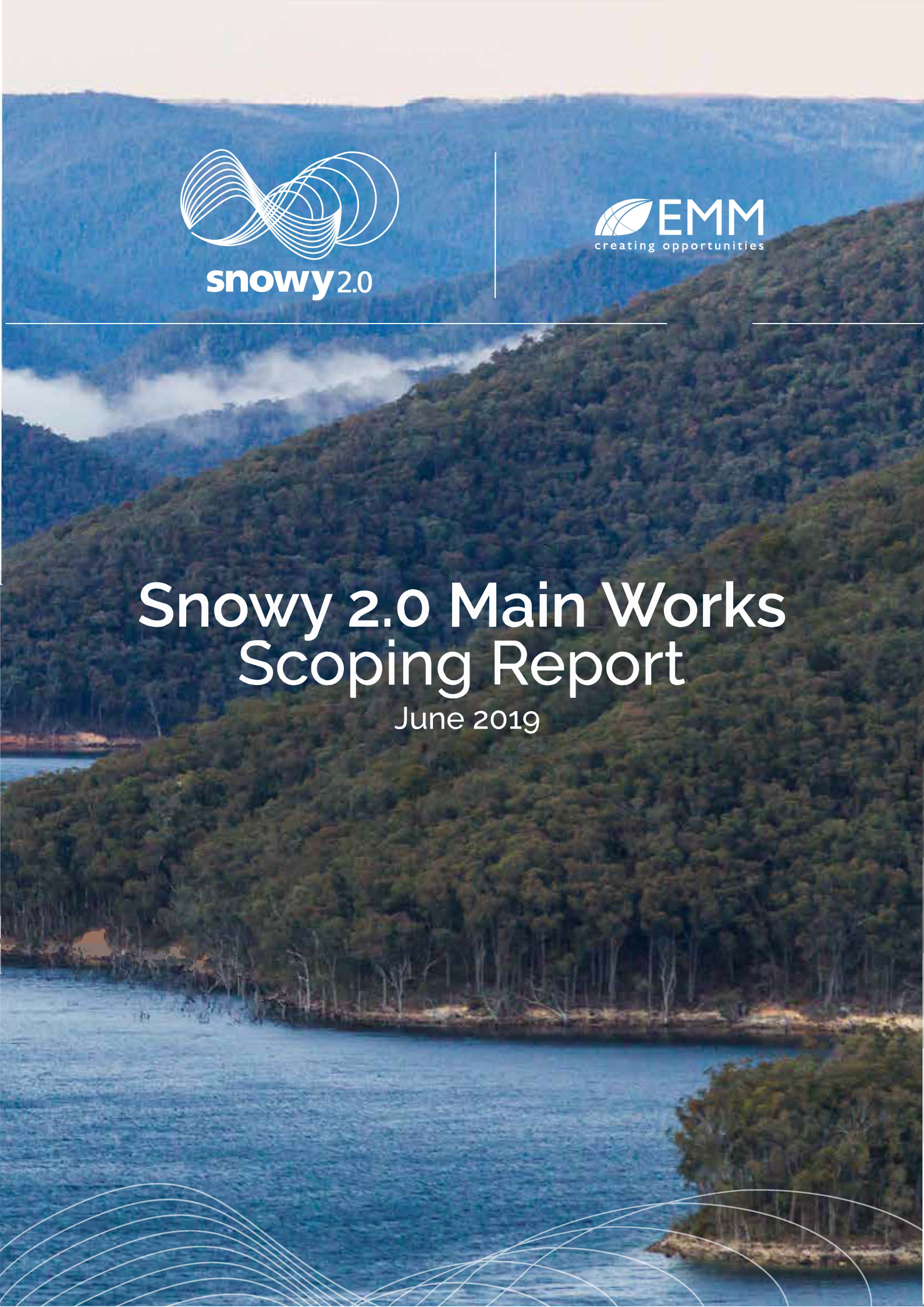


snowy 2.0

EMM
creating opportunities

Snowy 2.0 Main Works Scoping Report

June 2019

Main Works Scoping Report

Report Number

J17188 RP8

Client

Snowy Hydro Limited

Date

20 June 2019

Version

v4 Final – revised for amended project

Prepared by	**Approved by**
	
Alex Frolich	**Brett McLennan**
Associate Environmental Scientist	Director
20 June 2019	20 June 2019

This report has been prepared in accordance with the brief provided by the client 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 the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

Executive Summary

ES1 Introduction

Snowy Hydro Limited (Snowy Hydro), the operator of the Snowy Mountains Hydro-electric Scheme (Snowy Scheme), is proposing to build and operate Snowy 2.0. Snowy 2.0 is a project that will increase the pumped hydro-electric capacity within the existing Snowy Scheme by linking the Tantangara and Talbingo reservoirs with tunnels feeding a new underground power station. The project will involve tunnelling and excavation works between the two reservoirs to depths of up to 1 kilometre (km).

Snowy 2.0 has been declared Critical State Significant Infrastructure (CSSI) in accordance with the provisions of Division 5.2 of the New South Wales (NSW) *Environmental Planning and Assessment Act 1979* (EP&A Act) with the declaration coming into effect on 9 March 2018. As a result, Snowy 2.0 may be carried out without obtaining development consent under Part 4 of the EP&A Act. However, Snowy 2.0 is subject to Division 5.2 of the EP&A Act, which requires the preparation of an environmental impact statement (EIS) and the approval of the NSW Minister for Planning.

With respect to the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), while considerable survey work has been carried out to date, additional detailed surveys remain to be completed to determine potential impacts of Snowy 2.0 Main Works on matters of national environmental significance (MNES) and the environment generally. Accordingly, Snowy Hydro referred Snowy 2.0 Main Works to the Commonwealth Minister for the Environment and nominated that Snowy 2.0 Main Works has potential to have a significant impact on MNES and the environment generally. On 5 December 2018, Snowy 2.0 Main Works were deemed a controlled action and potential impacts of the project will be assessed by accredited assessment under Division 5.2 of the EP&A Act.

The purpose of this Scoping Report is to request and inform the content of the Secretary's Environmental Assessment Requirements (SEARs) for the Snowy 2.0 Main Works. The SEARs will specify the requirements for the EIS that will be prepared to accompany the application for the Snowy 2.0 Main Works.

A Scoping Report was previously submitted to Department of Planning and Environment (DPE) in October 2018 based on a reference design for Snowy 2.0. Since this submission, a number of design changes have been made and has warranted an update to this Scoping Report. This Scoping Report replaces the Scoping Report prepared for Snowy 2.0 Main Works in October 2018.

ES2 Snowy 2.0 Main Works

Snowy 2.0 is being developed in phases with this Scoping Report addressing the second phase of the project, known as the **Snowy 2.0 Main Works**. The scope includes the construction and operation of Snowy 2.0.

The following key design elements are needed for the operation of Snowy 2.0, and are referred to as operational infrastructure:

- an underground pumped hydro-electric power station complex;
- water intake structures at Tantangara and Talbingo reservoirs;
- power waterway tunnels, chambers and shafts;
- access tunnels;
- new and upgraded roads to allow ongoing access and maintenance; and

- power and communication infrastructure, including:
    - a cableyard to facilitate connection between the national electricity market (NEM) electricity transmission network and Snowy 2.0;
    - permanent auxiliary power supply connection; and
    - permanent communication cables.

To support the construction of operational infrastructure, the following temporary and permanent design elements and activities are needed, and are referred to as construction elements. Construction elements include:

- construction compounds at Talbingo, Lobs Hole, Marica and Tantangara;
- construction adits at Talbingo and Tantangara;
- a construction logistics site at Rock Forest;
- site-based accommodation camps at Lobs Hole, Marica and Tantangara;
- road establishment and other access improvements and upgrades to allow access to construction areas;
- management of excavated rock from tunnelling activities, including:
    - permanent storage within Talbingo and Tantangara reservoirs; and
    - temporary and/or permanent on-land storage within the KNP and temporary and/or permanent storage outside of KNP; and
- supporting services infrastructure including construction power, water and wastewater infrastructure, and communication infrastructure; and
- continued access to Talbingo Reservoir for laying of the communications cable and establishment of barge access infrastructure at Tantangara Reservoir for construction of the intake and placement of excavated material.

A project area for Snowy 2.0 Main Works has been identified that includes the elements of the project, including all construction and operational elements. Some construction activities associated with Snowy 2.0 Main Works may also be undertaken outside of the project area, subject to a separate assessment and approval process if required. Once Snowy 2.0 Main Works are completed, temporary construction elements (such as construction compounds and accommodation camps) will be removed and on-going rehabilitation and revegetation programs implemented.

Operation of Snowy 2.0 will involve the transfer of water through a series of newly established power waterway tunnels and the underground power station to provide for energy generation, as well as large scale energy storage. Energy will be generated when water is transferred from Tantangara Reservoir, through the headrace tunnel into the underground power station, before being transferred to Talbingo Reservoir through the tailrace tunnel. Storage of energy will be possible by pumping water back through the tailrace tunnel, from Talbingo Reservoir up to Tantangara Reservoir, where it can be used again for energy generation when needed.

Decisions concerning the operational mode, flow rates and flow duration would be made remotely by Snowy Hydro on the basis of the state of the NEM with due regard given to operational and licensing constraints.

ES3 Strategic context

The Snowy Scheme plays a critical role in the NEM. With its large scale, fast start and reliable dispatchable generation, the Scheme ensures energy security and reliability across the NEM during periods of high demand. Backed by the Scheme, Snowy Hydro is the leading provider of risk management products to the NEM.

The NEM is undergoing unprecedented transition. This will continue in coming decades, with increasing amounts of intermittent variable renewable energy (for example, from wind and solar) entering the market, and existing coal-fired power stations progressively retiring. This shift is driven by several strategic plans and policies set out by the Australian and NSW governments, as well as the favourable economics of renewables. The falling costs of new renewable projects makes them economically favourable, even with a cost added for 'firming'.

As part of this transition, the NEM is facing challenges through rising energy costs and deterioration in system security and reliability. To best manage these challenges, the NEM requires large scale energy storage and dispatchable generation to fill the gaps in generation and manage the system instability, resulting from increasing intermittent and variable generation sources. This means the products and services Snowy Hydro provides to the NEM today will be in even greater demand, and as such underpins the rationale for Snowy 2.0. The rate of change being experienced across the NEM reflects the high degree of urgency with which Snowy Hydro is progressing Snowy 2.0.

Snowy 2.0 is a major pumped-hydro expansion of the Scheme. Snowy 2.0 would provide an additional 2,000 megawatts (MW) of dispatchable generating capacity and provide approximately 350 gigawatt hours (GWh) of storage available to the NEM, enough to ensure the stability and reliability of the NEM even during prolonged weather events, such as wind or solar 'droughts'.

With its large scale and strategic location between the two major load centres of Sydney and Melbourne, Snowy 2.0 would enable the delivery of up to 2,000 MW to major load centres within minutes at times of high demand. It would also absorb and store large amounts of 'excess' electricity in the system at times of low demand, thereby not only ensuring system security but also physically and financially 'firming' renewables entering the market.

Snowy 2.0 is the least cost option to meet the future needs of the NEM for dispatchable generation and storage. Without Snowy 2.0, the most likely alternative is gas-fired and diesel peak electricity generating plants paired with batteries, which would cost much more to build.

Compared with other alternatives, Snowy 2.0 provides:

- increasing supply of energy generation and competition for the NEM putting downward pressure on energy prices;
- increasing the efficiency of the NEM by absorbing excess energy;
- increased storage capacity, longer lifespan for storage, and cheaper full life-cycle cost when compared with other storage options;
- more efficient delivery of electricity to major load centres and less emissions; generation when compared with traditional electricity generating plants; and
- improved security and reliability of supply when compared with the intermittency of primary renewable energy sources (such as wind and solar).

