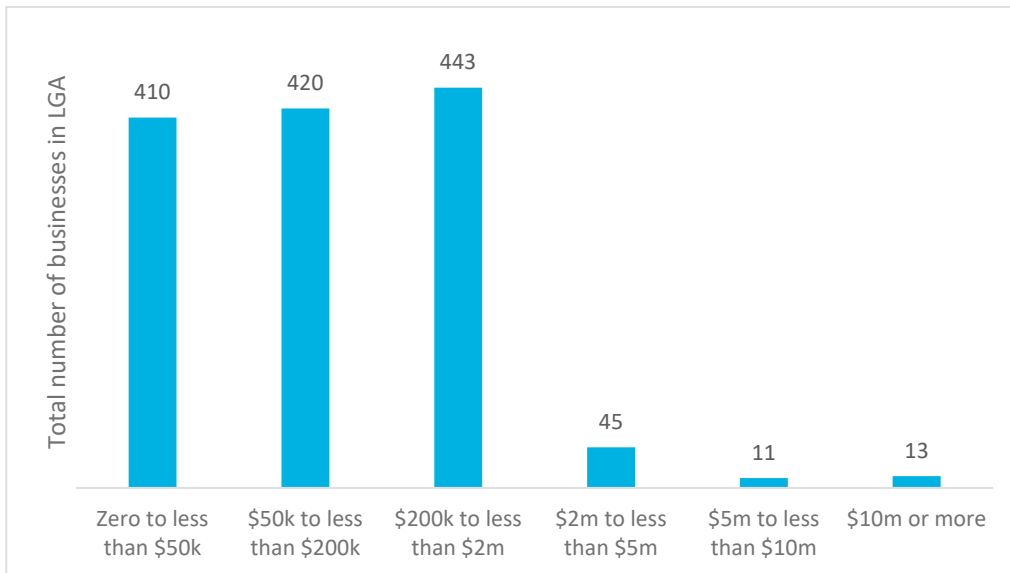


Figure 4.4 Total business turnover

4.2.5 Vulnerable groups

i Homelessness, 2016

According to the Census of Population and Housing: Estimating Homelessness (2016), Lithgow LGA had approximately 60 homeless people in 2016, comprising approximately 0.3% of its total population. NSW had approximately 37,692 homeless people, or approximately 0.5% of its total population. Levels of estimated homelessness are only available at LGA level.

According to the 2021 Census of Population and Housing, there were 346 people who identified as having a need for assistance in the local area, comprising 9.8% of the total local area's population. This proportion is higher than the proportion of people identified as having a need for assistance in both the key urban area (8.5%) and the regional area (7.6%). This indicator is important to consider in relation to the Project as any changes to Lake Lyell may affect the quality of the service that the Lake currently provides as a free recreational activity, such as reduced access to swimming areas for disabled peoples.

The 2021 Census of population and Housing also identified the number of people who identified as having provided unpaid assistance to a person with a disability, health condition, or due to old age. In the local area, 10.6% of the population (or 375 people) identified as aiding people in need, which is comparable to the proportions in the key urban area (10.8%) and regional area (11.1%). This indicator is significant for identifying its impact on labour force participation rates and can also reflect the levels of care which are provided to disabled or elderly people outside of social services.

The proportions of people identified as having a need for assistance, and as providing unpaid assistance to people with a disability, health concern, or due to old age, are shown in Table 4.6.

Table 4.6 Disability and disability support, 2021

Area	Persons identified as having a need for assistance	% of total pop	Persons identified as providing unpaid assistance (for a person with a disability, health condition, or due to old age)	% of total pop
Local area				
Rydal SAL	7	4.3%	19	11.7%
Bowenfels SAL	254	12.4%	171	8.3%
South Bowenfels SAL	85	6.4%	185	14.0%
Totals	346	9.8%	375	10.6%
Key urban area				
Lithgow SA2	1049	8.5%	1337	10.8%
Regional area				
Lithgow LGA	1592	7.6%	2306	11.1%

Source: ABS 2021a, Census of Population and Housing: General Community Profiles; ABS 2021b Census of Population and Housing: Quickstats

4.2.6 Health

The local area has a notably higher proportion of people experiencing health conditions compared to NSW, including arthritis (13.5% vs 8.4%), asthma (10.4% vs 7.8%), and mental health conditions (10.2% vs 8.0%). All health indices, except for instances of kidney disease (which are lower or similar), are higher in the local area, key urban area, and regional area, than in NSW. Health indicators are displayed in Table 4.7.

Table 4.7 Health indicators summary, 2021

Area	Arthritis	Asthma	Cancer (including remission)	Dementia (including Alzheimer's)	Diabetes (excluding gestational diabetes)	Heart disease (including heart attack or angina)	Kidney disease	Lung condition (including COPD or emphysema)	Mental health condition (including depression or anxiety)	Stroke	Any other long-term health condition(s)
Local area											
Rydal SAL	15.3%	6.1%	4.3%	0.0%	4.3%	6.7%	0.0%	4.9%	7.4%	3.1%	5.5%
Bowenfels SAL	12.7%	10.5%	2.9%	2.4%	6.2%	5.4%	1.1%	2.7%	12.6%	1.8%	8.2%
South Bowenfels SAL	14.6%	10.8%	4.1%	1.0%	5.7%	6.7%	0.3%	2.5%	6.9%	1.4%	8.4%
Totals	13.5%	10.4%	3.4%	1.8%	5.9%	5.9%	0.8%	2.7%	10.2%	1.7%	8.1%
Key urban area											
Lithgow SA2	14.7%	10.3%	3.5%	1.3%	7.2%	6.0%	1.0%	3.1%	11.8%	1.4%	8.7%
Regional area											
Lithgow LGA	13.9%	9.7%	3.6%	1.0%	6.7%	5.4%	1.0%	3.0%	10.7%	1.3%	8.4%
NSW											
NSW	8.4%	7.8%	2.8%	0.8%	4.8%	3.9%	1.0%	1.7%	8.0%	0.9%	7.8%

4.3 Recreation at Lake Lyell

Lake Lyell is a popular recreation destination, and multiple recreational opportunities and businesses supporting and relying on these opportunities have been identified. The table below outlines the key businesses identified in the Local area to date but does not include businesses relying on through-traffic such as recreation suppliers, petrol or food and beverage services.

Table 4.8 Local recreation and tourism overview

Opportunity or business	Type	Location
Lake Lyell Dam and reserve	Visitor attraction: dam viewing platform, swimming, fishing, camping (Hampton River Rd, Old Western Rd, Lockyer Rd), boating, canoeing, picnicking	Rydal NSW 2790
Mt Walker Trig Point	Tourist attraction	Mt Walker, South Bowenfels NSW 2790
Lidsdale State Forest	Tourist attraction: walking tracks, mountain biking, 4WD	15km west of Lithgow along the Great Western Highway.
Marrangaroo National Park	Tourist attraction: Camping, swimming, wildlife spotting (platypus), 4WD, mountain biking, canoeing, kayaking.	G3HR+J4, Marrangaroo NSW 2790
McKanes Falls Bridge	Tourist attraction (temporarily closed)	Bindaree, 484 McKanes Falls Rd, South Bowenfels NSW 2790
Chapel House	Accommodation	18 Coach Rd, Rydal NSW 2790
Wattle Views a tiny house	Accommodation	271 Martins Rd, Rydal NSW 2790
The Alexander Hotel (Rydal Pub)	Food and Beverage, Accommodation	LOT A Bathurst St, Rydal NSW 2790
Springmead B& B and Springmead Stud Farm and Saddlery	Accommodation; Retail	Kimбри Dr, Rydal NSW 2790
Lake Lyell Recreation Park	Accommodation	Lot 56 Magpie Hollow Rd, Lithgow NSW 2790
Lakely	Accommodation	271 Sandalls Dr, Rydal NSW 2790
Eagle View Escape	Accommodation	271 Sandalls Dr, Rydal NSW 2790
Japanese Bath House	Day Spa and Accommodation	259 Sir Thomas Mitchell Dr, South Bowenfels NSW 2790
Seclusions Blue Mountains	Accommodation	209 Martins Rd, Rydal NSW 2790
Kookawood	Accommodation	271 Martins Rd, Rydal NSW 2790
Bowen Inn Motel	Accommodation	5 Col Drewe Dr, South Bowenfels NSW 2790

Source: Google Maps, Accessed 1/11/2022

4.4 Community profile summary

At the time of the ABS 2021 Census of Population and Housing, the local area had a total population of 3,538 people, while the key urban area (Lithgow SA2) had 12,385 people, and the regional area (Lithgow LGA) had 20,842 people. The gender distribution of this population is comparable across the local area, regional area, and NSW, yet the age distribution indicates that the local area has a slightly older average population compared to NSW. This local area population also includes a notably higher proportion of Aboriginal and/or Torres Strait Islander people (8.7%) than the proportion across NSW (3.4%). This is driven by a relatively large Indigenous population in Bowenfels SAL (234 people).

According to the 2016 SEIFA, Lithgow SA2 experiences relatively high levels of socio-economic disadvantage, and low levels of socio-economic advantage, ranking in the bottom 10% of areas across NSW in three of the four categories. Lithgow LGA also experiences high levels of socio-economic disadvantage, though slightly higher than that in Lithgow SA2. These levels of advantage and disadvantage are important to consider in relation to the regional area's vulnerable groups, including those experiencing homelessness (0.3%) or disability with a need for assistance (7.6%). The proportion of people experiencing disability is even higher in the local area (9.8%).

Within the local area the total unemployment rate is 2.5%, however there is notable variation across the SALs, with some areas as low as 2.4% (South Bowenfels SAL), and others as high as 10.4% (Bowenfels SAL). There is also significant variation in the local area's labour force participation rates, creating a total labour force participation rate of 37.1%, a proportion significantly lower than both the regional area's labour force participation rate (50.4%), as well as the labour force participation rate across NSW (58.7%).

In the local area, there were 346 people who identified as having a need for assistance, or 9.8% of the total population. This proportion is higher than the proportion of people identified as having a need for assistance in both the key urban area (8.5%) and the regional area (7.6%). The local area also has a notably higher proportion of people experiencing health conditions compared to NSW in most categories, including arthritis (13.5% vs 8.4%), asthma (10.4% vs 7.8%), and mental health conditions (10.2% vs 8.0%).

Businesses linked with recreation and tourism opportunities are prevalent in the local area, as can be seen in Figure 4.3 and Table 4.8. Businesses which are likely to be reliant on tourism and recreation income include accommodation, food and beverage services, retail, fishing and arts and recreation services. These businesses rely on the scenic quality and amenity of the local area.

In summary, the local area has an aging population which may contribute to both the low labour force participation rate as well as the higher proportions of people experiencing health conditions and may be sensitive to changes to environmental conditions.

The area also experiences high levels of socio-economic disadvantage, which can be reflected by indices such as the proportion of homeless people, or the varied unemployment rates. This may enhance the benefit derived through targeted local employment. This benefit may be further supported by the prevalence of local construction industry businesses (263) identified in Figure 4.3.

5 Outcomes of SIA field study and issue identification

This section summarises the findings of the engagement activities undertaken for the Project to date and for this SIA scoping study. Stakeholder engagement had two objectives:

1. provision of information about:
 - the Project
 - the EIS and scoping process
 - opportunities for the community/stakeholders to provide feedback on the Project and the EIS scoping process
2. identification of community and stakeholder concerns for the Project.

Engagement which informed the SIA scoping study included:

- Project stakeholder briefings
- SIA Community survey
- community information sessions.

The findings summarised below are based on a small sample of resident and groups. Participants opted-in to the SIA community survey and the sampling method and small size means the findings cannot be assumed to be representative of the broader local and regional community.

5.1 Summary of matters raised by stakeholders

The identified community and stakeholders identified a range of issues that are summarised in Table 5.1.