While Snowy 2.0 is a critical project for the NEM, more developments will be needed to meet the future needs of a decarbonising NEM. Other pumped-hydro projects, gas and diesel peakers, commercial scale batteries and demand-side solutions will all be needed.

ES4 Relevant matters to be addressed by the EIS

Preliminary environmental investigations have been carried out to identify the relevant matters to be addressed in the EIS for Snowy 2.0, and the required level of assessment. This process was guided by the draft guidelines for scoping an environmental impact statement as prepared by the NSW Department of Planning and Environment (DPE) (DPE 2017).

The identification of relevant matters has benefited from:

- consultation with the DPE as the determining authority, including the SEARs prepared for the preceding phase of the development covering the scope of activities assessed in the Exploratory Works EIS (EMM 2018a);

- community and stakeholder consultation that included government agencies, industry and environment groups, business and local communities that has covered issues initially associated with the Snowy 2.0 project generally and then the Exploratory Works (including community and stakeholder submissions received on the Exploratory Works EIS). This included regular and ongoing consultation established during Exploratory Works with the NSW National Parks and Wildlife Service (NPWS), NSW Office of Environment and Heritage (OEH), NSW Environment Protection Authority (EPA) and NSW Department of Primary Industries – Fisheries (DPI Fisheries) and carried forward to the development of Snowy 2.0 Main Works; and

- detailed investigations of the proposed Exploratory Works as included in the Exploratory Works EIS (EMM 2018a) and Exploratory Works Response to Submissions Report (EMM 2018b).

Based on the findings of the scoping assessment (Appendix A of this Scoping Report), the following are considered key issues or matters for the EIS:

- conservation areas, primarily KNP;

- biodiversity, including:

    - terrestrial ecology;

    - aquatic ecology;

- heritage, including:

    - Aboriginal cultural heritage;

    - historic heritage;

- amenity, including:

    - noise and vibration;

    - landscape and visual amenity;

- land, including:
  - geology and soils;
  - contamination;
- water, including:
  - ground water;
  - surface water, including geomorphology and flooding;
- transport and access;
- social; and
- economic.

Other issues or matters that require assessment, but may not require a standalone or detailed technical assessment in the EIS are:

- air quality;
- built environment; and
- climate change and other risks.

ES5 Overview of the proposed engagement approach

Stakeholder engagement for Snowy 2.0 has been comprehensive to date and reflects the importance Snowy Hydro places on this aspect of its business. Building on previous engagement activities carried out since the introduction of Snowy 2.0 to all stakeholders in mid-to-late 2017 and engagement activities as part of the Exploratory Works EIS, Snowy Hydro will continue to engage with stakeholders during the approval process for Snowy 2.0 Main Works.

Engagement targeted specifically for Snowy 2.0 Main Works will comprise several initiatives, as follows:

- two rounds of community consultation sessions to be held in key local communities. One round was completed in late 2018 and one round will be held mid 2019;
- Chamber of Commerce-led engagement with businesses around impacts and opportunities associated with Snowy 2.0 Main Works;
- engagement with Indigenous leaders, groups, and organisations around mobilisation for opportunities associated with Snowy 2.0 Main Works;
- discussions with potentially-affected commercial operators in KNP;
- discussions with recreational groups around potential impacts to recreational usage associated with Snowy 2.0 Main Works; and
- ongoing stakeholder engagement with State and Commonwealth agencies, local authorities and Councils.

In addition to these direct stakeholder and community engagement initiatives project information will also be provided to the local community and targeted stakeholders.

ES6 Overview of proposed EIS

Snowy 2.0 has been declared SSI and CSSI in accordance with the provisions of Division 5.2 of the EP&A Act with the declaration coming into effect on 9 March 2018. As a result, Snowy 2.0 Main Works may be carried out without development consent under Part 4 of the EP&A Act. However, the project is subject to Division 5.2 of the EP&A Act that requires preparation of an EIS and approval from the NSW Minister for Planning.

With respect to the provisions of the EPBC Act, Snowy 2.0 Main Works has the potential to result in a significant impact on MNES and the environment generally, and has been deemed a controlled action by the Commonwealth Minister for the Environment. The Commonwealth has accredited the NSW assessment process under Division 5.2 of the EP&A Act. This enables DPE to manage the assessment process of Snowy 2.0 Main Works, including the issuing of SEARs and the assessment of the EIS.

Accordingly, a single EIS will be required for Snowy 2.0 Main Works, and that the EIS will address the requirements of all State and Commonwealth agencies. The EIS will be supported by comprehensive technical reports attached as appendices to the main report and based on the key issues identified in this Scoping Report.

Table of Contents

Appendices

Tables

Figures

1 Introduction

Snowy Hydro Limited (Snowy Hydro), the operator of the Snowy Mountains Hydro-electric Scheme (Snowy Scheme), is proposing to build and operate Snowy 2.0. Snowy 2.0 is a project that will increase the pumped hydro-electric capacity within the existing Snowy Scheme by linking the Tantangara and Talbingo reservoirs with tunnels feeding a new underground power station. The project will involve tunnelling and excavation works between the two reservoirs to depths of up to 1 kilometre (km).

Snowy 2.0 will provide large-scale storage of energy that will be available as quick-start electricity generation at critical times of peak demand. Pumping water at times of low electricity demand means that Snowy 2.0 will have water ready to use for energy generation at times when consumers need it most. Snowy 2.0 will make efficient use of our precious water resources to generate electricity without impacting on the supply of valuable irrigation and town water supplies for the food bowl of the Murray-Darling Basin.

When operational, Snowy 2.0 will function primarily as an energy storage facility; pumping water out of Talbingo Reservoir (the lower reservoir) to Tantangara Reservoir (the upper reservoir) in the storage mode and allowing the water to flow from Tantangara Reservoir into Talbingo Reservoir in the generating mode. Decisions concerning the operational mode, flow rates and flow duration would be made remotely by Snowy Hydro on the basis of the state of the national electricity market (NEM) with due regard given to operational and licensing constraints, including the need to maintain downstream supply and environmental flows. Further information in relation to the operation of the existing scheme, including Snowy Hydro's operational and licensing constraints, is provided in Section 4.2.

Snowy 2.0 has been declared Critical State Significant Infrastructure (CSSI) in accordance with the provisions of the New South Wales (NSW) *Environmental Planning and Assessment Act 1979* (EP&A Act) with the declaration coming into effect on 9 March 2018. As a result, Snowy 2.0 may be carried out without obtaining development consent under Part 4 of the EP&A Act. However, Snowy 2.0 is subject to Division 5.2 of the EP&A Act, which requires the preparation of an environmental impact statement (EIS) and the approval of the NSW Minister for Planning.

Snowy 2.0 is being developed in two phases. The first phase, the Exploratory Works, includes an exploratory tunnel and portal and other exploratory and construction activities primarily in the Lobs Hole area of the Kosciuszko National Park (KNP). The scope of the Exploratory Works phase is excluded from this Scoping Report. Exploratory Works has been assessed in a separate EIS and subject to a separate approval (Snowy Hydro, 2018, see Application Number SSI 18_9208 to the NSW Department of Planning and Environment (DPE)).

This Scoping Report addresses the second phase of the project, which is to be known as the **Snowy 2.0 Main Works**. As the title suggests, this phase of the project covers the major construction elements of Snowy 2.0, including permanent infrastructure (such as the underground power station, power waterways, access tunnels, chambers and shafts), temporary construction infrastructure (such as construction adits, construction compounds and accommodation), management and storage of extracted rock material and establishing supporting infrastructure (such as road upgrades and extensions, water and sewage treatment infrastructure, and the provision of construction power). Snowy 2.0 Main Works also includes the operation of Snowy 2.0.

Snowy 2.0 Main Works is shown in Figure 1.1. If approved, the Snowy 2.0 Main Works would commence before completion of Exploratory Works.

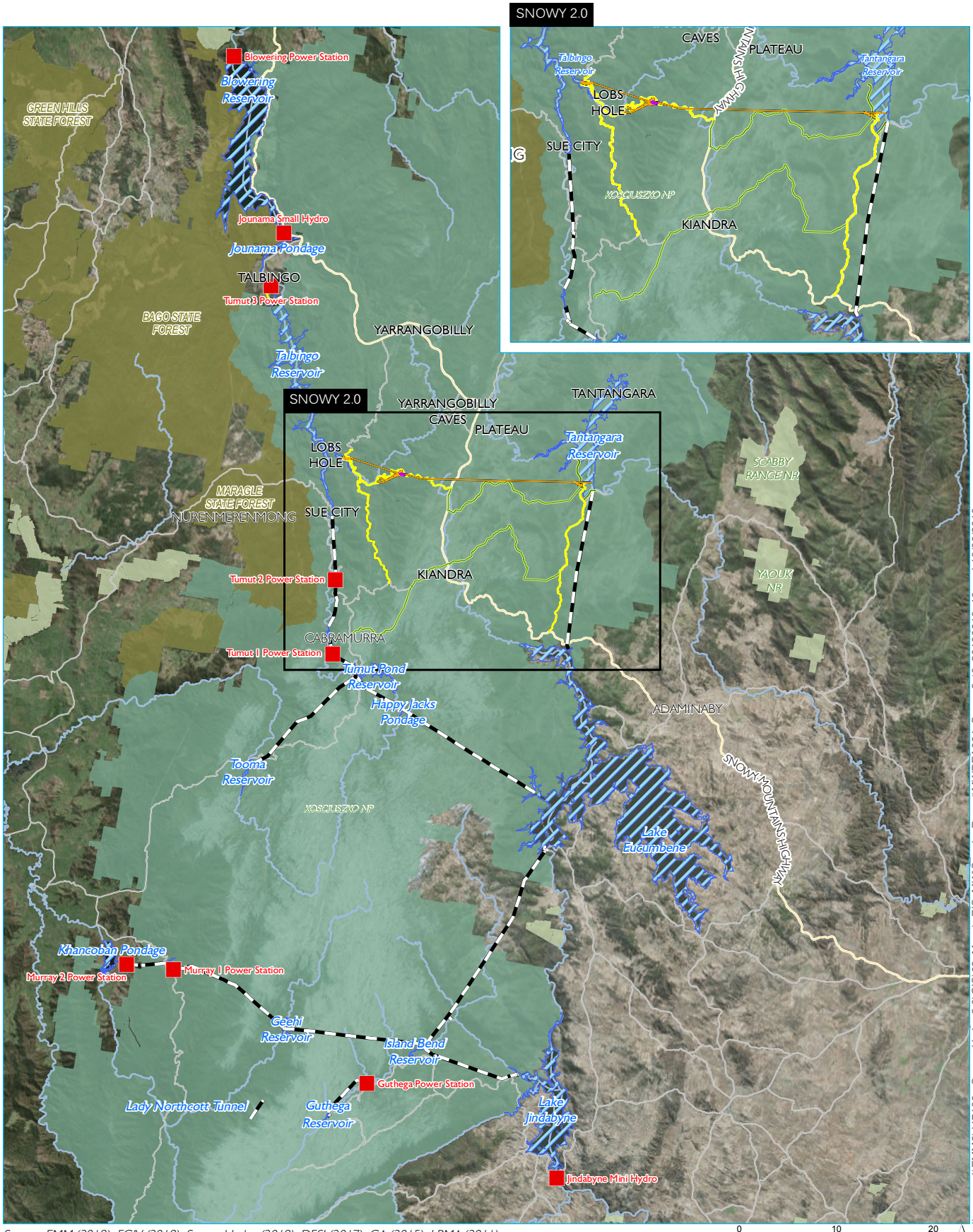
The Snowy 2.0 Main Works do not include the main transmission works proposed by TransGrid (TransGrid 2018) that provide connection between the cableyard and the NEM. These transmission works will provide the ability for Snowy 2.0 to efficiently and reliably transmit additional renewable energy to major load centres during periods of peak demand, as well as enable a supply of renewable energy to pump water from Talbingo Reservoir to Tantangara Reservoir during periods of low demand. While the upgrade works to the wider transmission network and connection between the cableyard and the network form part of the CSSI declaration for Snowy 2.0, they do not form part of this application and will be subject to separate application and approval processes.