Table 5.1 Key matters raised – potential impacts or benefits

Issues	Project stakeholder briefings	SIA Community surveys	Community information sessions
Air quality		✓	
Aboriginal cultural heritage	✓	✓	✓
Access to housing		✓	✓
Access to Project information and engagement opportunities and decision making	✓		✓
Access to short-term accommodation		✓	
Access to services		✓	✓
Access to social infrastructure		✓	(Addressed in Recreation)
Agriculture		✓	

Table 5.1 Key matters raised – potential impacts or benefits

Issues	Project stakeholder briefings	SIA Community surveys	Community information sessions
Biodiversity	✓	✓	✓
Climate change		✓	✓
Employment and training	✓	✓	✓
Groundwater		✓	✓
Health and safety		✓	✓
Land use		✓	
Local business	✓	✓	✓
Noise		✓	✓
Property prices		✓	✓
Recreation	✓	✓	✓
Regional economic diversity		✓	✓
Renewable/ Clean Energy		✓	✓
Safety			✓
Surface water	✓	✓	✓
Traffic	✓	✓	✓
Tourism	✓	✓	✓
Visual amenity	✓	✓	✓
Cumulative impacts	✓		✓

5.1.1 Project stakeholder briefings

Three (3) stakeholder briefings were conducted by EnergyAustralia with:

- Bathurst Local Aboriginal Land Council, and key matters raised included:
 - need for ongoing on-country engagement in future EIS processes to include both male and female representatives
 - possibility of men’s business sites on Mt Walker
 - not many local businesses with indigenous employees, though there is a presence in traffic management and residential trades which may be useful during construction
 - cumulative or associated impacts for surface water usage and flows with Central West PHES (nearby Project’s) and impacts on Frying Pan Creek.
- Lithgow City Council, and key matters raised included:

- traffic impacts
- need for access to more project information and engagement opportunities
- visual impacts
- need for affirmation of potential local Project benefits, i.e. securing Lake Lyells future; jobs and shared benefits and future opportunities for local financial contributions.
- Lithgow Chamber of Commerce, and key matters raised included:
 - need for access to more Project information and engagement opportunities
 - biodiversity – impacts to endangered species
 - the Lake is EnergyAustralia’s lake and that the community benefits from it being made available
 - surface water impacts to Lake Lyell water levels
 - sought co-benefits for tourism – lookout or education centre
 - information on how the project benefits Lithgow – need to secure benefits for local jobs and companies, possibly through or with training programs
 - possible mitigations for visual impact of reservoir, e.g. Portland grain silos.

5.1.2 Community Survey

The community survey was published on the Project website on 14 October 2022 was advertised via a letter promoting the community drop-in sessions on 23 September 2022, was distributed to the Project email mailing list on 14 October 2022 and was closed on 25 October 2022.

The survey received 11 responses,

- 5 were residents in the local area
- 3 were from residents of the regional area
- 1 was from a visitor from the Sydney region
- 1 was from an EnergyAustralia subconsultant
- 1 person did not provide a suburb.

A summary of the survey questions and responses is provided as Appendix A, and key findings are outlined below.

i Q4: How do you feel about the proposed Lake Lyell Pumped Hydro Energy Storage Project?

Overall, six respondents expressed that they are strongly opposed to the Project, with those most strongly opposed generally being from the local area and nearby regional area. However, four respondents were strongly supportive. Respondents who lived further from the Project site were more supportive. One respondent identified a neutral response and explained that more information was needed to make an informed decision.

ii Q5: Consider how the Lake Lyell Pumped Hydro Energy Storage Project may affect the local community (either positively or negatively) and select the appropriate response.

The top 5 possible “Positive” or “Very Positive” benefits identified were:

3. employment (45%)
4. local business (40%)
5. renewable/clean energy (36%) – received the most “Very Positive” responses (27%)
6. climate change (27%)
7. energy prices (27%).

The top 5 possible “Negative” and “Very Negative” impacts identified were:

1. visual amenity (81%)– received the most “Very Negative” responses (72%)
2. surface water (72%)
3. recreation (63%)
4. biodiversity (63%)
5. access to housing (63%)

There were also a high proportion of neutral responses to parts of Question 5, for example Agriculture (72%), Access to short term accommodation (60%) and Health (54%). This is believed to be reflective of respondents feeling they needed more information to determine the impact or benefit, or that some matters were perceived as unlikely to be significantly affected by the Project.

iii Q6: What do you value most about your local area? (please select one or more)

Respondents identified that the aspects of living in the local area they value most highly are; the environment (70%), economic opportunities (70%) and community/family (70%).

iv Q7: Based on your current understanding of hydro energy storage, what do you believe are the most positive benefits of the Project?

The most positive benefit of the Project was seen to be that it “supports provision of renewable energy” (70%).

v Q8: How and when do you most see or use Mount Walker and Lake Lyell?

For Question 8 “how and when do you most see or use Mount Walker and Lake Lyell?”:

- The visitor to the area identified that their family visits up to five times a year for different attractions, including 4wd, the Japanese Bath and Camping.
- A resident of the regional area also identified that they most commonly see the area through visiting the Japanese Baths.
- One resident of the regional area worked at Lake Lyell for a period of time installing safety rails.

- Local residents either identified that they have daily views towards the site, or that they use Lake Lyell and Mt Walker on a weekly or daily basis for recreation, including fishing and camping.

5.1.3 Community information sessions

Most feedback was received from the community during the community information sessions. These sessions were held as follows:

- Wallerawang Library: 40 Main Street Wallerawang, from 1:00 pm to 4:00 pm on Tuesday 4 October 2022. Approximately 6 community attendees.
- Portland Foundations Building: 36 Williwa St, Portland, from 9:00 am to 12:00 pm on Wednesday 5 October 2022. Approximately five community attendees.
- Rydal Showground Pavilion: Market St, Rydal from 1:00 pm to 4:00 pm on Wednesday 5 October 2022. Approximately 20 community attendees.
- Lithgow Library: 157 Main Street, Lithgow, from 9:00 am to 12:00 pm on Thursday 6 October 2022. Approximately 13 community attendees.

During these sessions EnergyAustralia Project staff provided information about the Project, while the community asked questions and raised concerns. Notes were taken on key comments and issues raised by the community. A summary of key matters raised at these sessions is provided in Table 5.2 below.

Table 5.2 Key issues and matters raised during community information sessions

Issues	Matters raised by the community
Aboriginal cultural heritage	<ul style="list-style-type: none"> “Concerned about cultural heritage on site.” “An Aboriginal cultural study including the cumulative impacts of projects in the region is key.” “Need for co-benefits, e.g. a cultural heritage centre.”
Access to housing	<ul style="list-style-type: none"> “Housing affordability is becoming an issue in Lithgow.” “Foreign investment in farming land and houses is driving out locals.”
Access to Project information, engagement opportunities and decision making	<ul style="list-style-type: none"> Future information sessions should be accessible for all, (i.e. held outside of business hours). “Need for additional Project information – detailed design and technical studies completed by qualified persons.” “Project maps, analysis and communications should include local houses and illustrate their proximity to the site.” Communications and engagement should be simple and easy for everyone to use and access. “Locals want to be involved in the EIS process and Local government should have more of a say.” “What can we do to make it more beneficial?” Need to understand local needs and wants.

Table 5.2 Key issues and matters raised during community information sessions

Issues	Matters raised by the community
Access to services	<p>Energy:</p> <ul style="list-style-type: none"> • “Huge cost for support to existing energy networks.” • “How much energy will it use and where is this energy coming from?” • “How much energy storage is required to maintain the network (level of service)?” • “Cost of living is front of mind.” • Cheaper power is a key potential co-benefit of the Project. • “3 existential threats facing humanity – climate crisis, energy crisis, covid pandemic. This Project is a potential contribution to solving climate and energy problems.” • “Lithgow has some of the best renewable energy resources in the region – good wind and solar resources, lots of pumped hydro sites and access to electrical distribution network – lots of positives to be capitalised on.”
Access to social infrastructure	<ul style="list-style-type: none"> • (General social context, not related to the Project) “Young people moving away – people socialising in hotels have reduced, and there are fewer sporting groups”.
Biodiversity	<ul style="list-style-type: none"> • “No amount of rehabilitation or replanting will resolve the Project’s impacts to native plants and wildlife or impacts from runoff into the creeks and water systems.” • “Sure, there are environmental impacts but that’s the case with any Project.” • “Fishing in Farmers Creek, where fish spawning along the creek may be impacted by any changes to Lake Lyell. (Also noted that Lake Lyell has been recently restocked with fish.)” • Most interested in ecology, noting that this is very, very important. Wants clear information on what the impacts will be generally, as well as on specific species: <ul style="list-style-type: none"> – Purple Copper Butterfly and it’s habitat, specifically the Native Blackthorn – Platypus – recorded in the area the Project intake – Wombats – Echidna – Kangaroos – Farmers Creek Trout. • The Project will kill off Mt Walker and decimate Farmer’s Creek. • “Ecological studies for Geotech drilling identified that the Native Blackthorn and the Purple Copper Butterfly live in the Project area. For the butterfly to survive, you’ve got to have both the Blackthorn and the altitude.” • “Platypus have been recorded in the area the Project intake is expected to be.” • “The butterfly has already lost 80% (of it’s habitat? of the total population?). This has got to change.” • “Pumped hydro will have a significant impact on fishing and frogs, particularly eggs and spawning. Need to understand what the ecological impacts on the entire food chain will be, including microbes, tadpoles and fish spawn.” • Energy Australia’s existing (perceived lack of) property maintenance is a significant concern, and reduces trust in the biodiversity and conservation elements of the Project. Existing issues include: <ul style="list-style-type: none"> – feral pigs – residents often set traps along property boundaries to prevent damage. Also an ecological concern – blackberry – foxes – willow trees – other feral animals.
Climate change	<ul style="list-style-type: none"> • “To mitigate the climate emergency, one of the three phases must be deep and rapid decarbonisation – and this Project helps contribute towards that, soaks up excess energy from intermittent renewables, and stores and discharges when you don’t have the excess energy – provides reliability and a low carbon emission source of energy.” • “Rather than filling up (project vehicles) with diesel, you swap the batteries out to improve on emissions.”

Table 5.2 Key issues and matters raised during community information sessions

Issues	Matters raised by the community
Employment and training	<ul style="list-style-type: none"> • “How many people will be employed by the Project.” • Transition and local employment a particular concern and possible benefit, though short term. • Information and analysis should be provided on the future of employment and how the Project contributes. • “Area dependant on industries like coal and power stations for employment, but they have to go as they’re contributing to GHG emissions, so we have to look at employment alternatives.” • “Need for a range of programs and actions for local indigenous people.”
Groundwater	<ul style="list-style-type: none"> • “What will be the impact of fault lines and ground water movement?”
Health / Safety	<ul style="list-style-type: none"> • Dangers of construction on the mountain. • “Concerned about direction of water should dam break.” • “What disaster recovery program will there be – how are breaks prevented? What is the regulatory context?” • “The Project will take 14.4. GL and water movements won’t be safe for lake users.” • Safety risk of people accessing the reservoir wall – fall from height.
Local business	<ul style="list-style-type: none"> • Ran a hotel in town, business downturn affects pubs – closures. • Run a local accommodation business, concerned about tourism impacts.
Noise	<ul style="list-style-type: none"> • “The Project will cause noise issues for local residents.” • “Concerned about noise travelling down the mountain - bought into the area for peace and quiet.” • “Disturbance to peace – construction noise and water pumping of particular concern.”
Project costs and funding vs. economic benefit	<ul style="list-style-type: none"> • “The Project is being financed by taxpayers money (11 million gov. grant), but where do the profits go if the Project is built?” • “Concerned that decision making won’t factor in the economic cost” of the Project. • “Huge cost for support to existing networks, does this the draw from Coal power stations?” • Concern economic benefits will go overseas instead of benefiting the local community “Money goes out of the country without paying tax, doesn’t circulate.” • Opportunities for community ownership or addressing community needs and wants. • “Where does the money for the Project come from, how much is government funded?”
Property prices	<ul style="list-style-type: none"> • The Project will affect resale value of properties.
Recreation	<ul style="list-style-type: none"> • “Access to Mt Walker is across private land. Concerned about Project access arrangements as the public currently have access to the area, even though it’s private property. Concern that this may be closed.” • There’s a concern that “if the project goes ahead, there will be a need to close the lake to recreation due to level fluctuations and the size of potential mud banks, as well as the legacy issue with the current roadway under the lake, which will be closed to public use.” • “Impacts of the reservoir on Mt Walker and from water extraction on Lake Lyell– mud flats will be extremely dangerous and will destroy recreational use.” • “The Project will drain Lake Lyell without any consideration to the lake users.” • “The legacy of the project for grandchildren and making sure they have the same opportunities.”
Regional economic diversity	<ul style="list-style-type: none"> • “Operational jobs provided by the project have 0 social impact for both local businesses and people looking for work. There’s a lot more that could have been put there that would have a better benefit.”

Table 5.2 Key issues and matters raised during community information sessions

Issues	Matters raised by the community
Renewable/ Clean Energy	<ul style="list-style-type: none"> • “The important thing I see is that if we don’t stop our GHG emissions, we won’t have a planet to live on a Project like this will improve the situation.” • “Transition from coal to distribution and storage of sustainable energy (“Why not just have solar. What happens with solar if there’s no winter sun?”) • “How does it work with renewable energy?” • “What will the Project benefit be? That it operates while people are using energy in summer?” • “How much energy will the facility generate?” • “How does the net gain in/benefit for energy from the Project occur?” • “Will the availability of solar and wind generation line up with when the Project is likely to be finished?” • “Will this Project alone provide stability for the grid?” • “How much energy storage is required to maintain the network?” • Need more of an understanding about how the Project works – particularly around how using energy to pump water uphill will work. • “Concern that Energy Australia won’t fund alternatives (e.g. batteries), if the Project goes ahead.” • “What is the progress on funding alternatives like batteries?”
Surface water	<ul style="list-style-type: none"> • “Don’t believe the Project will have a positive effect on Lake Lyell overall.” • “Impacts of the reservoir on Mt Walker and from water extraction on Lake Lyell– mud flats will be extremely dangerous and will destroy recreational use.” • “The lake isn’t big enough – “a 6th of the volume doesn’t stack up”. The Project would be better sited somewhere with more water and a greater elevation for the reservoir. The project would be better off on a massive hill like they have in the Snowy.” • “The Project provides a reservoir and not a dam – no additional benefit for water supply, that could have been useful in a drought.” • Concern about the ecological and water quality impacts of the potential mitigations. • Need more of an understanding about how the project works – particularly around how using energy to pump water uphill will work. • “Water level changes impact use of the lake.” • “Capacity of Coxs River to deal with flow changes – existing flows not great, plus downstream” • Main grounds for opposing are adverse impact on water resources – seepage and evaporation requiring reservoir top up during drought.
Traffic	<ul style="list-style-type: none"> • “Works on the road to Mt Walker” – current (geotechnical) and planned.
Tourism	<ul style="list-style-type: none"> • “The area sees 2,000 visitors a day over 8 weeks in summer for camping and recreation. These visitors won’t come if the Project goes ahead. Not only due to direct Project impacts to lake levels and visual impacts on Mt Walker, but also due to secondary impacts from availability of petrol and food. Lack of tourism will be a significant economic impact for the community. There’s no way to mitigate this. The lake will be closed.” • “90% of people who come here are from out of the area, tourists spend money. Income from tourism is key for the area.” • “Area is important for local tourism – destination planned for years ahead.” • “2,000 people a year, what will happen to our region when it becomes a place no one wants to camp anymore?”

Table 5.2 Key issues and matters raised during community information sessions

Issues	Matters raised by the community
Visual amenity	<ul style="list-style-type: none"> • Bulk and scale of upper reservoir. • “Most people object on aesthetic grounds due to the upper reservoir. However, we could do something similar to US Mount Rushmore on the concrete face and make it a tourist attraction. Or paint it to turn a negative into a positive.” • Noticed with electricity supply going into the Project – existing overhead powerline tapping into 1 km from proposed Turbine Hall. Aesthetics – overhead or underground. Need to clear a swathe, whereas underground is less clearing. But more costly. Only 1 km. • “The Project will be unsightly – no one wants it in this location, on an iconic mountain which is the highest in the area.” • “Where will Project sit – will it be visible from the lake? – what can be done to reduce this?”
Cumulative impacts	<ul style="list-style-type: none"> • Examples of good and bad outcomes. • Transition to renewable energy – closure of local coal mines and power stations and the overall loss of employment in these sectors.

6 Proposed SIA scope

This section considers the findings of the initial social baseline and considers likely social impacts to inform the proposed scope of the SIA as part of the EIS for the Project.

6.1 Potential social impacts

A preliminary set of potential social impacts and benefits of the project has been identified. These impacts have been based on the SIA scoping assessment, including the outcomes of the community survey, community and stakeholder engagement and completion of the SIA scoping worksheet. This process has been completed in alignment with previous relevant SIAs and EMM Social Scientist’s professional judgement. Additional details are provided in the SIA Guideline (2021) Scoping Worksheet in Appendix B.

The purpose of identifying potential impacts and benefits at this preliminary stage is to ensure the EIS preparation focuses on:

- the potential social impacts identified by, and of greatest concern, to the community
- an appropriate range of stakeholders, and that affected groups of individuals are included in the future SIA field study activities.

Potential impacts (negative and positive) that have been identified as requiring a detailed or standard level of assessment are listed in Table 6.1.

Table 6.1 Identified potential social impact mapped to matters, positive and negative

Potential social impacts	Issue – negative related to:	Issue – positive related to:
Way of life	Visual impacts of Mt Walker reservoir and supporting infrastructure affecting community sense of place and associated values attached to the environment and scenery.	
	Construction noise resulting in disruption to local residences and businesses.	
	Housing and short stay accommodation availability compromised due to demand generated by non-local workforce.	
Community	Community composition and character temporarily altered due to influx of non-local workforce.	
	Recreation and amenity impacted by changes to potential water quality and water levels in Lake Lyell and the Coxs River arm and Farmer's Creek arm of Lake Lyell.	
Access	Construction increases volume and size of vehicles accessing small local roads, resulting in noise and reduced accessibility through traffic and road condition impacts.	Improved sustainability and stability of the energy network and support for transition to renewable energy, with resulting environmental benefits.
	Capacity of services (health, education, community services, local businesses) to support additional construction workforce.	The project may enable continued Lake Lyell operation and maintenance by continuing its use for energy generation and supply purposes.

Table 6.1 Identified potential social impact mapped to matters, positive and negative

Potential social impacts	Issue – negative related to:	Issue – positive related to:
	Reduced or impeded public access to Lake Lyell and Mt Walker due to construction traffic, works and possible road closures impacting recreation and sense of connection to place.	
Culture	Impacts on material culture for Aboriginal people, including impacts to heritage sites.	
	Loss or diminution of traditional attachment to the land or connection to Country and associated cultural obligations to care.	
Health and wellbeing	Community safety risks during construction and operation of the reservoir and intake.	
Surroundings	Biodiversity impacts related to clearing and ongoing management of EnergyAustralia property impacting scenic and recreation values, as well as private property values.	
	Biodiversity impacts related to fluctuation of water levels in Lake Lyell and the Cox’s River arm and Farmers Creek arm of Lake Lyell impacting environmental and recreational values.	
	Changes to quality of life caused by amenity impacts affecting property prices and residents desire to stay in the area.	
Livelihoods	Potential for loss of income to tourism businesses reliant on pristine appearance and recreational value of the local landscape.	Employment and training opportunities for residents in the regional area.
		Business opportunities for the regional area.
		Business, employment and training opportunities for indigenous people .
		Economic benefit of increased indirect employment opportunities and project related spending on local business.
Decision-making systems	Residents ability to access information and be involved in planning and decision making processes, to maintain the sense of connection between the project site and the broader locality.	
	Unequal geographic distribution of economic, social and environmental impacts and benefits from the project.	

6.2 Proposed methodology

A detailed SIA will be prepared in accordance with the SIA Guideline. The SIA will:

- Build upon the scoping report and engagement undertaken with stakeholders to provide follow-through and affirm that stakeholder views will be fairly addressed and represented throughout the SIA process.
- Confirm the area of social influence through the further development of the social baseline and collection of qualitative and quantitative data.
- Deliver quantitative and qualitative analysis of key project impact pathways, including:
 - Workforce introduction and planning to minimise impacts and enhance benefits during construction (for example, a preliminary Workforce Management Plan), through input from the early contractor involvement and detailed design process.
 - Recreation opportunities and importance, through an analysis of existing recreation and identifying mitigation needs and opportunities to enhance tourism and recreation.
 - Tourism and tourism reliant businesses in the region through an analysis of tourist volumes, stay duration, attractions and routes.
- Engage with the community and project stakeholders in a targeted manner which collaborates with existing Project and EnergyAustralia opportunities and approaches. Engagement opportunities should be provided with flexible time, style and place offerings so that the community's identified need for "Access to Project information, engagement opportunities and decision making" can be met.

Details on possible targeted engagement requirements are provided in the SIA Scoping Worksheet in Appendix B, and will include:

- In-depth interviews with:
 - Impacted residents, service providers and businesses in the local area.
 - Key stakeholders, such as Local Council, the Lithgow Business Chambers, service providers and businesses in the key urban area.
 - Environmental and recreational interest groups in the regional area.
 - Key Indigenous stakeholders, in a manner aligned with the Aboriginal Cultural Heritage Assessment (ACHA) and the proposed Aboriginal Participation Plan for the Project.
 - Interviews will be offered in person, online and over the phone.
- Online surveys, used to targeted tourism and recreation as well as to capture the views of the regional community. These will be advertised using project communications and engagement mediums and in local media. The surveys will aim to deliver a representative proportion of responses.
- It is understood that a recreational survey conducted by Nation Partners (on behalf of EnergyAustralia) will take place around recreational uses of Lake Lyell during the 2022/2023 school holidays. This information will also be assessed and used to inform the SIA.
- Attendance at engagement events offered by the Project, including any further community information sessions during the EIS completion timeframes.

- Use primary and secondary data to predict and analyse the potential direct and indirect impacts (positive and negative) of the Project. This will include research and review of the existing social context through mechanisms consistent with the SIA Guideline (2021).
 - Preparation of a detailed Social Baseline for the Project.
 - Analysis of the regional planning context and associated community views and values.
 - Further supporting research as required. This may include the media context and current social research.
- Consider the social consequences resulting from the findings of other technical investigations such as investigations into visual impact, biodiversity, surface water and Aboriginal heritage to identify potential amenity impacts as well as the outcomes of the economic assessment.
- Develop appropriate mitigation and enhancement strategies.

References

DPE 2021, *Social Impact Assessment Guideline for State Significant Projects*

EMM Consulting 2023, *Lake Lyell Pumped Hydro Energy Storage Scheme Scoping Report*

Energy Australia, 2020 Who we are <https://www.energyaustralia.com.au/about-us/who-we-are>. Accessed 1/11/2022

Study qualifications

This report has been prepared by a suitably qualified and experienced lead author and co-author and reviewed and approved by a suitably qualified and experienced co-author. All contributors hold appropriate qualifications and have the relevant experience to carry out the SIA for this Project, as required by the SIA Guideline. The following introduces each author:

Breannan Dent (Author)

- Masters of Urban Management and Planning, University of Western Sydney.
- Bachelor of Social Science, University of Western Sydney.

Breannan is a Social Planner with 8 years' experience in statutory and strategic urban planning and community and stakeholder engagement, working with infrastructure clients and local government in NSW. She is experienced in preparing, assessing and reporting planning proposals, development control plan amendments and local policy to council. Breannan also has a strong engagement skillset around remote and online community engagement, in person interviews and community workshops, and engagement strategies and community participation plans.

Christopher Mahoney (Co-author/Reviewer)

- Masters Urban and Regional Planning, Griffith University.
- Bachelor of International Economics , Griffith University.
- Member Planning Institute Australia.
- Member International Association of Impact Assessment.