With respect to the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), while considerable survey work has been carried out to date, additional detailed surveys remain to be completed to determine potential impacts of Snowy 2.0 Main Works on matters of national environmental significance (MNES) and the environment generally. Accordingly, on a precautionary basis, Snowy Hydro referred Snowy 2.0 Main Works to the Commonwealth Minister for the Environment and nominated that Snowy 2.0 Main Works has potential to have a significant impact on MNES and the environment generally.

On 5 December 2018, Snowy 2.0 Main Works were deemed a controlled action by the Commonwealth Department of Environment and Energy (DEE). It was also determined that potential impacts of the project will be assessed by accredited assessment under Division 5.2 of the EP&A Act. This accredited process will enable DPE to manage the assessment of Snowy 2.0 Main Works, including the issuing of the assessment requirements for the EIS.

This Scoping Report has been prepared by EMM Consulting Pty Limited (EMM) on behalf of Snowy Hydro, the proponent for Snowy 2.0. It has been prepared in accordance with the *draft Environmental Impact Assessment Guidance Series* (June 2017) prepared by DPE.

The purpose of this Scoping Report is to request and inform the content of the Secretary's Environmental Assessment Requirements (SEARs) for Snowy 2.0 Main Works. The SEARs will specify the requirements for the EIS that will be prepared to accompany the application for the Snowy 2.0 Main Works.



Source: EMM (2019); FGJV (2019); Snowy Hydro (2019); DFSI (2017); GA (2015); LPMA (2011)

0 10 20 km
GDA 1994 MGA Zone 55
N

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_MW\ScopingReport\MWPEA001_Snowy2pt0_20190619_10.mxd 19/06/2019

KEY

Snowy 2.0 project elements
- Utilities
- Tunnels, portals, intakes
- Power station
- Permanent roads and surface infrastructure

Existing Snowy Scheme
- Existing power station
- Existing pipeline tunnel
- Scheme storage

- Main road
- Local road or track
- Watercourse
- Kosciuszko National Park
- NPWS reserve
- State forest

Snowy 2.0

Snowy 2.0
Scoping Report
Main Works
Figure 1.1

snowy2.0

EMM creating opportunities

2 Project details

2.1 Project title

This Scoping Report addresses the main works associated with Snowy 2.0, a proposal by Snowy Hydro to increase the pumped hydro-electric capacity within the Snowy Scheme by linking the Tantangara and Talbingo reservoirs with tunnels feeding an underground power station. The project will involve tunnelling and excavation works between the two reservoirs to depths of up to 1 km.

This phase of Snowy 2.0 is to be known as **Snowy 2.0 Main Works**.

2.2 Proponent details

Details on the proponent for Snowy 2.0 Main Works, as well as details on the persons who prepared this scoping report, and the site owner are as follows:

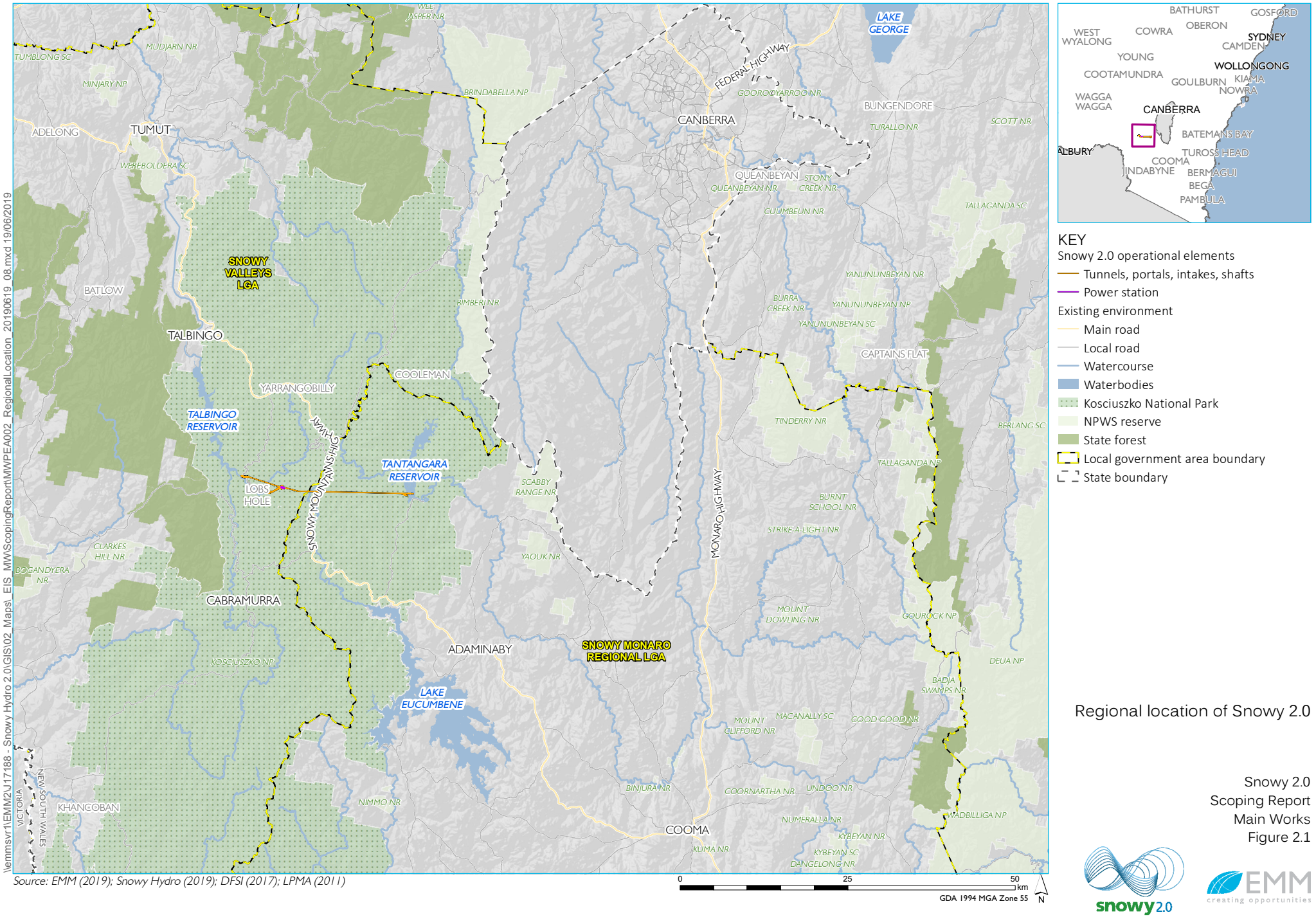
Table 2.1 Proponent details

Requirement	Detail
Proponent	Snowy Hydro Limited
Postal address	Monaro Highway, Cooma NSW 2630
ABN	17 090 574 431
Nominated contact	Andrew Nolan General Manager Water and Environment
Contact details	PO Box 332 Cooma NSW 2630 Phone: 02 6453 2888 Email: snowy2.0@snowyhydro.com.au
Name and qualifications of persons who prepared Scoping Report	Allan Reid Bachelor of Regional and Town Planning Grad Dip (Environmental Studies) Alex Frolich Bachelor of Science (Marine Science)
Site owner	The State of NSW as represented by NSW Office of Environment and Heritage (OEH) and the National Parks and Wildlife Service (NPWS); and Timothy Gregory Russell

2.3 Site details

2.3.1 Project location

Snowy 2.0 Main Works is located in the Australian Alps in southern NSW, about mid-way between Canberra and Albury. Snowy 2.0 Main Works will be in both the Snowy Valleys and Snowy Monaro Regional local government areas (LGAs) as shown on Figure 2.1.



KEY

Snowy 2.0 operational elements
- Tunnels, portals, intakes, shafts
- Power station

Existing environment
- Main road
- Local road
- Watercourse
- Waterbodies
- Kosciuszko National Park
- NPWS reserve
- State forest
- Local government area boundary
- State boundary

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\ScopingReport\MWPEA002 RegionalLocation 20190619 08.mxd 19/06/2019

Regional location of Snowy 2.0

Snowy 2.0
Scoping Report
Main Works
Figure 2.1

snowy 2.0

EMM
creating opportunities

The nearest large towns to Snowy 2.0 Main Works are Cooma and Tumut. Cooma is located about 50 km south east of the project area (or 70 km by road from Providence Portal at the southern edge of the project area), and Tumut is located about 35 km north west of the project areas (or 45 km by road from Tumut 3 power station at the northern edge of the project area). Other townships near the project area include Talbingo, Cabramurra, Adaminaby and Tumbarumba. Talbingo and Cabramurra were built for the original Snowy Scheme workers and their families, while Adaminaby was relocated in 1957 to make way for the establishment of Lake Eucumbene. The location of Snowy 2.0 with respect to the region is shown in Figure 2.1.

The pumped hydro-electric scheme elements of Snowy 2.0 Main Works are mostly underground between the southern ends of Talbingo and Tantangara reservoirs, a straight-line distance of 27 km. Surface works will also occur at locations on and between the two reservoirs. Key locations for surface works include:

- **Tantangara Reservoir** - at an elevation of about 1,222 metres (m) to Australian Height Datum (AHD), Tantangara Reservoir will be the upper reservoir for the pumped hydro project and include the headrace tunnel and intake structure. The site will also be used for a temporary construction compound, accommodation camp and other temporary ancillary activities;

- **Marica** - this site will be used primarily for construction (including construction of vertical shafts to the underground power station (ventilation shaft) and headrace tunnel (surge shaft), and a temporary accommodation camp);

- **Lobs Hole** - the site will be used primarily for construction but will also become the main entrance to the power station during operation. Lobs Hole will provide access to the Exploratory Works tunnel, which will be refitted to become the main access tunnel (MAT), as well as the location of the emergency egress, cable and ventilation tunnel (ECVT), portal and associated services; and

- **Talbingo Reservoir** - at a full supply level of about 546 m AHD, Talbingo Reservoir provides the lower reservoir for the pumped hydro-electric project and will include the tailrace tunnel and water intake structure. The site will also be used for temporary construction compounds and other temporary ancillary activities.

Works will also be required within the two reservoirs for the placement of extracted rock. Supporting infrastructure will include establishing or upgrading access tracks and roads and electricity connections to construction sites.

Most of the proposed pumped hydro-electric and temporary construction elements and most of the supporting infrastructure for Snowy 2.0 Main Works are located within the boundaries of KNP. Some of the supporting infrastructure (including sections of road upgrade, power and communications infrastructure) extends beyond the national park boundaries. These sections of infrastructure are primarily located to the east and south of Tantangara Reservoir. One temporary construction site is located beyond the national park along the Snowy Mountains Highway about 3 km east of Providence Portal (referred to as Rock Forest).

There may be other areas required for construction laydown or other similar uses that extend beyond the boundaries of the project area as details emerge from the construction contractor recently selected to deliver Snowy 2.0, and as construction requirements are confirmed as part of the final design. Any activities associated with such uses would be assessed in the EIS and subject to consultation with relevant stakeholders and the community.

2.3.2 Project area description

A project area for Snowy 2.0 Main Works has been identified that includes the elements of the project, including all construction and operational elements. The project area is shown on Figure 2.2. Key features of the project area are:

- the water bodies of Talbingo and Tantangara reservoirs, covering areas of 19.4 square kilometres (km^2) and 21.2 km^2 respectively. The reservoirs provide the water to be utilised in the pumped hydro-electric scheme;
- major watercourses including the Yarrangobilly, Eucumbene and Murrumbidgee rivers and some of their tributaries;
- KNP, which covers the majority of the project area. Within the project area, KNP is characterised by two key zones: upper slopes and inverted treelines in the west of the project area (referred to as the 'ravine') and associated subalpine treeless flats and valleys in the east of the project area (referred to as the 'plateau'); and
- farm land southeast of KNP at Rock Forest.