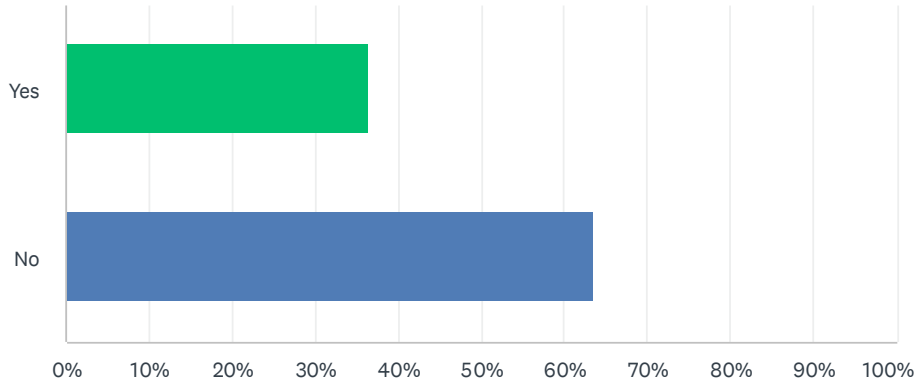
Chris is a social specialist with over 20 years' of professional experience in the delivery of social impact assessment and other forms of specialist social research, stakeholder engagement, monitoring and evaluation. He has delivered social impact assessments and community and stakeholder engagement programs for a multitude of projects across the infrastructure, resources and international development sectors. He has assisted a wide range of major resources and infrastructure projects to understand the social environment in which they operate and establish and maintain mutually beneficial relationships with community stakeholders.

Appendix A

SIA Scoping Survey summary of survey questions and responses

Q1 Have you had any previous communications with EnergyAustralia?

Answered: 11 Skipped: 0



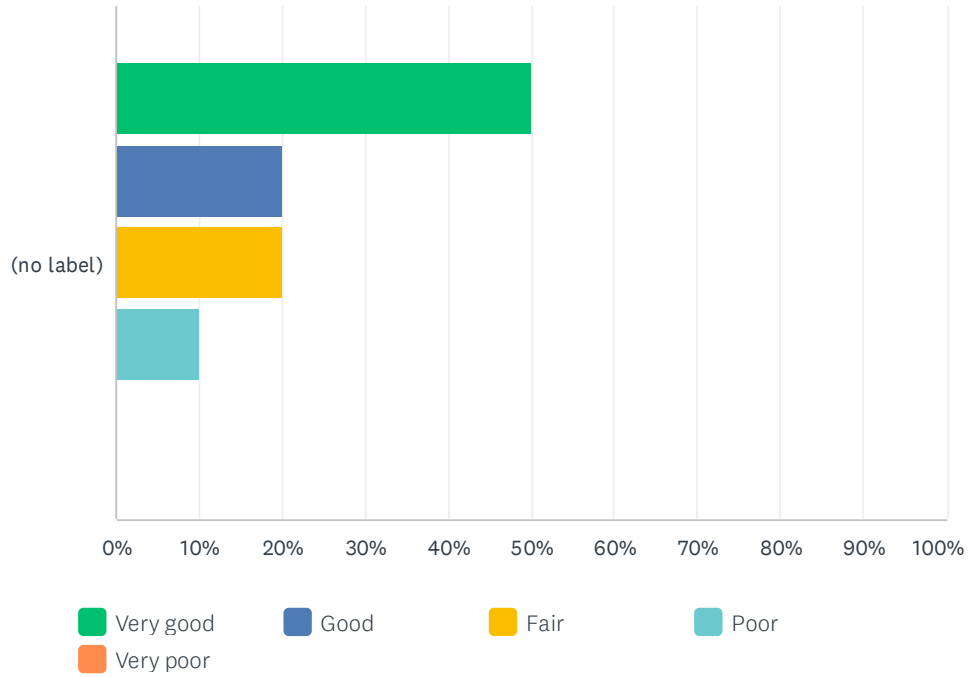
ANSWER CHOICES	RESPONSES	
Yes	36.36%	4
No	63.64%	7
TOTAL		11

Q2 If yes, what was the topic of discussion?

Answered: 5 Skipped: 6

Q3 How would you rate your awareness of the proposed Lake Lyell Pumped Hydro Energy Storage Project?

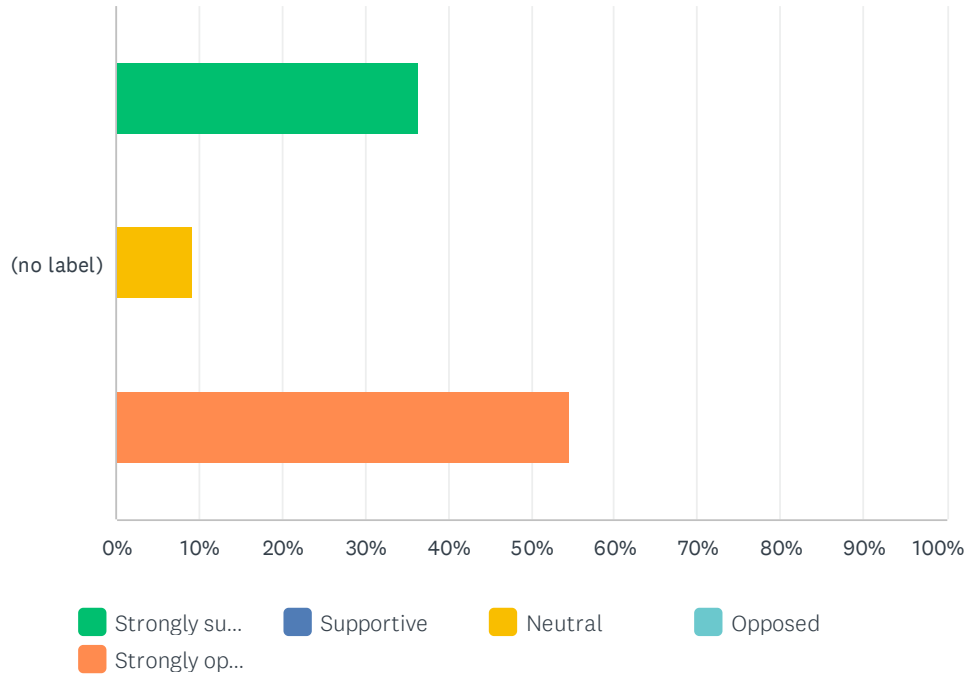
Answered: 10 Skipped: 1



	VERY GOOD	GOOD	FAIR	POOR	VERY POOR	TOTAL	WEIGHTED AVERAGE
(no label)	50.00%	20.00%	20.00%	10.00%	0.00%	10	1.90
	5	2	2	1	0		

Q4 How do you feel about the proposed Lake Lyell Pumped Hydro Energy Storage Project?

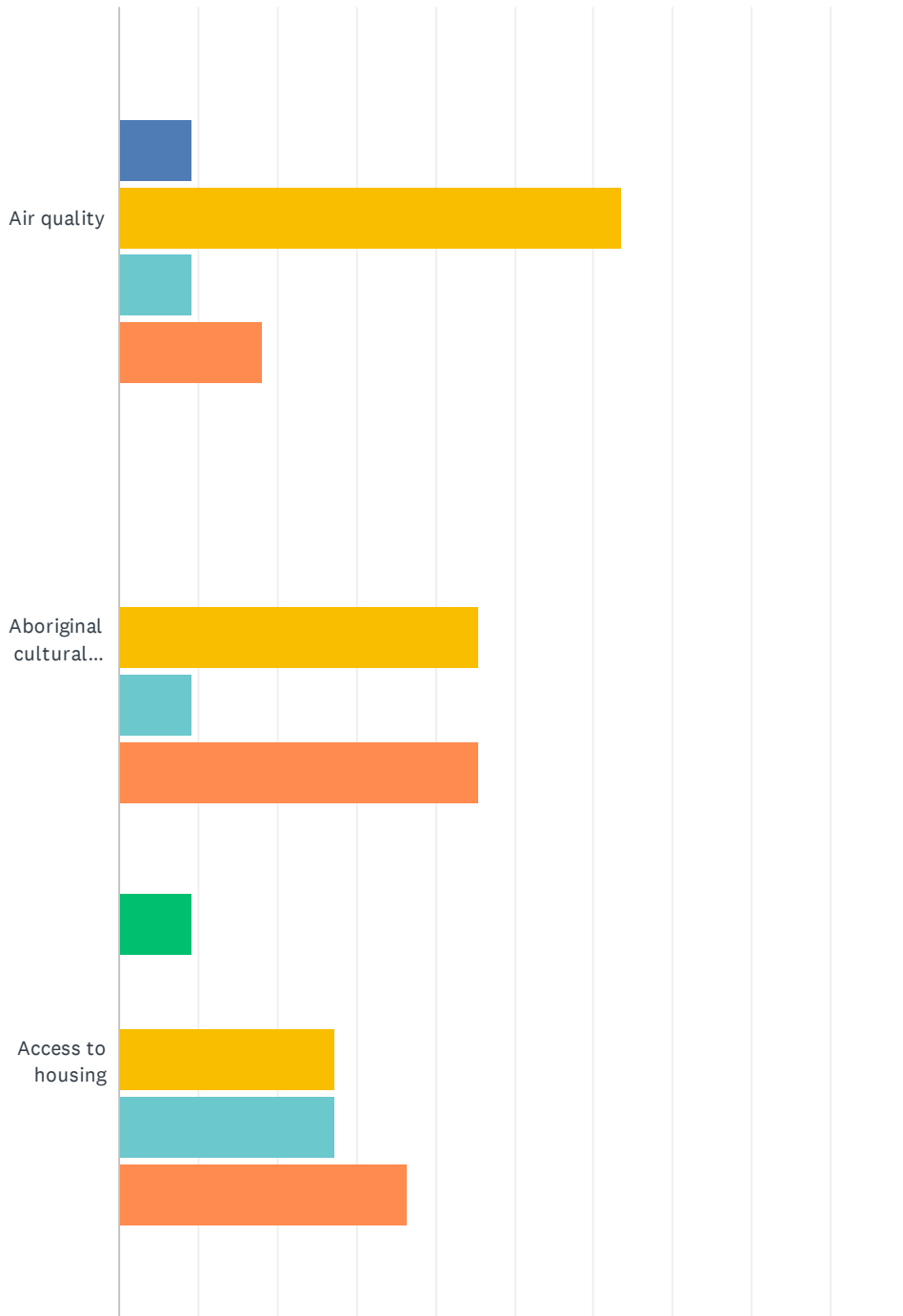
Answered: 11 Skipped: 0



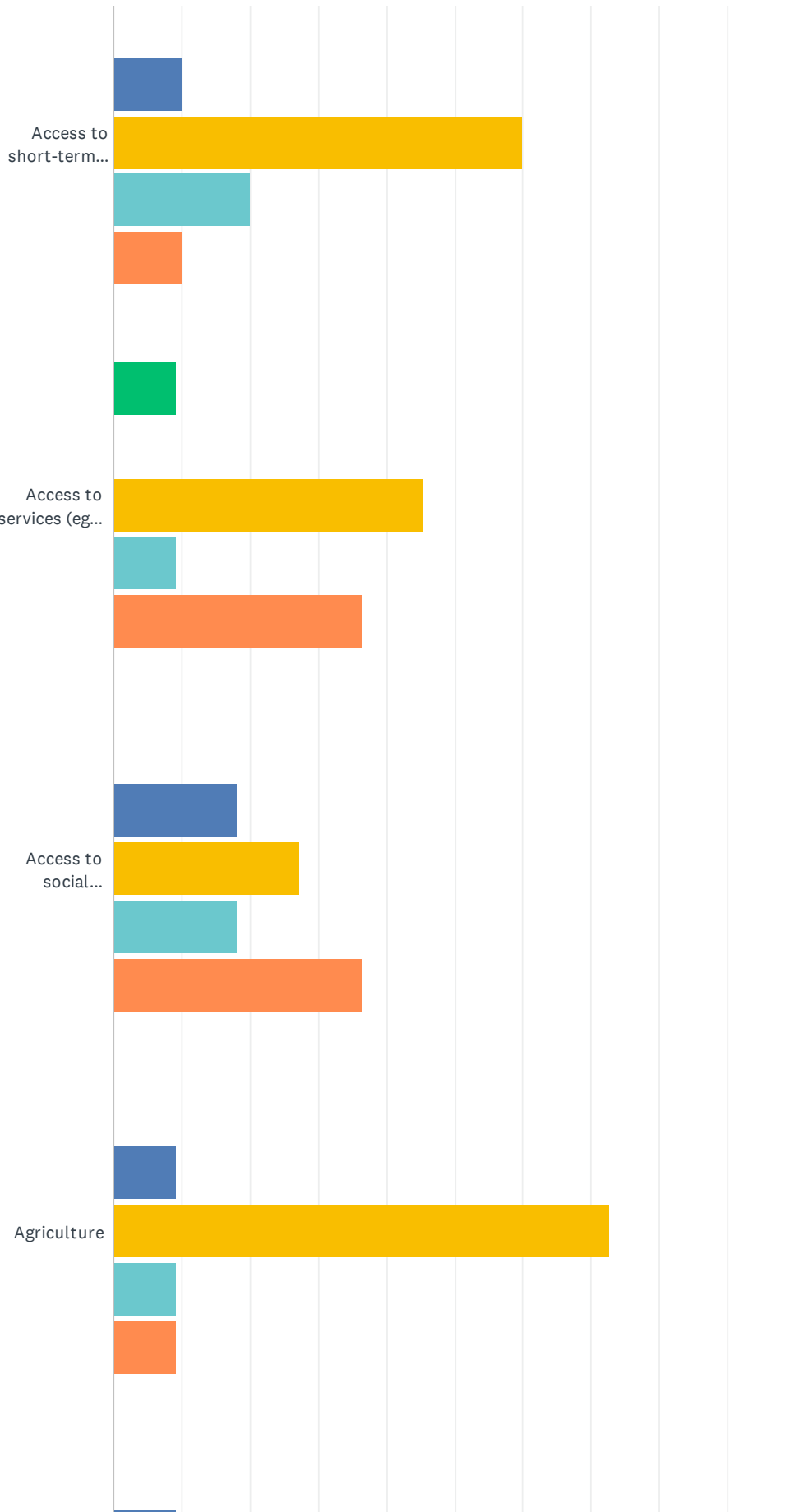
	STRONGLY SUPPORTIVE	SUPPORTIVE	NEUTRAL	OPPOSED	STRONGLY OPPOSED	TOTAL	WEIGHTED AVERAGE
(no label)	36.36%	0.00%	9.09%	0.00%	54.55%	11	3.36
	4	0	1	0	6		

Q5 Consider how the Lake Lyell Pumped Hydro Energy Storage Project may affect the local community (either positively or negatively) and select the appropriate response. Below is a list of potential impacts and benefits that are commonly associated with pumped hydro projects. Select the appropriate response for each potential impact and benefit using the buttons provided.

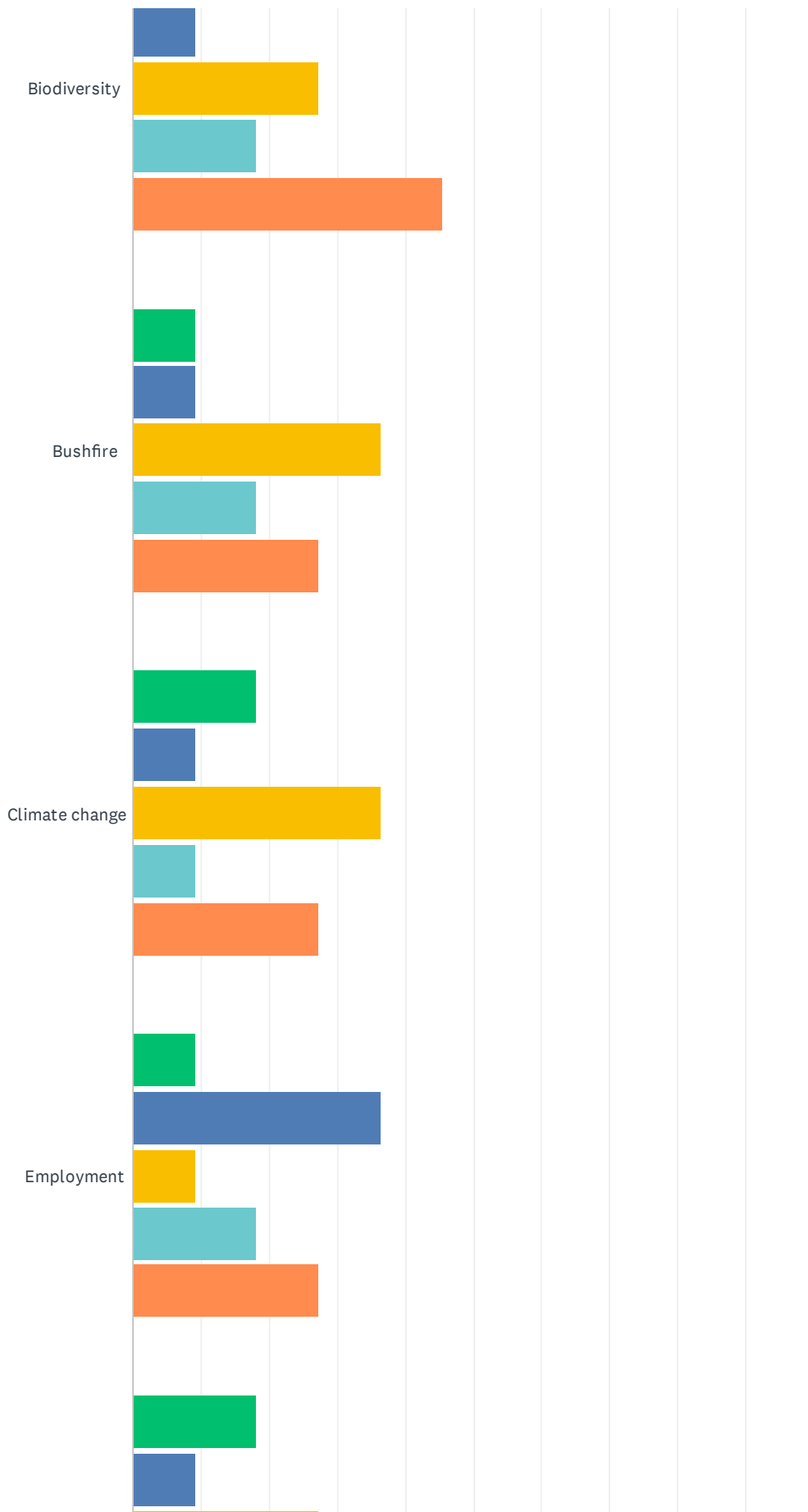
Answered: 11 Skipped: 0



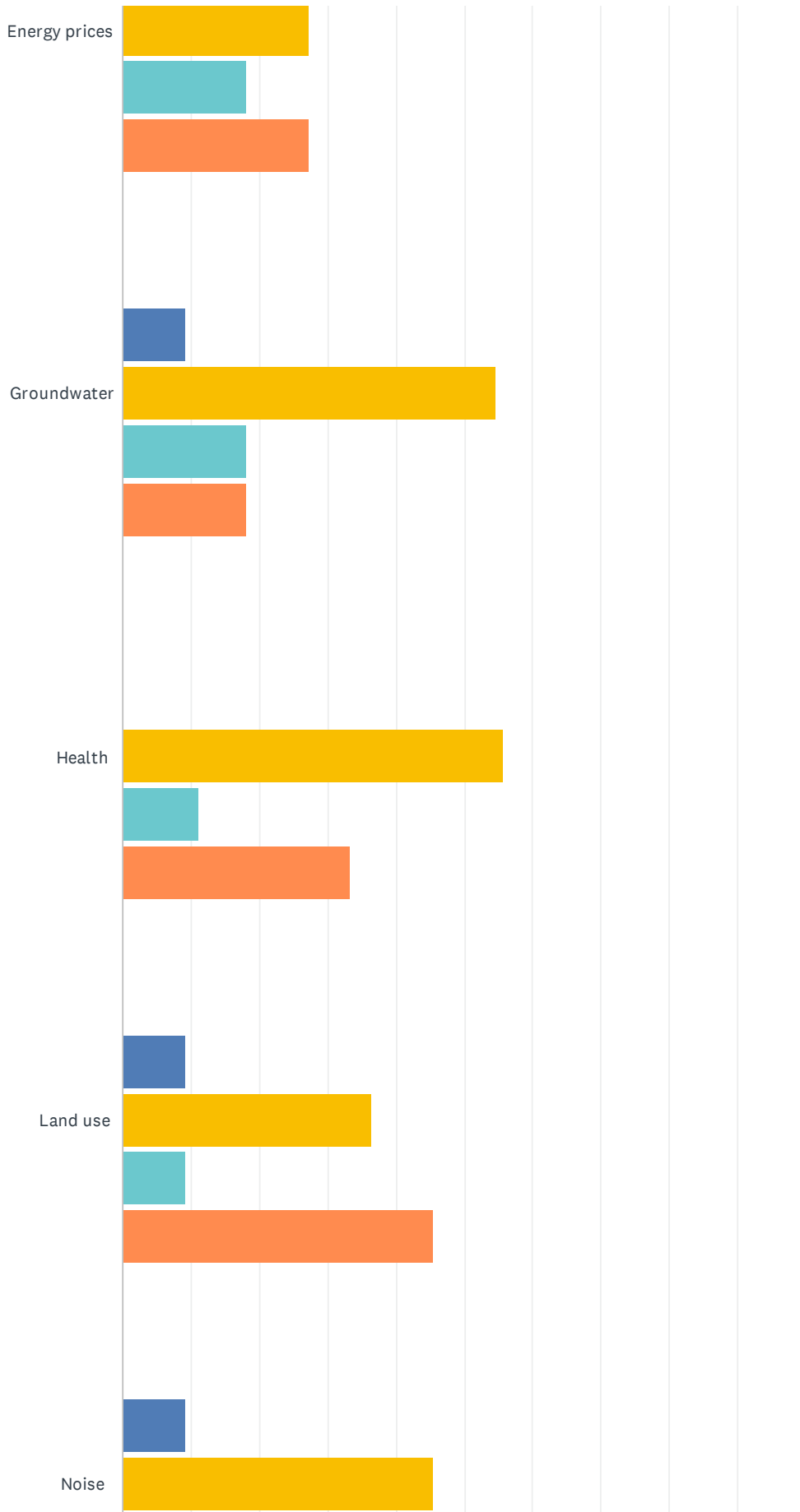
Lake Lyell Pumped Hydro Energy Storage Project Scoping Survey