The project area is interspersed with built infrastructure including recreational sites and facilities, main roads as well as unsealed access tracks, hiking trails, farm land, electricity infrastructure, and infrastructure associated with the Snowy Scheme.

2.4 Snowy 2.0 planning and design development

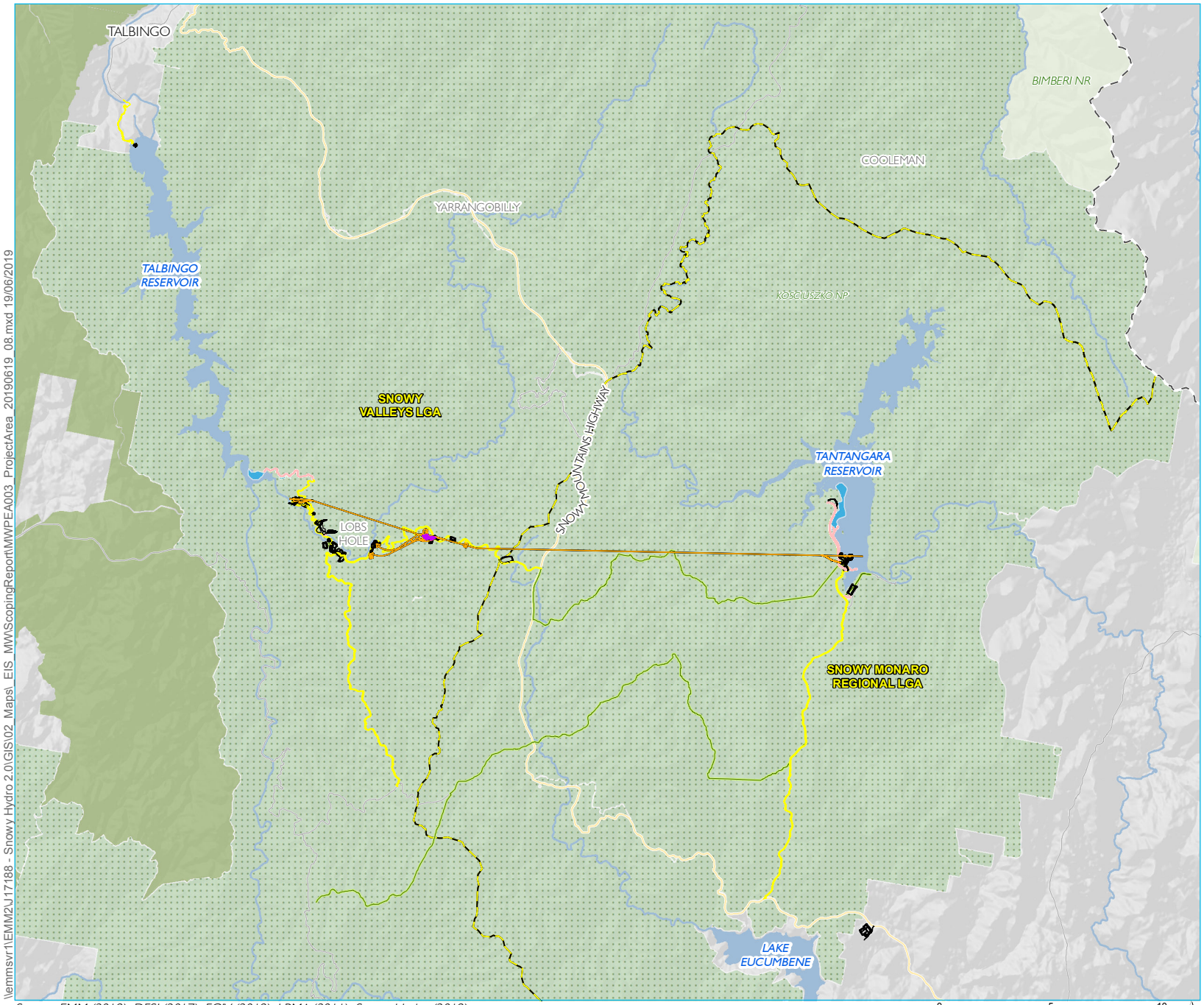
The design concept and identification of initial environmental risks for Snowy 2.0 were completed as part of the *Snowy 2.0 Feasibility Study* (Snowy Hydro 2017). The assessment of environmental risks for Snowy 2.0 and the generation and review of design elements of the Snowy 2.0 Main Works formally commenced with a preliminary environmental risk identification workshop held at Snowy Hydro's Cooma office on 12 September 2017. This workshop was attended by representatives from Snowy Hydro and relevant technical specialists and was followed by extensive field and community-based investigations that identified potential environmental, social, economic and cultural opportunities and constraints associated with Snowy 2.0. The process also allowed alternative solutions to be identified and considered.

This process of design development, regular workshops and targeted investigations has continued to this current phase of the project. Subsequent workshops carried out in 2018 have allowed further design solutions, supported by new and ongoing environmental investigations. This process will continue to be revisited and revised as design details emerge from the delivery contractor recently awarded in early 2019, and as environmental impacts are identified through the EIS process.

2.4.1 Snowy 2.0 design

The project that is described in this Scoping Report is largely a description of the reference design prepared by SMEC on behalf of Snowy Hydro and developed in accordance with Snowy Hydro's functional and performance requirements. Preparation of the reference design follows on from the *Snowy 2.0 Feasibility Study* (Snowy Hydro 2017).

Full details of the final design for Snowy 2.0 Main Works have yet to be completed. However, in January 2019 Snowy Hydro identified a preferred construction contractor to develop the final design and carry out construction of Snowy 2.0. The contract was formally awarded in April 2019. Wherever possible, this Scoping Report also considers relevant design solutions the contractor is developing for the final design.



KEY

- Main road
- Local road
- Watercourse
- Waterbodies
- Kosciuszko National Park
- NPWS reserve
- State forest
- Local government area boundary
- State boundary

Snowy 2.0 operational elements

- Tunnels, portals, intakes, shafts
- Power station
- Utilities
- Permanent road

Snowy 2.0 contruction elements

- Temporary construction compounds and surface works
- Temporary access road
- Indicative rock emplacement area

Source: EMM (2019); DFSI (2017); FGJV (2019); LPMA (2011); Snowy Hydro (2019)

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\ScopingReport\MWPEA003 ProjectArea 20190619 08.mxd 19/06/2019

Snowy 2.0 project area

Snowy 2.0
Scoping Report
Main Works
Figure 2.2

snowy 2.0

EMM
creating opportunities

2.4.2 Project elements that are fixed and those that are subject to change

Given the ongoing design process, an important distinction in terms of environmental scoping is the need to distinguish between project elements that are relatively fixed in design and those project elements that may change as a result of the ongoing design process.

Those elements that are considered fixed in design include the water intakes, power waterway tunnels and underground chambers. Other elements, such as the size and location of construction adits, construction compounds and accommodation camps and roads, are subject to confirmation of construction methodology and design finalisation.

The location of the power station that is the subject of the Exploratory Works and detailed underground geotechnical investigations, as detailed in the Exploratory Works EIS, will also be subject to final design. However, any refinements to location and design of the power station will be underground and will impact the design of underground infrastructure, without necessarily impacting surface works.

2.5 Alternatives considered

The Snowy 2.0 Main Works provide several benefits that justify its selection over alternative projects. In particular the pumped hydro-electric energy storage technology used in Snowy 2.0 would have high full cycle energy efficiency, a long lifespan and would provide a 350,000 megawatt hours (MWh) of energy storage, which is significant storage capacity. These benefits are considered to justify the use of pumped hydro energy storage to complement other smaller scale energy storage technologies.

While other opportunities have been identified in NSW and throughout Australia for pumped hydro-electric storage, notably the atlas of pumped hydro-electric storage released in 2017 (Blakers et al. 2017), the lead time and planning for such projects is extremely complex. Snowy 2.0 utilises existing assets under the control of Snowy Hydro. In this regard, Snowy Hydro is uniquely positioned to be able to deliver a project of the magnitude of Snowy 2.0 that will provide significant benefits to NSW and the NEM utilising its existing reservoirs.

In developing Snowy 2.0, Snowy Hydro considered a range of alternative designs, layouts and locations for various elements of the project. Some of these elements and their alternatives were considered during the *Snowy 2.0 Feasibility Study* (Snowy Hydro 2017). Others were the subject of more recent and more detailed investigations and resulted in the location of the elements that make up Snowy 2.0 Main Works.

The alternatives and options considered included:

- horizontal alignment options for headrace and tailrace tunnels, which is closely aligned with the location of intake structures within Talbingo and Tantangara reservoirs;
- optimisation of power house locations – with two options previously proposed: the ravine and plateau options, with the ravine option providing the preferred outcome of reduced construction timeframes;
- MAT and ECVT options, which included different locations and configurations to align with the preferred power house location; and
- road alignment options – a number of different road alignment options have been considered and continue to be considered in order to provide connection between key project infrastructure and minimising environmental impacts where possible. This includes iterations of road access to Marica.

As previously discussed, Snowy Hydro recently appointed a construction contractor for Snowy 2.0. It is anticipated that all feasible options and alternatives will be identified and documented within the EIS.

2.6 Relationship with Exploratory Works and Transmission Connection projects

This second Main Works phase of the project covers the major elements of Snowy 2.0, including the underground power station, power waterways, access tunnels and access, power supply and communications infrastructure, as well as supporting infrastructure to enable construction. It also includes the operation of Snowy 2.0.

The first phase of the project, known as the Exploratory Works, includes an exploratory tunnel and portal, temporary construction compound, accommodation camp and temporary excavated rock stockpiles, all located at Lobs Hole, as well as barge infrastructure at the northern and southern end of Talbingo Reservoir and the construction and upgrade of associated access infrastructure. Exploratory Works also includes a program for subaqueous placement of excavated rock in several locations within Talbingo Reservoir. The primary purpose of Exploratory Works is to gain a greater understanding of the rock conditions at the proposed location of the underground power station for Snowy 2.0. An exploratory tunnel is the key element proposed to gain this critical information.

The scope of the Exploratory Works phase is excluded from the scope of this EIS. Details of the Exploratory Works phase of Snowy 2.0 are contained in the Exploratory Works EIS (EMM 2018a, see Application Number SS I18_9208).

Other works are also excluded from the scope of Snowy 2.0 Main Works. This includes the outcomes of ongoing investigations for quarries to supply an estimated 600,000 cubic metres (m^3) to 800,000 m^3 of both aggregate and sand required for concrete production. A significant portion of the aggregate for concrete is expected to be retained from the intake excavation at Talbingo Reservoir. Some quantities of 'manufactured' sand will also be retained during the crushing process of this rock. However, the remainder of the required material will be supplied from quarries external to the project area. These will be the subject of separate applications if required.

Also excluded from the scope of Snowy 2.0 Main Works are the transmission works proposed by TransGrid that provide connection between the cableyard (to be located adjacent to the ECVT and the transmission network) and the NEM. All upgrade works to the wider transmission network and connection between the cableyard and the network do not form part of this application and will be subject to separate applications and approval processes by TransGrid (see Application Number SSI18_9717).

3 Project description

3.1 Overview

3.1.1 Operation of Snowy 2.0

Snowy 2.0 is a large scale pumped hydro-electric generation and storage project that will increase the pumped hydro-electric capacity of the existing Snowy Scheme by linking the existing Snowy Schemes' Tantangara and Talbingo reservoirs via a tunnel and an underground power station that will have a generating capacity of up to 2,000 megawatts (MW).

Snowy 2.0 is made possible by the water storage capacities of Tantangara and Talbingo reservoirs and the altitude difference between the two water bodies, ie Tantangara is located at a higher altitude than Talbingo (at 1,222 m AHD and 546 m AHD, respectively).