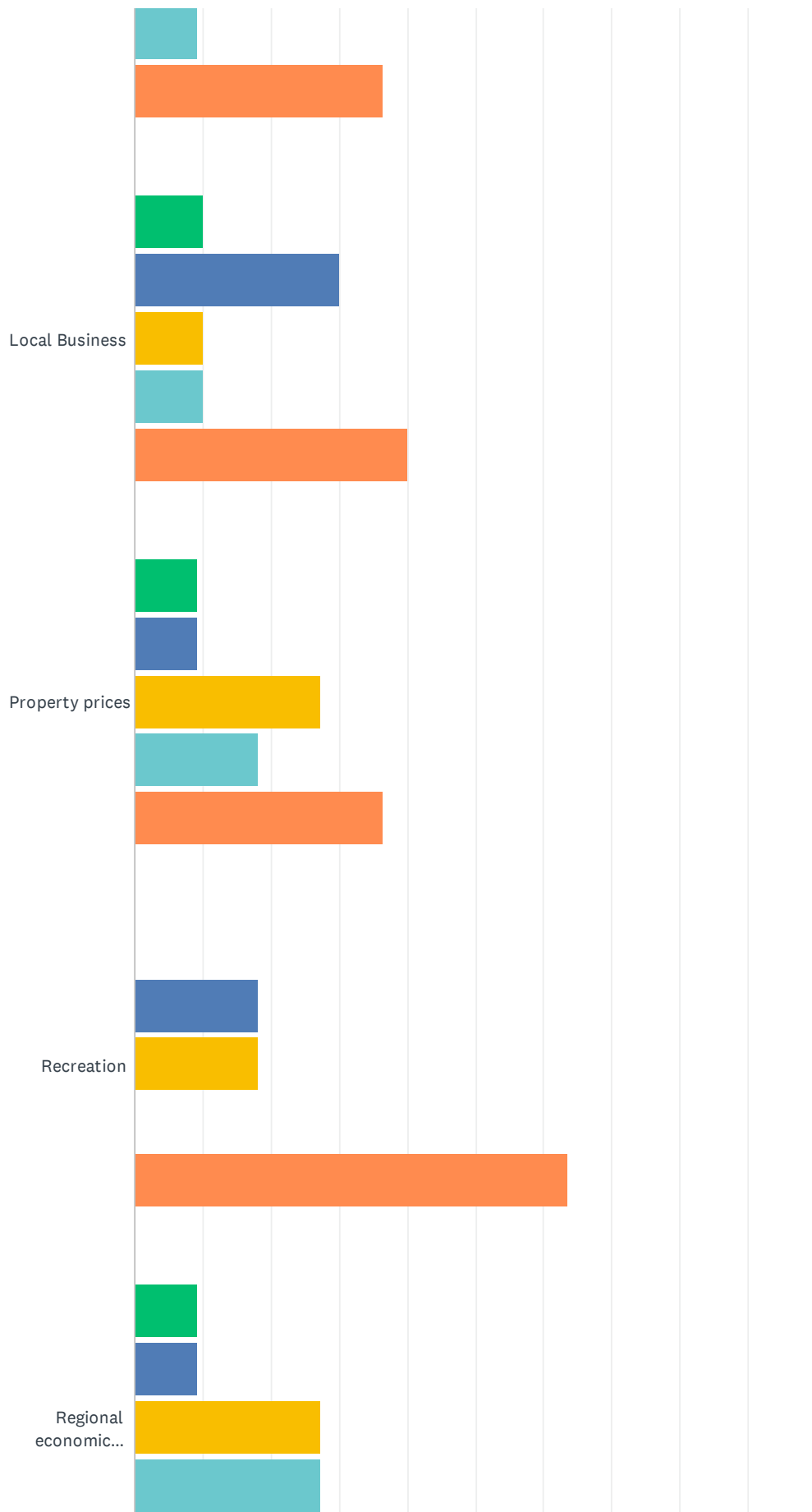
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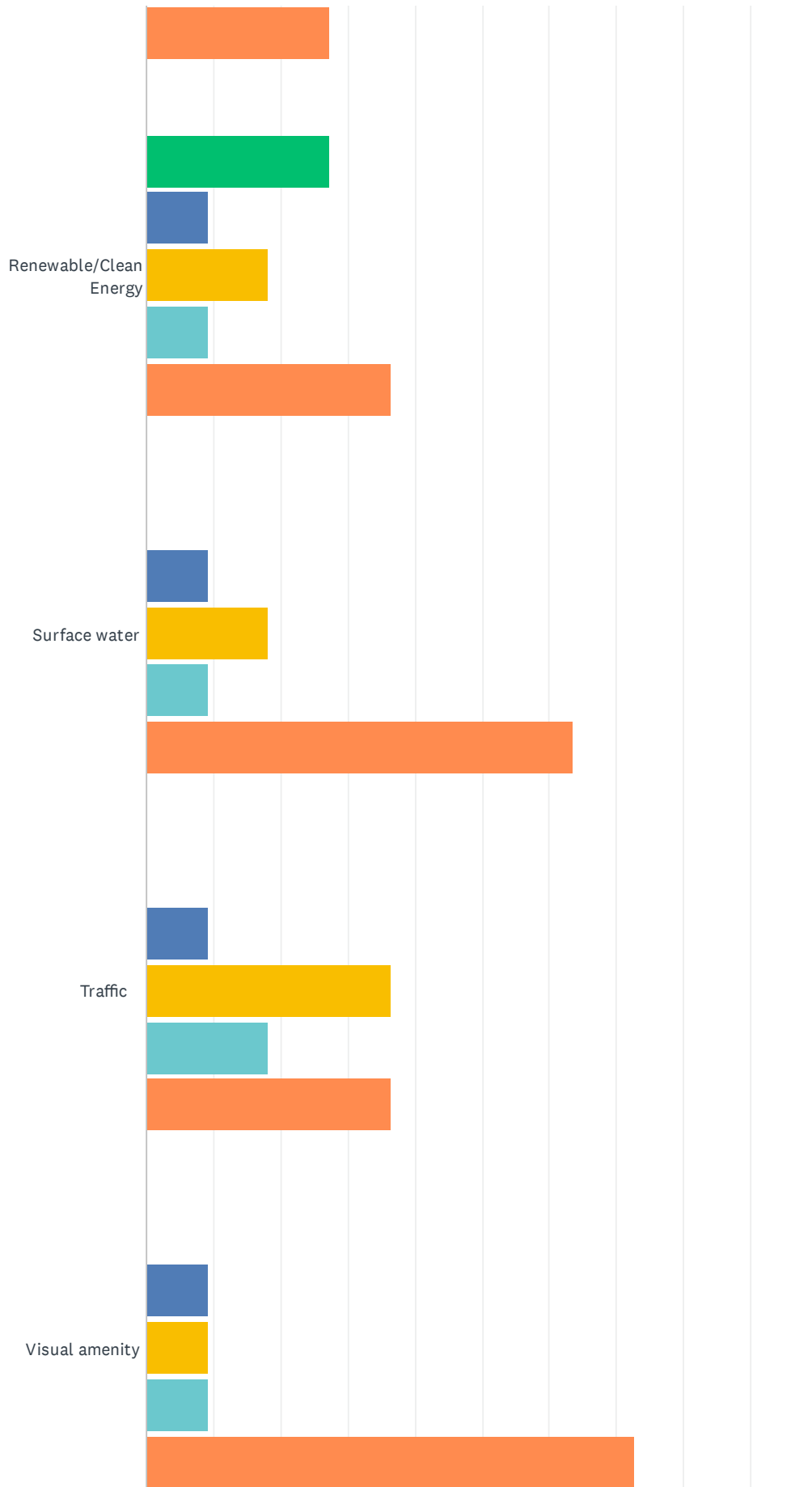
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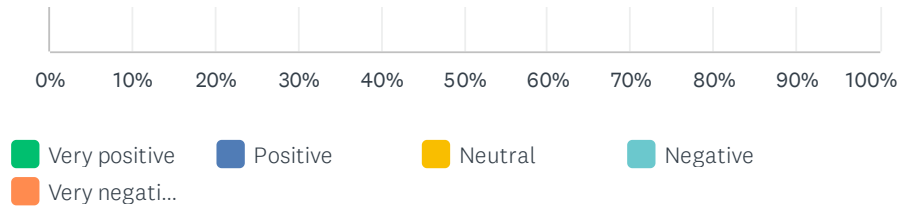
Lake Lyell Pumped Hydro Energy Storage Project Scoping Survey



Lake Lyell Pumped Hydro Energy Storage Project Scoping Survey



Lake Lyell Pumped Hydro Energy Storage Project Scoping Survey



Lake Lyell Pumped Hydro Energy Storage Project Scoping Survey

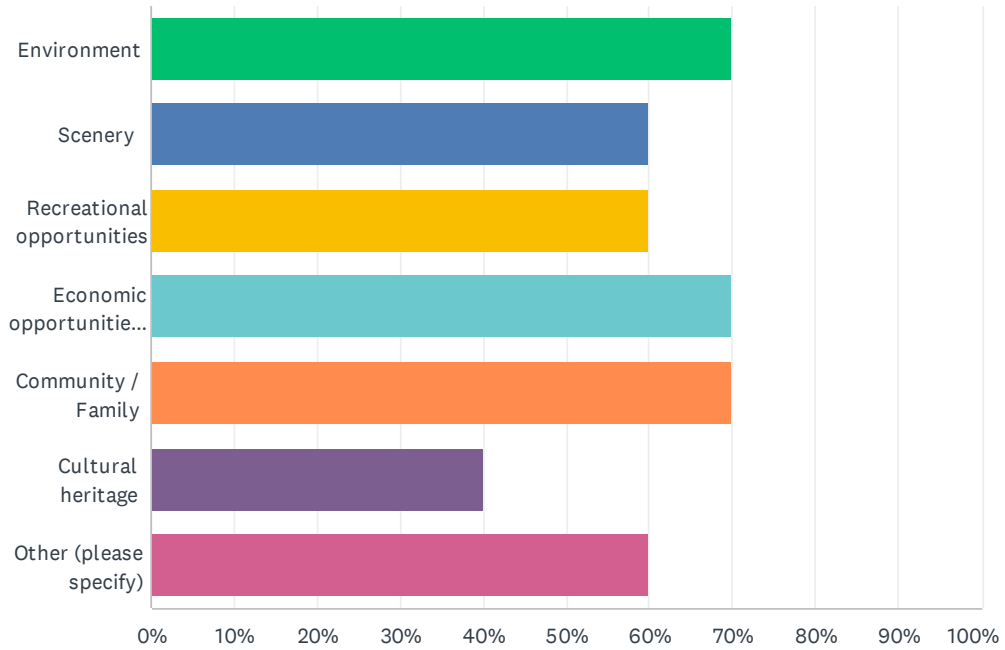
	VERY POSITIVE	POSITIVE	NEUTRAL	NEGATIVE	VERY NEGATIVE	TOTAL	WEIGHTED AVERAGE
Air quality	0.00% 0	9.09% 1	63.64% 7	9.09% 1	18.18% 2	11	3.36
Aboriginal cultural heritage	0.00% 0	0.00% 0	45.45% 5	9.09% 1	45.45% 5	11	4.00
Access to housing	9.09% 1	0.00% 0	27.27% 3	27.27% 3	36.36% 4	11	3.82
Access to short-term accommodation	0.00% 0	10.00% 1	60.00% 6	20.00% 2	10.00% 1	10	3.30
Access to services (eg. drinking water, electricity, transport infrastructure, waste)	9.09% 1	0.00% 0	45.45% 5	9.09% 1	36.36% 4	11	3.64
Access to social infrastructure (facilities, spaces, community services and networks that support quality of life)	0.00% 0	18.18% 2	27.27% 3	18.18% 2	36.36% 4	11	3.73
Agriculture	0.00% 0	9.09% 1	72.73% 8	9.09% 1	9.09% 1	11	3.18
Biodiversity	0.00% 0	9.09% 1	27.27% 3	18.18% 2	45.45% 5	11	4.00
Bushfire	9.09% 1	9.09% 1	36.36% 4	18.18% 2	27.27% 3	11	3.45
Climate change	18.18% 2	9.09% 1	36.36% 4	9.09% 1	27.27% 3	11	3.18
Employment	9.09% 1	36.36% 4	9.09% 1	18.18% 2	27.27% 3	11	3.18
Energy prices	18.18% 2	9.09% 1	27.27% 3	18.18% 2	27.27% 3	11	3.27
Groundwater	0.00% 0	9.09% 1	54.55% 6	18.18% 2	18.18% 2	11	3.45
Health	0.00% 0	0.00% 0	55.56% 5	11.11% 1	33.33% 3	9	3.78
Land use	0.00% 0	9.09% 1	36.36% 4	9.09% 1	45.45% 5	11	3.91
Noise	0.00% 0	9.09% 1	45.45% 5	9.09% 1	36.36% 4	11	3.73
Local Business	10.00% 1	30.00% 3	10.00% 1	10.00% 1	40.00% 4	10	3.40
Property prices	9.09% 1	9.09% 1	27.27% 3	18.18% 2	36.36% 4	11	3.64
Recreation	0.00% 0	18.18% 2	18.18% 2	0.00% 0	63.64% 7	11	4.09
Regional economic diversity	9.09% 1	9.09% 1	27.27% 3	27.27% 3	27.27% 3	11	3.55
Renewable/Clean Energy	27.27% 3	9.09% 1	18.18% 2	9.09% 1	36.36% 4	11	3.18

Lake Lyell Pumped Hydro Energy Storage Project Scoping Survey

Surface water	0.00% 0	9.09% 1	18.18% 2	9.09% 1	63.64% 7	11	4.27
Traffic	0.00% 0	9.09% 1	36.36% 4	18.18% 2	36.36% 4	11	3.82
Visual amenity	0.00% 0	9.09% 1	9.09% 1	9.09% 1	72.73% 8	11	4.45

Q6 What do you value most about your local area? (please select one or more)

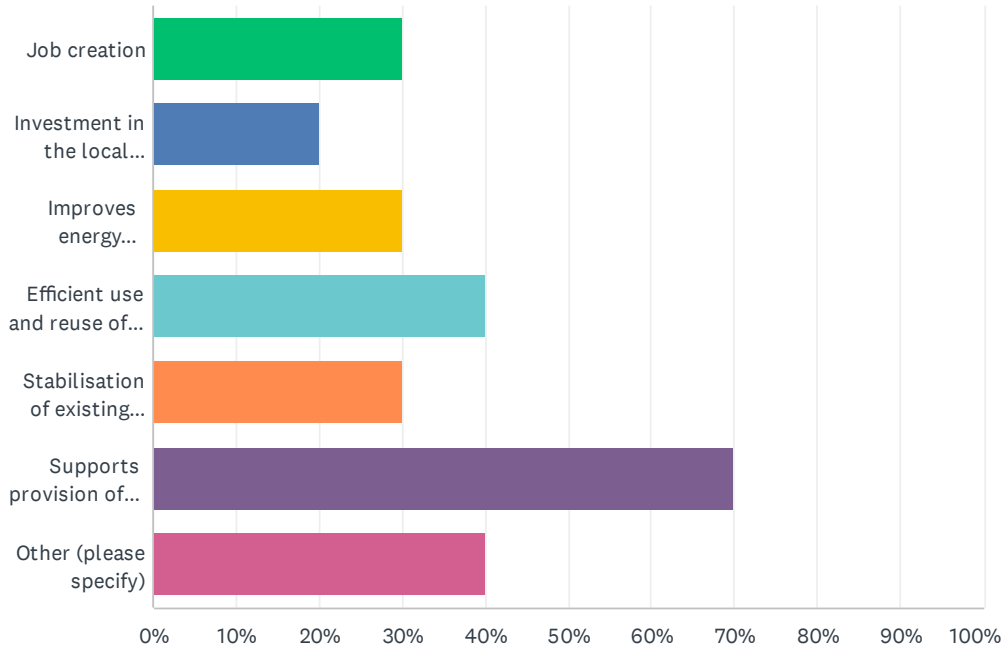
Answered: 10 Skipped: 1



ANSWER CHOICES	RESPONSES	
Environment	70.00%	7
Scenery	60.00%	6
Recreational opportunities	60.00%	6
Economic opportunities - business, farming and employment	70.00%	7
Community / Family	70.00%	7
Cultural heritage	40.00%	4
Other (please specify)	60.00%	6
Total Respondents: 10		

Q7 Based on your current understanding of hydro energy storage, what do you believe are the most positive benefits of the project? (please select one or more)

Answered: 10 Skipped: 1



ANSWER CHOICES	RESPONSES	
Job creation	30.00%	3
Investment in the local community	20.00%	2
Improves energy reliability	30.00%	3
Efficient use and reuse of existing infrastructure	40.00%	4
Stabilisation of existing energy grid	30.00%	3
Supports provision of renewable energy	70.00%	7
Other (please specify)	40.00%	4
Total Respondents: 10		

Q8 How and when do you most see or use Mount Walker and Lake Lyell?

Answered: 10 Skipped: 1

Q9 Do you have any other comments?

Answered: 4 Skipped: 7

Q10 What is your suburb?

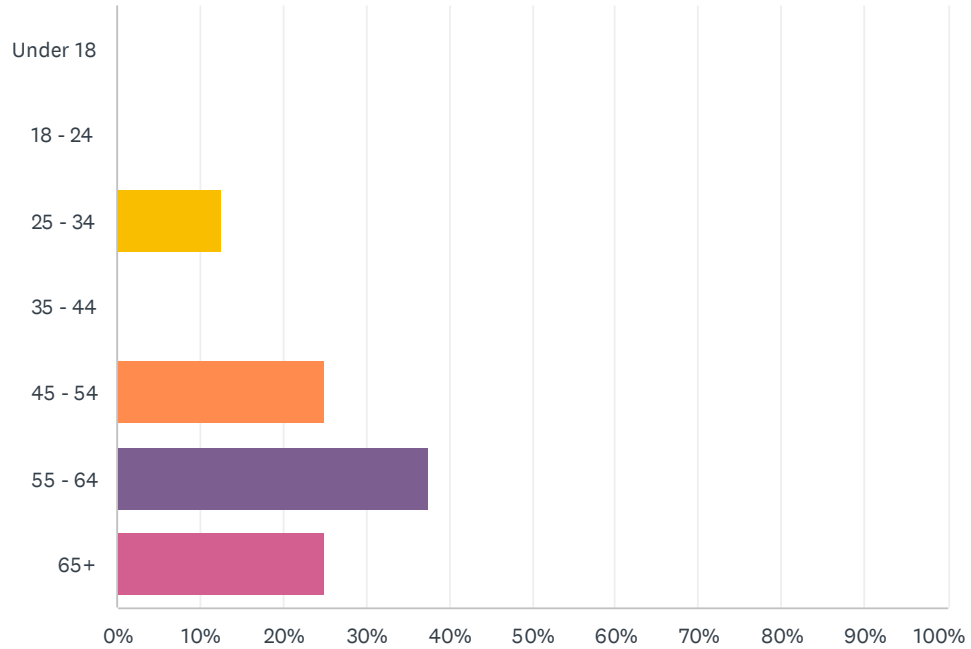
Answered: 10 Skipped: 1

Q11 What is your postcode?

Answered: 10 Skipped: 1

Q12 Which of the following age brackets do you fall into? (optional)

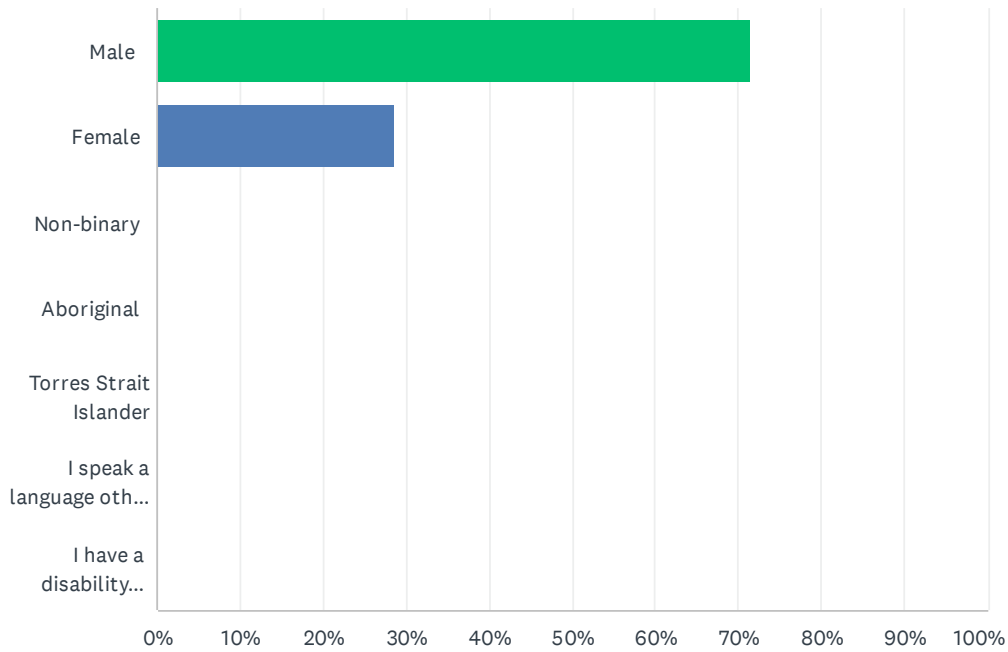
Answered: 8 Skipped: 3



ANSWER CHOICES	RESPONSES	
Under 18	0.00%	0
18 - 24	0.00%	0
25 - 34	12.50%	1
35 - 44	0.00%	0
45 - 54	25.00%	2
55 - 64	37.50%	3
65+	25.00%	2
TOTAL		8

Q13 Which of the following do you identify as? (optional) Please select all that apply to you.

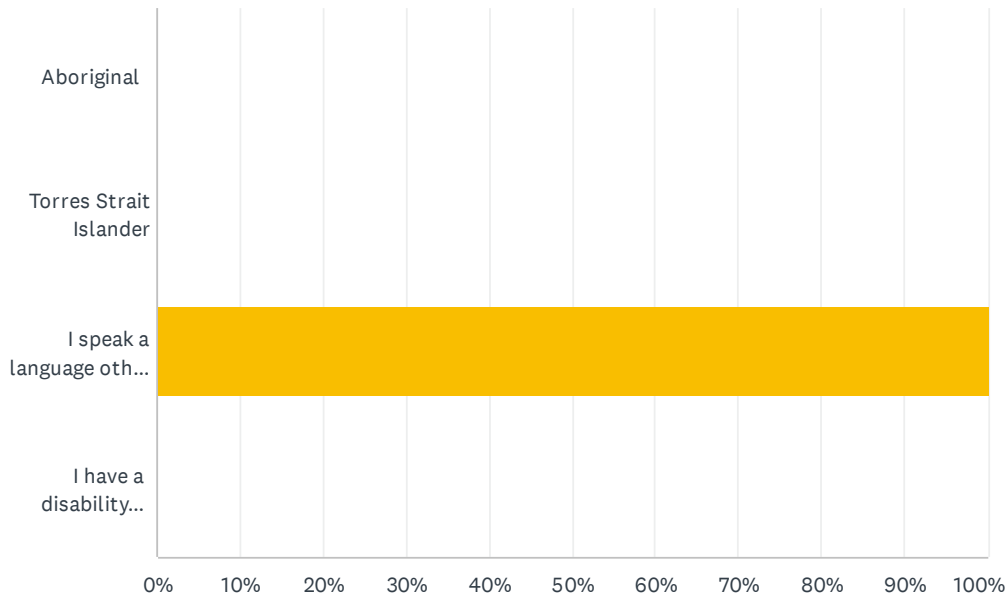
Answered: 7 Skipped: 4



ANSWER CHOICES	RESPONSES	
Male	71.43%	5
Female	28.57%	2
Non-binary	0.00%	0
Aboriginal	0.00%	0
Torres Strait Islander	0.00%	0
I speak a language other than English at home	0.00%	0
I have a disability and/or special need	0.00%	0
TOTAL		7

Q14 Which of the following do you identify as? (optional) Please select all that apply to you.

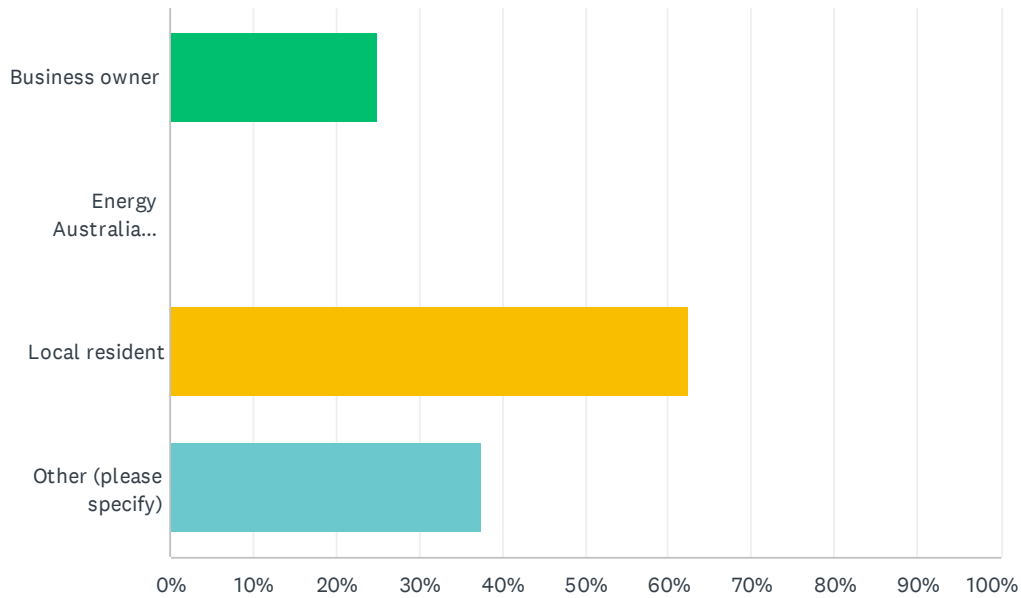
Answered: 1 Skipped: 10



ANSWER CHOICES	RESPONSES	
Aboriginal	0.00%	0
Torres Strait Islander	0.00%	0
I speak a language other than English at home	100.00%	1
I have a disability and/or special need	0.00%	0
Total Respondents: 1		