Hydroelectricity is generated when falling water spins large turbines. For Snowy 2.0, hydroelectricity will be generated when water is transferred through underground tunnels from Tantangara Reservoir, through turbines in the proposed underground power station, and transferred to Talbingo Reservoir. Snowy 2.0 will have reversible turbines, allowing water to be pumped back to Tantangara Reservoir so it can be used again. It is in this way that Snowy 2.0 acts like a battery and provides large scale storage of energy. Snowy 2.0 therefore has two key operational modes:

- generating mode – allowing the water to flow Tantangara Reservoir into Talbingo Reservoir; and
- storage mode – pumping water out of Talbingo Reservoir (the lower reservoir) to Tantangara Reservoir (the upper reservoir).

The operation of Snowy 2.0 involves recycling water between two existing storages and therefore does not need additional water.

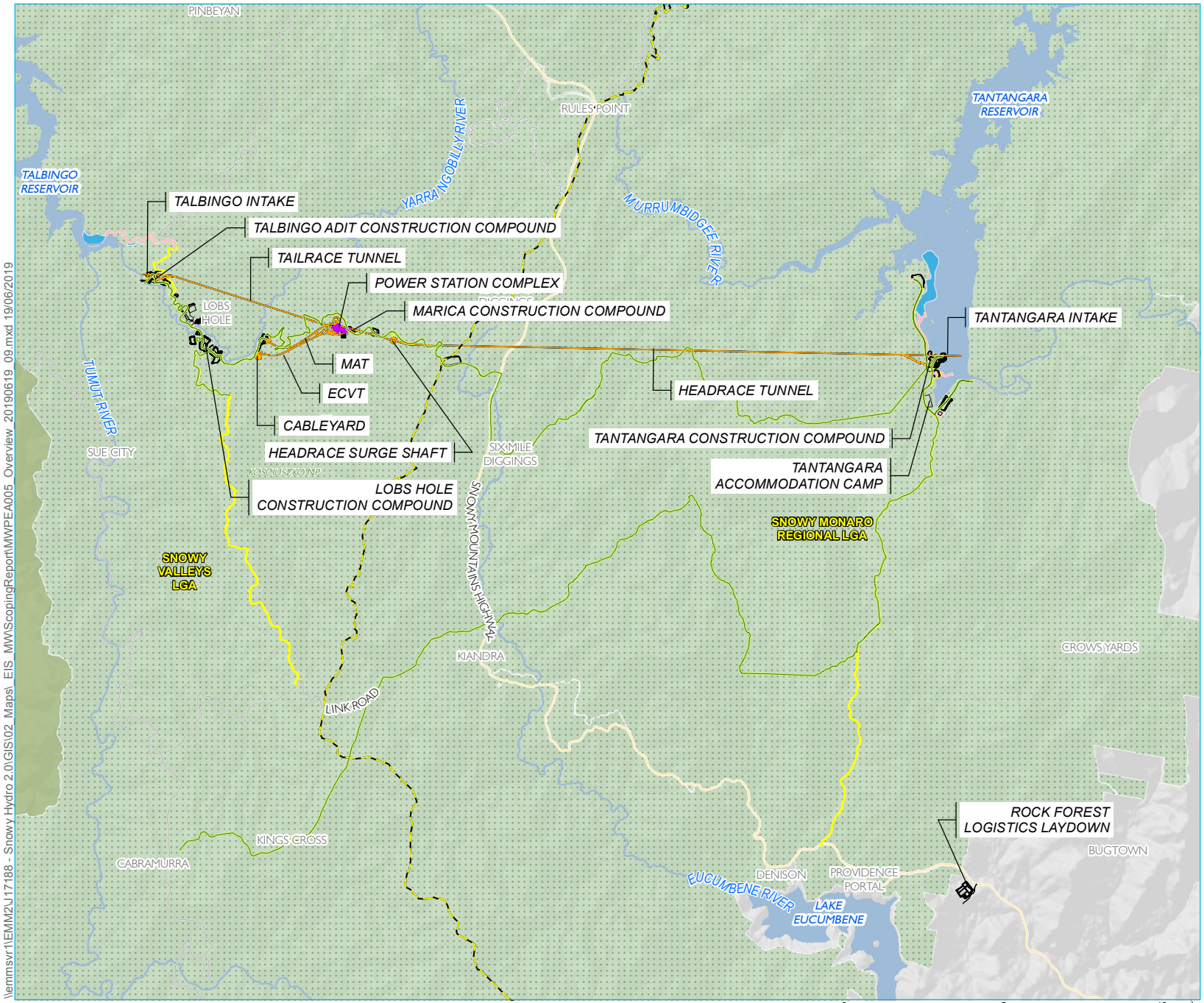
In its primary energy storage operating mode, Snowy Hydro would pump water from the lower reservoir to the upper reservoir at times that maximise the use of off-peak, less valuable energy and would generate high-value energy to meet peak system demands during periods of high energy demand. This cycling operation would be accompanied by water-level fluctuations within both reservoirs.

Decisions concerning the operational mode, flow rates and flow duration would be made remotely by Snowy Hydro on the basis of the state of the NEM with due regard given to operational and licensing constraints, including the need to maintain downstream supply and environmental flows for the Murray-Darling Basin. Further information in relation to the operation of the existing scheme, including Snowy Hydro's operational and licensing constraints, is provided in Section 4.2.

Site-based operational staff would oversee the operation and maintenance of the station, however the station would be primarily a remotely-operated facility. Access to the powerhouse for all staff and visitors would be via the MAT.

Snowy 2.0 will provide large-scale storage of energy that will be available as quick-start electricity generation at critical times of peak demand. Pumping water at times of low demand means that Snowy 2.0 will have water ready to use for energy generation at times when consumers need it most.

Snowy 2.0 is shown in Figure 3.1 and the major project elements for Main Works are described in the following section.



KEY

Existing environment

- Main road
- Local road
- Watercourse
- Waterbodies
- Kosciuszko National Park
- State forest
- Local government area boundary

Snowy 2.0 operational elements

- Tunnels, portals, intakes, shafts
- Power station
- Utilities
- Permanent road

Snowy 2.0 contruction elements

- Temporary construction compounds and surface works
- Temporary access road
- Indicative rock emplacement area

\\emmsvr1\EMM2\J117188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_MW\ScopingReport\MWPEA005_Overview_20190619_09.mxd 19/06/2019

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 5 10 km

GDA 1994 MGA Zone 55

N

Snowy 2.0 Main Works – Overview of project elements

Snowy 2.0
Scoping Report
Main Works
Figure 3.1

snowy 2.0

EMM creating opportunities

3.1.2 Key project elements

The following key design elements are needed for the operation of Snowy 2.0, and are referred to in this Scoping Report as operational infrastructure:

- an underground pumped hydro-electric power station complex;
- water intake structures at Tantangara and Talbingo reservoirs;
- power waterway tunnels, chambers and shafts;
- access tunnels;
- new and upgraded roads to allow ongoing access and maintenance; and
- power and communication infrastructure, including:
    - a cableyard to facilitate connection between the NEM electricity transmission network and Snowy 2.0; and
    - permanent auxiliary power supply connection; and
    - permanent communication cables.

To support the construction of operational infrastructure, of the following temporary and permanent design elements and activities are needed, and are referred to in this Scoping Report as construction elements. Construction elements include:

- construction compounds at Talbingo, Lobs Hole, Marica and Tantangara;
- construction adits at Talbingo and Tantangara;
- a construction logistics site at Rock Forest;
- site-based accommodation camps at Lobs Hole, Marica and Tantangara;
- road establishment and other access improvements and upgrades to allow access to construction areas;
- management of excavated rock from tunnelling activities, including:
    - permanent storage within Talbingo and Tantangara reservoirs; and
    - temporary and/or permanent on-land storage within the KNP and temporary and/or permanent storage outside of KNP; and
- supporting services infrastructure including construction power, water and wastewater infrastructure, and communication infrastructure; and
- continued access to Talbingo Reservoir for laying of the communications cable and establishment of barge access infrastructure at Tantangara Reservoir for construction of the intake and placement of excavated material.

The placement of excavated material at locations within Talbingo and Tantangara reservoirs is proposed to be carried out from land, using shore-based placement methods. Shore-based placement is being considered as an optimised solution compared to the previously preferred subaqueous placement method described in the Exploratory Works EIS. As such, confirmation on specific locations and the method will be determined once results of further design and modelling investigation become available and will be detailed in the EIS.

Decommissioning and rehabilitation will be an important element of the project, which will be designed and developed in consultation with NPWS.

3.1.3 Expected capital investment value

The current cost estimate of Snowy 2.0 is between $3.8 and $4.5 billion.

3.2 Operational infrastructure

3.2.1 Underground power station

Central to the operation of Snowy 2.0 is the power station located underground, at a site to be optimised as a result of the geotechnical investigations as set out in the Exploratory Works phase of development. While the location of the power station is to be the subject of further refinement as a result of the underground geotechnical drilling program (as described in the Exploratory Works EIS), the design and features of the power station are predominantly fixed.

The power station comprises two main caverns; the machine hall and the transformer hall. The machine hall will house six 340 MW pump-turbine generating units and associated plant facilities required for operating the power station. The machine hall will be approximately 237 m long, 30 m wide and 50 m high. The transformer hall will house the power station's six transformers, power transmission equipment and the draft tube valves. The transformer hall will be 204 m long, 18 m wide and 46 m high. The two caverns will be connected through Isolated Phase Busduct (IPB) galleries, which contain electrical equipment needed between the generating units and transformers. A conceptual layout of the power station is shown on Figure 3.2.

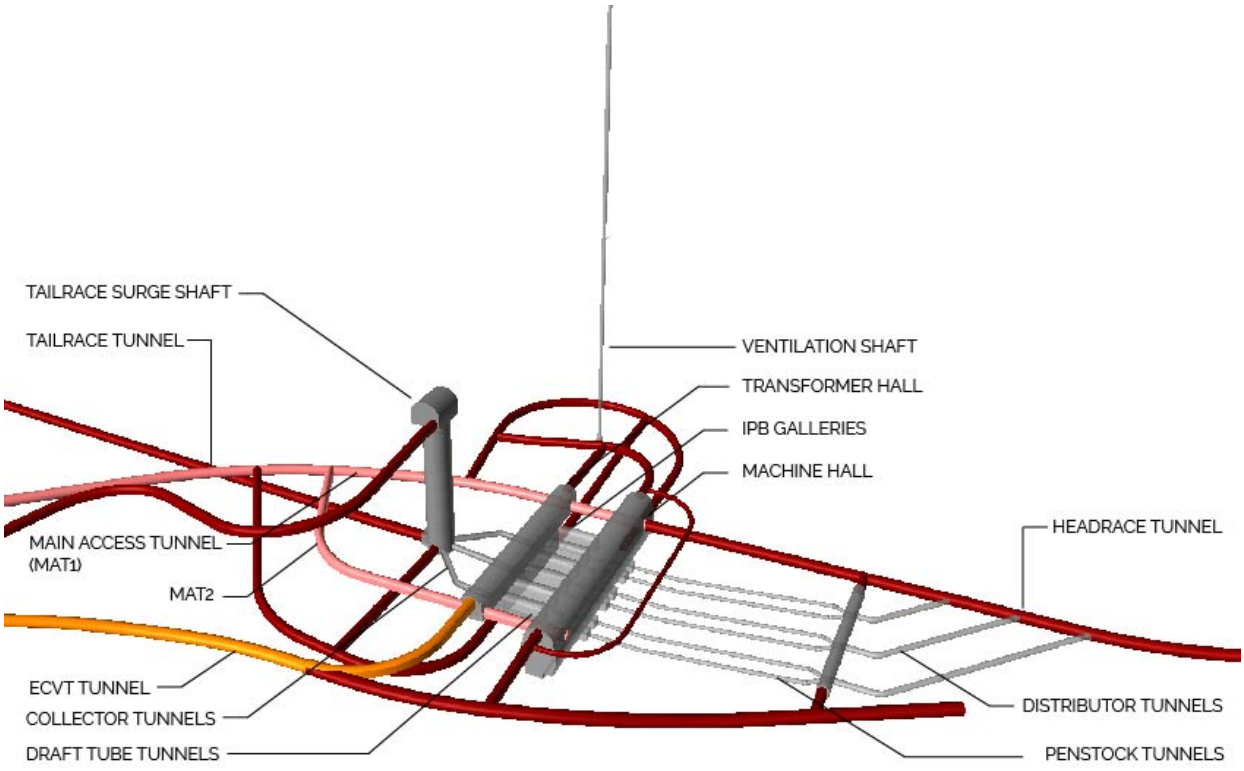


Figure 3.2 Conceptual layout of Snowy 2.0 power station complex

3.2.2 Water intakes

Water intakes are required at the Tantangara and Talbingo reservoirs to convey water in and out of the power waterway and ultimately to and from the Snowy 2.0 power station. Both intake structures are designed to operate in either generating or pumping mode with minimum head losses and with minimum impact on the environmental setting of the structures within KNP. Each intake will comprise:

- a permanently submerged approach channel;
- an intake structure; and
- an intake gate shaft or tower.

For safety reasons, and similar to the intakes at other existing Snowy Hydro power stations, closure or restrictions of parts of the reservoirs will need to be implemented to restrict public access to the intake structures.

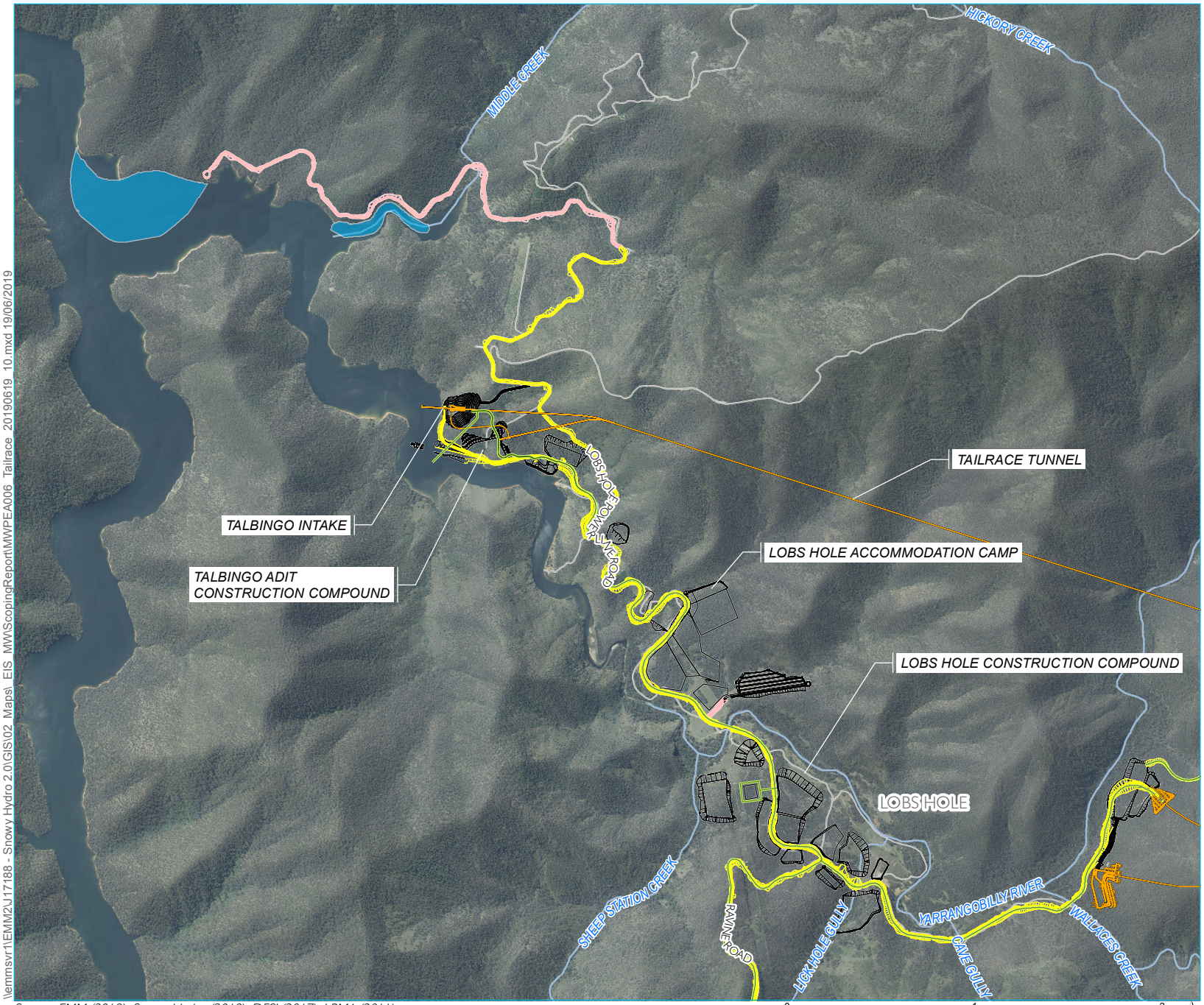
3.2.3 Power waterway tunnels, chambers and shafts

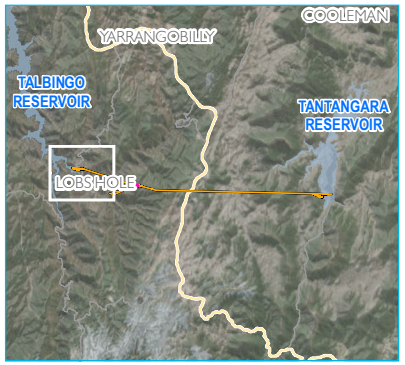
Approximately 25 km of power waterway tunnels, chambers and shafts are required to convey water between Tantangara and Talbingo reservoirs through the Snowy 2.0 power station. Most of the power waterway infrastructure will be established underground, with access to the surface provided via several access tunnels and portals described further in Section 3.2.4. The proposed power waterway tunnels, chambers and shafts are summarised in Table 3.1 and shown on Figure 3.3 to Figure 3.7.

Table 3.1 Summary of power waterway tunnels, chambers and shafts

Power waterway element	Description
Headrace tunnel	The headrace tunnel is an approximately 18km-long tunnel with a minimum 9.8 m internal diameter. The headrace tunnel will lead west from Tantangara intake terminating at the pressure shafts upstream of the power station complex.
Headrace surge shaft and expansion chamber	The headrace surge shaft will be at the end of the headrace tunnel and attenuates transient pressures caused by operational changes and in emergency rapid shut downs and startups. The surge shaft will have an internal diameter of 9 m (lower section) and about 25 m (upper section), and will surface at Marica (east of the power station location).
Inclined pressure shaft	An inclined pressure shaft will be established to enable the 680 m drop in elevation between the Tantangara and Talbingo reservoirs, connecting the headrace surge shaft with the power station.
Distributor and penstock tunnels	Before entering the power station complex, the inclined pressure shaft enter the penstock manifold and split into three distributor tunnels first and then into six penstock tunnels terminating at the six main inlet valves in the machine hall of the power station. The distributor tunnels are 5 m in diameter and approximately 100 m long. The penstock tunnels are 4 m diameter and approximately 200 m long.
Draft tube and collector tunnels	As water is discharged from the turbines into the tailrace tunnel, it will pass through six 3.5 m diameter draft tube tunnels which will merge into three short 5.4 m diameter collector tunnels. The draft tube tunnels will be fitted with six draft tube valves located at the lower section of the transformer cavern. The draft tube valves will allow each of the six draft tubes and pump/turbines to be individually isolated from the rest of the power station to allow maintenance work without interrupting the operation of the rest of the power station.
Tailrace surge tank and expansion chamber	The tailrace surge tank will be at the power station complex end of the tailrace tunnel and attenuates the transient pressures in the tailrace tunnel and protect the pump/turbines from excessive pressure variations. The tailrace surge tank does not surface.
Tailrace tunnel	A 6 km long and a 9.8 m internal diameter tailrace tunnel between the tailrace surge tank and Talbingo intake structure to complete the power waterway.

Notes: All power waterway dimensions are indicative only.





KEY

Snowy 2.0 operational elements

- Tunnels, portals, intakes, shafts
- Utilities
- Permanent road

Snowy 2.0 contruction elements

- Temporary construction compounds and surface works
- Temporary access road
- Indicative rock emplacement area

Existing environment

- Local road
- Watercourse

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\ScopingReport\MWPEA006 Tailrace 20190619 10.mxd 19/06/2019

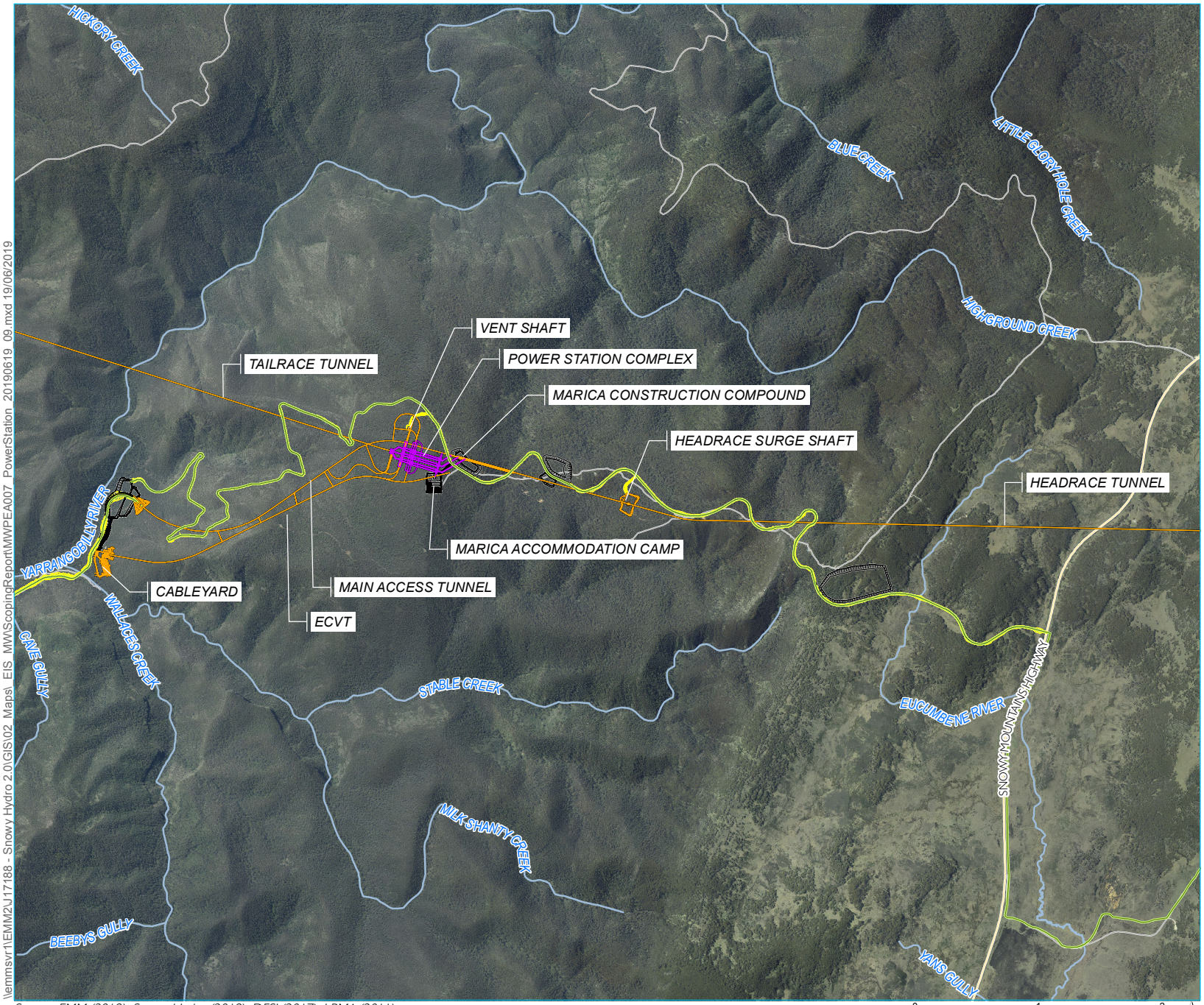
Source: EMM (2018); Snowy Hydro (2018); DFSI (2017); LPMA (2011)