Q15 Which of the following best describes you? Please select all that apply to you

Answered: 8 Skipped: 3



ANSWER CHOICES	RESPONSES	
Business owner	25.00%	2
Energy Australia employee	0.00%	0
Local resident	62.50%	5
Other (please specify)	37.50%	3
Total Respondents: 8		

Appendix B

SIA Scoping Worksheet

Social Impact Assessment (SIA) Worksheet																	Project name: Lake Lyell Pumped Hydro Energy Storage Project					Date: 4/11/2022		
CATEGORIES OF SOCIAL IMPACTS		POTENTIAL IMPACTS ON PEOPLE		PREVIOUS INVESTIGATION OF IMPACT	CUMULATIVE IMPACTS	ELEMENTS OF IMPACTS - Based on preliminary investigation					ASSESSMENT LEVEL FOR EACH IMPACT	PROJECT REFINEMENT			MITIGATION / ENHANCEMENT MEASURES									
What social impact categories could be affected by the project activities	What impacts are likely, and what concerns/aspirations have people expressed about the impact? Summarise how each relevant stakeholder group might experience the impact. NB. Where there are multiple stakeholder groups affected differently by an impact, or more than one impact from the activity, please add an additional row.	Is the impact expected to be positive or negative	Has this impact previously been investigated (on this or other projects)?	If "yes - this project," briefly describe the previous investigation. If "yes - other project," identify the other project and investigation	Will this impact combine with others from this project (think about when and where), and/or with impacts from other projects (cumulative)?	If yes, identify which other impacts and/or projects	Will the project activity (without mitigation or enhancement) cause a material social impact in terms of its: You can also consider the various magnitudes of these characteristics					Level of assessment for each social impact	What methods and data sources will be used to investigate this impact?			Has the project been refined in response to preliminary impact evaluation or stakeholder feedback?	What mitigation / enhancement measures are being considered?							
	extent i.e. number of people potentially affected?						duration of expected impacts? (i.e. construction vs operational phase)	intensity of expected impacts i.e. scale or degree of change?	sensitivity or vulnerability of people potentially affected?	level of concern/interest of people potentially affected?	Secondary data		Primary Data - Consultation	Primary Data - Research										
way of life	Visual impacts of Mt Walker reservoir and supporting infrastructure affecting community sense of place and associated values around the environment and scenery.	Negative	No		Yes	This Project: "Loss or diminution of traditional attachment to the land or connection to Country and associated cultural obligations to care for Country, or loss of rights to gain spiritual sustenance from the land, including using water for cultural practices" and "Residents ability to access information and be involved in planning and decision making processes, to maintain the sense of connection between the project site and the broader locality."	Unknown	Yes	Yes	Unknown	Yes	Detailed assessment	Local Council Plans and Strategies	Targeted interviews with residents and businesses in the local area	Detailed Design and Project Technical Studies	No	Landscape and visual impact assessment and detailed design investigations to identify mitigation options							
way of life	Construction noise travelling down Mt Walker resulting in disruption to local residences and businesses	Negative	No		No		Unknown	Yes	Yes	Unknown	Yes	Standard assessment		Targeted interviews with residents and businesses in the local area	Detailed Design and Project Technical Studies	No	If required as a result of noise modelling within the noise impact assessment, reasonable and feasible mitigation measures will be identified.							
way of life	Housing and short stay accommodation availability compromised due to competition with non-local workforce	Negative	No		No		Unknown	Yes	Yes	No	Yes	Standard assessment	Workforce management plan	Targeted interviews with residents and businesses in the local area		No	On-site accommodation to be considered as part of detailed design							
community	Community composition and character temporarily altered due to influx of non-local workforce	Negative	No		Yes	This Project: "Housing and short stay accommodation availability compromised due to competition with non-local workforce"	Unknown	Yes	Unknown	No	Yes	Standard assessment	Workforce management plan. Local Council Strategies and Plans	Targeted interviews with residents and businesses in the local area		No	To be considered as part of construction planning (early contractor involvement as part of the detailed design).							
community	Recreation and amenity impacted by changes to water quality and water levels in Lake Lyell, including the Coxs River arm and Farmer's Creek arm of Lake Lyell (not including biodiversity)	Negative	No		No		Unknown	Yes	Unknown	Unknown	Yes	Detailed assessment	Detailed regional analysis and comparison of recreation opportunities.	Survey of recreational water users	Project Technical Studies	No	To be considered as part of surface water assessment, and through further recreational investigations and enhancement opportunities proposed through consultation activities for the Project							
access	Construction increases volume and size of vehicles accessing small local roads, resulting in noise and reduced accessibility through traffic and road quality impacts.	Negative	No		No		Yes	Yes	Yes	Yes	Yes	Standard assessment	Workforce management plan	Engagement along proposed transport route - interviews offered. Also identify and target recreational user groups who may be affected, eg. 4WD, Mountainbiking, Camping and	Detailed Design and Project Technical Studies	No	To be considered as part of detailed design and the traffic impact assessment							
access	Improved sustainability and stability of the energy network and support for transition to renewable energy, with resulting benefits for climate change.	Positive	Yes - other project	Oven Mountain PHES	No		Yes	Yes	Yes	Yes	Yes	Detailed assessment	Planning policy context - eg. Net Zero by 2050	Consultation with key stakeholders with regard to benefits to the NEM	Project Description, Detailed Design and Project Technical Studies	No	To be considered through the EIS and consultation with key stakeholders with regard to benefits to the NEM							
access	Capacity of services (health, education, community services, local businesses) to support additional construction workforce	Negative	No		Unknown	TBD - EIS engagement with serviceproviders	Unknown	Yes	Unknown	Yes	Unknown	Standard assessment	Social Baseline comparison with Workforce management plan	Engagement with relevant service providers	Detailed Social Baseline	No	To be considered and determined through targeted consultation with service providers and development of the detailed social baseline for the Project							
access	Reduced or impeded public access to Lake Lyell and Mt Walker due to construction traffic, works and possible road closures impacting recreation and sense of connection to place	Negative	No		Yes	This Project: Initial Geotechnical studies	Unknown	Unknown	Unknown	Unknown	Yes	Standard assessment	Review of historic engagement with Council and Community complaints on road access for Geotechnical investigations.	Engagement along proposed transport route - interviews offered. Also identify and target recreational user groups who may be affected, eg. 4WD, Mountainbiking, Camping and	Transport Route to be proposed in Detailed Design and Project Technical Studies	No	To be considered through detailed design, technical assessments and consultation with community and relevant stakeholders.							
access	The project may enable continued Lake Lyell operation and maintenance by continuing its use for energy generation and supply purposes.	Positive	No		Yes	Other projects: Closure and planned closure of nearby Liddell and Mt Piper power stations and transition away from coal-fired power.	Unknown	Unknown	Unknown	Unknown	Yes	Standard assessment			Project Description, Detailed Design, Project Technical Studies	No	No additional proposed enhancements.							
health and wellbeing	Community safety risks during construction and operation of the reservoir and intake.	Negative	No		Yes	This Project: "Reduced or impeded public access to Lake Lyell and Mt Walker due to construction traffic, works and possible road closures impacting recreation and sense of connection to place"	Unknown	Unknown	Unknown	Unknown	Yes	Standard assessment			Detailed Design and Project Technical Studies	No	To be considered through detailed design.							
culture	Direct impacts to material culture for Aboriginal people, including impacts to heritage sites	Negative	Yes - this project	Initial Geotechnical Survey development application	No		Unknown	Yes	Unknown	Unknown	Yes	Detailed assessment	Regional project context	Engagement with Project Registered Aboriginal Participants through existing ACHA process	Project Technical Studies	No	To be identified through engagement with Aboriginal stakeholders for the Project as part of the ACHA process.							
culture	Loss or diminution of traditional attachment to the land or connection to Country and associated cultural obligations to care for Country, or loss of rights to gain spiritual sustenance from the land, including using water for cultural practices	Negative	No		Yes	This project: Direct impacts to material culture for Aboriginal people, including impacts to heritage sites	Unknown	Yes	Unknown	Unknown	Yes	Standard assessment	Regional project context	Ongoing engagement and relationship building with LALC. Engagement with Project Registered Aboriginal Persons through existing ACHA process	Project Technical Studies	No	To be identified through engagement with Aboriginal stakeholders for the Project as part of the ACHA process.							
livelihoods	Employment and training opportunities for residents in the regional area	Positive	No		Yes	Other projects: Closure and planned closure of nearby Liddell and Mt Piper power stations and transition away from coal-fired power.	Yes	Yes	Unknown	Unknown	Unknown	Standard assessment	Workforce management plan	Interviews with relevant service providers and local residents, survey for regional area residents	Project Technical Studies	No	To be considered as part of construction planning (early contractor involvement as part of the detailed design).							
livelihoods	Business opportunities for residents in the regional area	Positive	No		Yes	This Project: "Employment and training opportunities for residents in the regional area"	Unknown	Yes	Unknown	Yes	Unknown	Standard assessment	Workforce management plan	Ongoing engagement with Lithgow Chamber of Commerce and engage directly with identified affected businesses.	Project Technical Studies	No	To be considered as part of construction planning (early contractor involvement as part of the detailed design).							
livelihoods	Business, employment and training opportunities for indigenous people - IAPP	Positive	No		Yes	Other projects: Closure and planned closure of nearby Liddell and Mt Piper power stations and transition away from coal-fired power.	Unknown	Yes	Yes	Unknown	Unknown	Standard assessment	Indigenous/Aboriginal Participation Plan	Ongoing engagement with LALC and interviews with RAPS	Project Technical Studies	No	Indigenous/Aboriginal Participation Plan will be prepared for the Project.							

CATEGORIES OF SOCIAL IMPACTS	POTENTIAL IMPACTS ON PEOPLE		PREVIOUS INVESTIGATION OF IMPACT	CUMULATIVE IMPACTS	ELEMENTS OF IMPACTS - Based on preliminary investigation					ASSESSMENT LEVEL FOR EACH IMPACT	PROJECT REFINEMENT			MITIGATION / ENHANCEMENT MEASURES		
	What impacts are likely, and what concerns/aspirations have people expressed about the impact? Summarise how each relevant stakeholder group might experience the impact. NB. Where there are multiple stakeholder groups affected differently by an impact, or more than one impact from the activity, please add an additional row.	Is the impact expected to be positive or negative	Has this impact previously been investigated (on this or other project/s)?		Will this impact combine with others from this project (think about when and where), and/or with impacts from other projects (cumulative)?	extent i.e. number of people potentially affected?	duration of expected impacts? (i.e. construction vs operational phase)	intensity of expected impacts i.e. scale or degree of change?	sensitivity or vulnerability of people potentially affected?	level of concern/interest of people potentially affected?	Level of assessment for each social impact	What methods and data sources will be used to investigate this impact?			Has the project been refined in response to preliminary impact evaluation or stakeholder feedback?	What mitigation / enhancement measures are being considered?
livelihoods	Potential for loss of income to tourism businesses reliant on pristine appearance and recreational value of the local landscape	Negative	No	Yes	This Project "Recreation and amenity impacted by changes to water quality and flows in the Coxs River, Farmer's Creek and Lake Lyell"	Yes	Yes	Unknown	Unknown	Yes	Detailed assessment	Local Council Plans and Strategies	Ongoing engagement with Lithgow Chamber of Commerce and Lithgow City Council, engage directly with tourism and accommodation businesses in the local area	Project Technical Studies	No	A detailed recreational and tourism analysis is being considered for the Project, which will identify potential mitigation and opportunities.
livelihoods	Economic benefit of Project investment in increased indirect employment opportunities and project related spending on local business.	Positive	No	Yes	Other projects: Closure and planned closure of nearby Liddell and Mt Piper power stations and transition away from coal-fired power.	Unknown	Unknown	Yes	Yes	Unknown	Standard assessment	Social Baseline	Ongoing engagement with Lithgow Chamber of Commerce and engage directly with identified affected businesses.	Project Technical Studies	No	Determined through ongoing engagement with local business as part of Project consultation activities and the development of social baseline in the SIA.