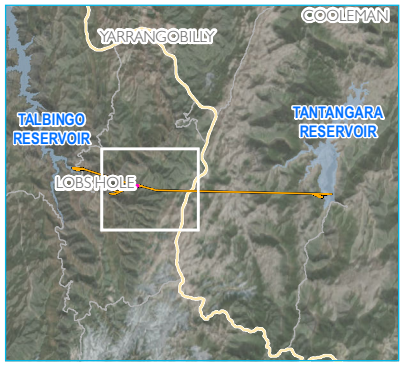
Tailrace intake and tunnel

Snowy 2.0
Scoping Report
Main Works
Figure 3.3

snowy 2.0

EMM
creating opportunities





KEY

Snowy 2.0 operational elements
- Tunnels, portals, intakes, shafts
- Power station
- Utilities
- Permanent road

Snowy 2.0 construction elements
- Temporary construction compounds and surface works

Existing environment
- Main road
- Local road
- Watercourse

Power station

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 1 2 km

GDA 1994 MGA Zone 55

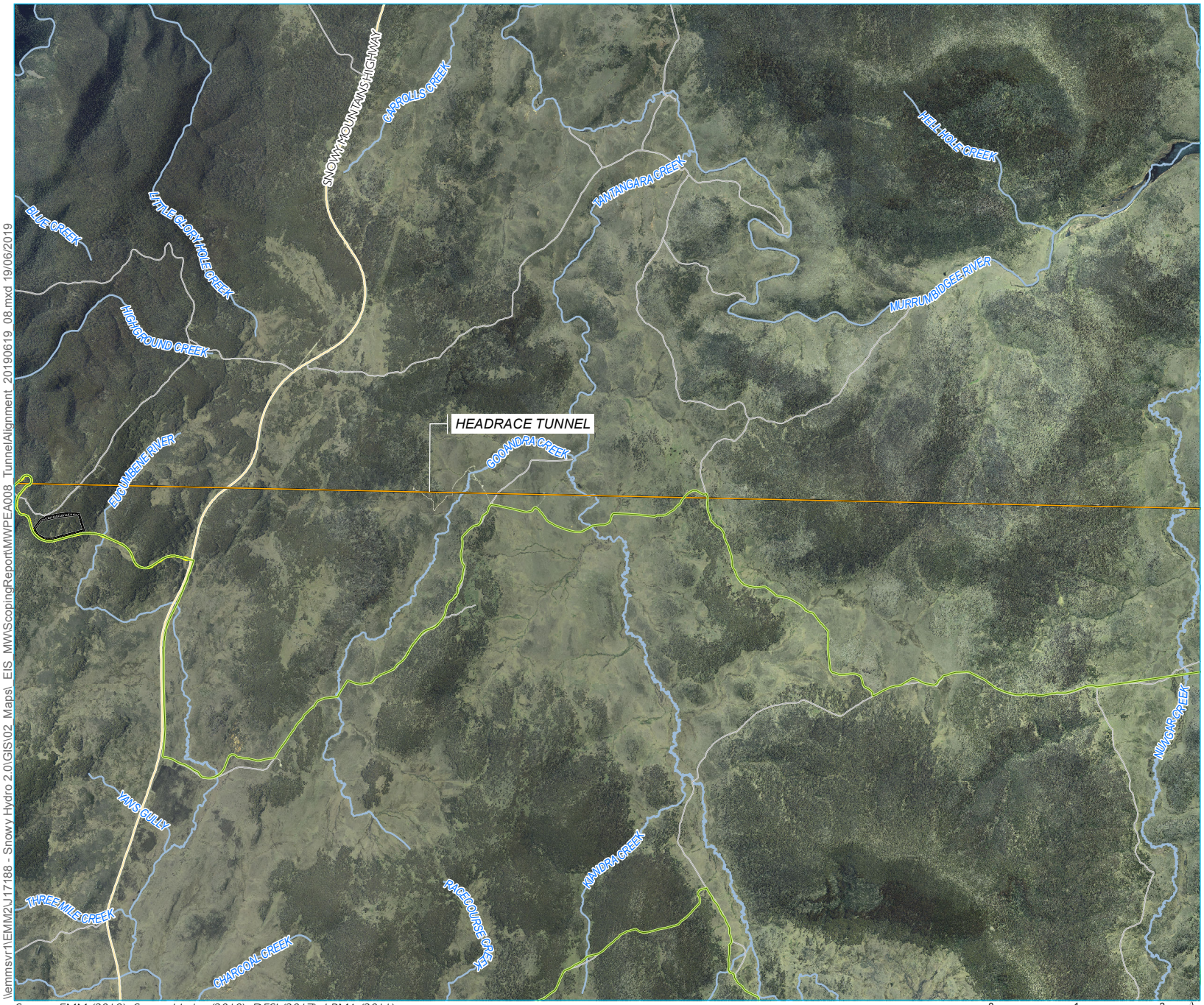
N

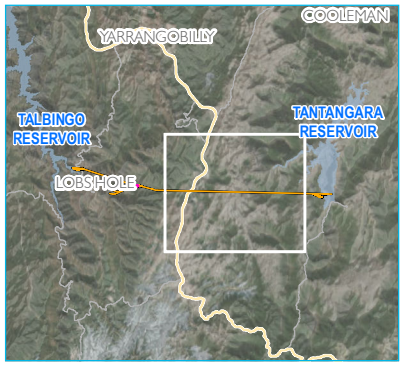
Snowy 2.0
Scoping Report
Main Works
Figure 3.4

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\ScopingReport\MWPEA007 PowerStation 20190619 09.mxd 19/06/2019





KEY

Snowy 2.0 operational elements
- Tunnels, portals, intakes, shafts
- Utilities
- Permanent road

Snowy 2.0 construction elements
- Temporary construction compounds and surface works

Existing environment
- Main road
- Local road
- Watercourse

Source: EMM (2018); Snowy Hydro (2018); DFSI (2017); LPMA (2011)

0 1 2 km

GDA 1994 MGA Zone 55

N

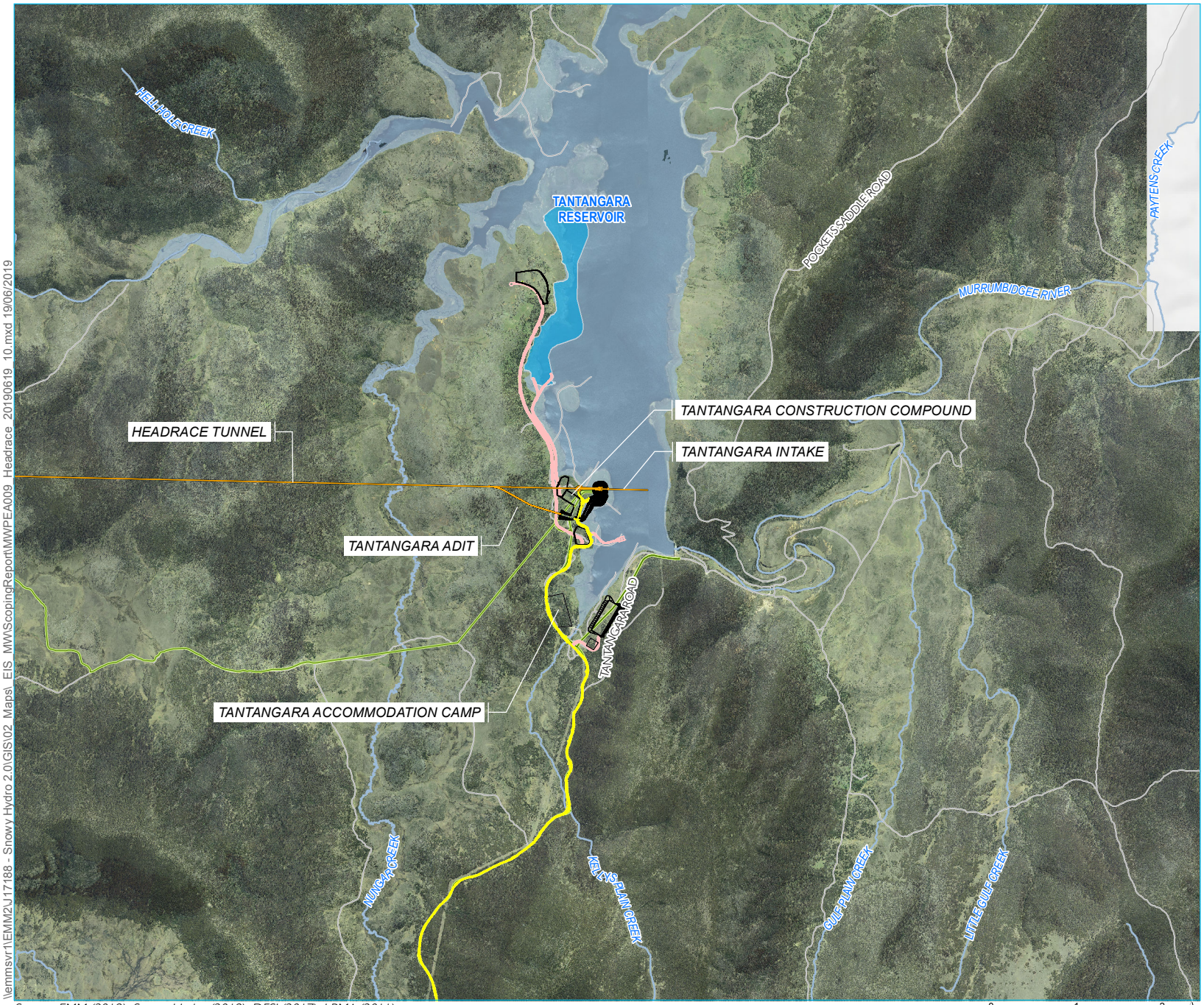
\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\ScopingReport\MWPEA008 TunnelAlignment 20190619 08.mxd 19/06/2019

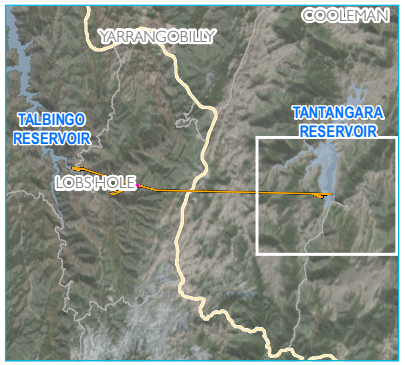
Headrace tunnel

Snowy 2.0
Scoping Report
Main Works
Figure 3.5

snowy 2.0

EMM creating opportunities





KEY

Snowy 2.0 operational elements
- Tunnels, portals, intakes, shafts
- Utilities
- Permanent road

Snowy 2.0 contruction elements
- Temporary construction compounds and surface works
- Temporary access road
- Indicative rock emplacement area

Existing environment
- Local road
- Watercourse
- Waterbody

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 1 2 km

GDA 1994 MGA Zone 55

N

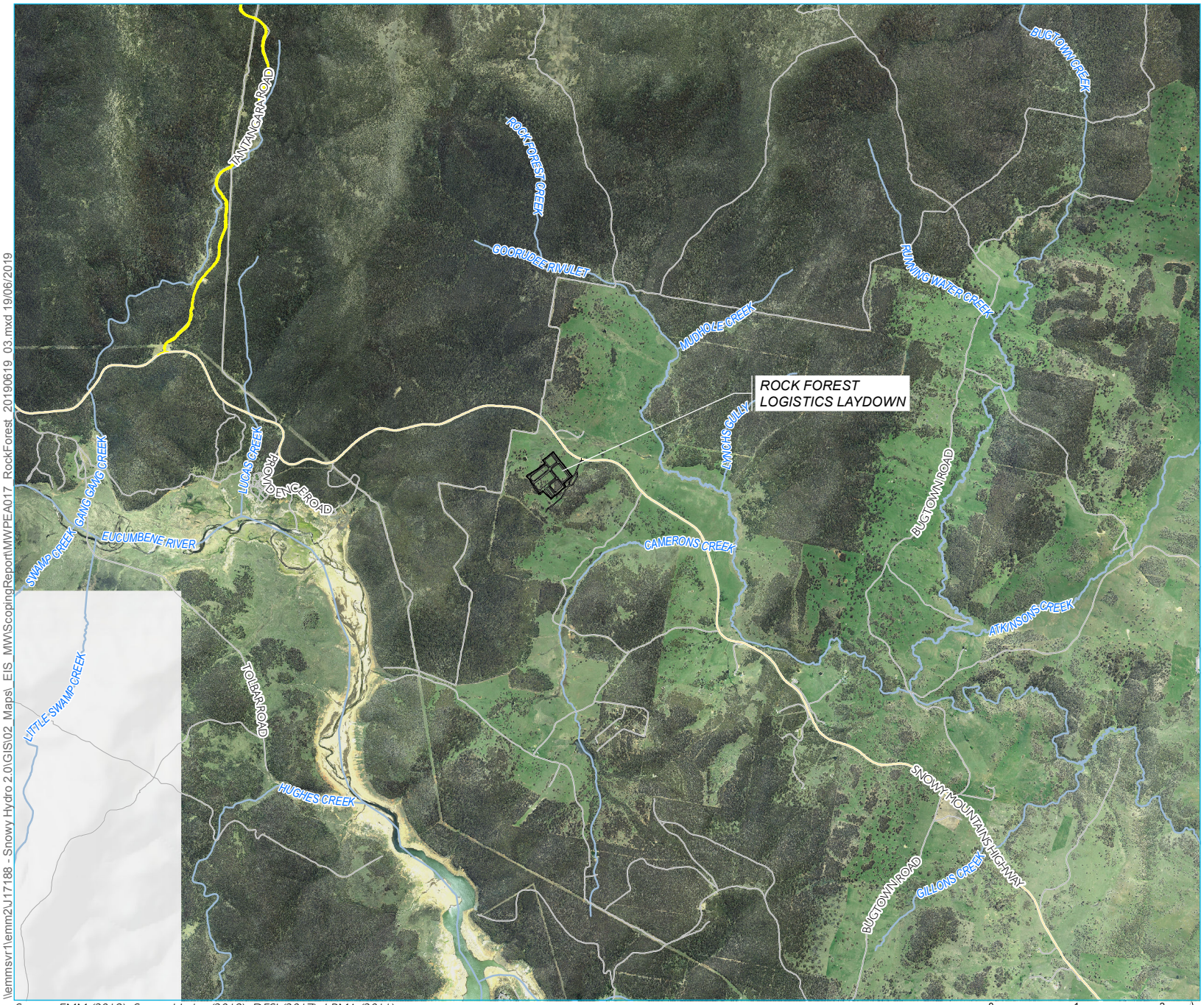
\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\ScopingReport\MWPEA009 Headrace 20190619 10.mxd 19/06/2019

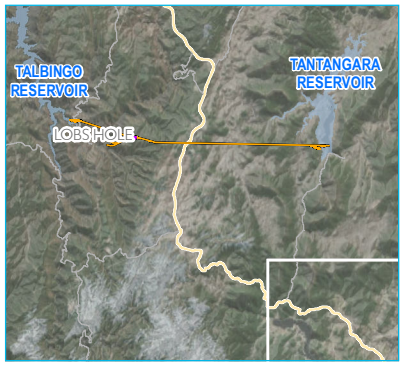
Headrace intake and tunnel

Snowy 2.0
Scoping Report
Main Works
Figure 3.6

snowy 2.0

EMM creating opportunities





KEY

Snowy 2.0 contruction elements

- Temporary construction compounds and surface works

Snowy 2.0 operational elements

- Permanent road

Existing environment

- Main road
- Local road
- Watercourse

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 1 2 km

GDA 1994 MGA Zone 55

N

\\emmsvr1\emm2\J17188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_MW\ScopingReport\MWPEA017_RockForest_20190619_03.mxd 19/06/2019

Rock Forest

Snowy 2.0
Scoping Report
Main Works
Figure 3.7

snowy 2.0

EMM
creating opportunities

3.2.4 Access tunnels

Access tunnels are needed to provide efficient and safe access to permanent infrastructure. Access tunnels are considered to be permanent tunnels, which may also be used during construction of operational infrastructure. Access tunnels proposed for Main Works are shown in Figure 3.1 and summarised in Table 3.5.

All access tunnels will have portals and surface infrastructure established to facilitate entry. Portal positions for the permanent tunnels have been defined based on the topography, geological environment and spatial dimensions of the tunnel. Tunnels requiring surface infrastructure (ie portals) are the MAT and ECVT , tailrace and headrace construction adits.

The MAT is the Exploratory Works tunnel, refitted and redesigned, as required, to provide the permanent main entry to the underground power station, power waterway tunnels, chambers and shafts.

Table 3.2 Permanent access tunnels

Access tunnel	Description
MAT	The MAT is the primary access conduit to the power station complex during operation. It is required for the transportation of the major mechanical and electrical equipment into the power station. The MAT meets the power station at its southern end and is approximately 2.5 km-long with an internal diameter of 9.8 m.
MAT2	To provide flexibility in the construction of the machine hall and transformer hall as well as improved operational access, a second MAT is proposed. This MAT2 branches off the main MAT near the downstream surge tank to meet the power station at its northern end. MAT2 is about 390 m long.
ECVT	An approximately 2.5 km-long and 9.8 m-wide ECVT is needed for the distribution of the power generated in the power station to a cable yard on the ground surface at Lobs Hole. The ECVT will also supply fresh air into the power station, evacuate exhaust air and provide a second escape route for power station personnel in an emergency. In addition, the ECVT will also contain a number of utility and services installations required for the occasional dewatering of the tailrace tunnel. The alignment of the ECVT is located close to the confluence of Yarrangobilly River and Stable Creek.
Draft tube valve gallery access tunnel	An approximate 480 m-long and 8 m-wide tunnel providing access to the draft tube valve gallery. This will branch off the MAT.
Tailrace surge tank access tunnel	An approximate 710 m-long and 6m-wide tunnel providing access to the tailrace surge tank, branching off the MAT.

Notes: All access tunnel dimensions are indicative only.

3.2.5 Access road establishment and upgrades

As Snowy 2.0 is located in KNP, there is a limited existing road network. Approximately 24 km of new roads will need to be constructed, and approximately 45 km of existing access tracks upgraded to provide permanent access to the new facilities such as the Tantangara and Talbingo intake structures and the underground power station complex. These roads would initially be established during construction. New roads and upgrades to existing roads required for operation are identified in Table 3.3. All roads required for the project area shown on Figure 3.3 to Figure 3.6. The final road layouts will be subject to the selection of construction methods, identification of impact avoidance and minimisation measures and further design.

Bridges and waterway crossings will be required as part of the access road upgrades and establishment. A bridge is proposed at Tantangara Road over Nungar Creek. Further, it is proposed to replace the existing twin culvert on Quarry Trail over Kellys Plain Creek.

Table 3.3 Snowy 2.0 roads needed during operation and maintenance

Road	Reason for new road/road upgrade
Lobs Hole Ravine Road	Provides access from Link Road to the MAT
Mine Trail Road	Provides access from Link Road to the MAT
Tantangara Road	Provides access from Snowy Mountains Highway to Tantangara intake structure
Quarry Trail	Provides access from Tantangara Road to Tantangara intake structure
Middle Bay Road	Provides access from Lobs Hole Ravine Road to Talbingo intake structure
Talbingo Intake Road	Provides access from Lobs Hole Ravine Road to Talbingo intake structure
Marica West Trail	Provides access from Mine Trail Road to the surge shaft
Marica Trail	Provides access from Snowy Mountains Highway to the surge shaft

During construction of Snowy 2.0, some existing roads will need to be closed to the public for safety reasons. This includes Lobs Hole Ravine Road and potentially Tantangara Road. Once Snowy 2.0 is commissioned for operation, some roads may need to remain restricted or closed to public access. This will be determined as part of the final design, and any that have the potential to impact KNP operations will be subject to detailed consultation with NPWS.

3.2.6 Power and communication infrastructure

i Transmission cableyard

A cableyard will be established to facilitate the distribution of electricity from Snowy 2.0 to the transmission network and NEM. As previously stated, the establishment of the cableyard does not include any associated connection or transmission works connecting the cableyard to the transmission network.

ii Permanent auxiliary power supply

One connection point is proposed to supply permanent auxiliary power for Snowy 2.0 Main Works infrastructure from the existing electricity network, the Lobs Hole substation.

The Lobs Hole substation will be located adjacent to the existing TransGrid transmission line north-west of the intersection of Lobs Hole Road, Mine Trail Road and Lobs Hole Ravine Road. This will be a TransGrid connection of 80 mega volt amps (MVA). The Lobs Hole substation will be established during the Exploratory Works and its construction forms part of a separate application for a modification to the Exploratory Works (see Application number SSI-9208-Mod-1).

The use of this connection point will continue through the Main Works. Initially it will be used to supply power for construction works and it will be subsequently retained for permanent auxiliary power supply during operation.

iii Communication cable

Communications infrastructure will be established as part of the Snowy 2.0 Main Works and will connect infrastructure at Tantangara and Talbingo reservoirs to the existing communications system at Snowy Hydro's Tumut 3 power station (via the submarine communications cable in Talbingo Reservoir established during Exploratory Works) and Upper Tumut group control. This will involve a buried conduit linking the Talbingo intake, the underground power station, headrace tunnel surge shaft and Tantangara intake.

3.3 Construction elements

3.3.1 Overview of construction methods

The construction methods assumed for the purpose of this Scoping Report are identified in Table 3.4. It is likely that these methods would be optimised by the delivery contractor to meet Snowy Hydro requirements and to respond to environmental issues identified during the EIS.

Table 3.4 Construction method identified in the reference design

Project element	Construction method
Underground power station	Construction of the main caverns and connecting tunnels will involve drill and blast methods, followed by benching with the excavated rock being removed through the MAT and ECVT. Construction adits are also required to access the site of the underground power station.
Water intakes	Both intakes are expected to be excavated using a combination of conventional earthmoving and drill and blast methods. The method includes retaining a rock plug between the intakes and the reservoirs to allow works within a dry zone. The rock plug would be removed as part of last stages of excavation of the intake channels. Construction adits are also required to facilitate construction.
Power waterway tunnel, chambers and shafts	Construction of the headrace and tailrace tunnels is anticipated to be via tunnel boring machine (TBM). In some areas of unfavourable geology, drill and blast methods may be used. The majority of the power waterway tunnels, chambers and shafts will be concrete-lined, with some sections of steel lining as required.
Access tunnels	Access tunnels and construction adits are required for construction, operation and maintenance of Snowy 2.0. Access tunnels and construction adits will be constructed by either TBM or drill and blast methods.
Access roads	Access road construction will involve civil earthworks followed by placement of road pavement material, installation of road safety furniture and signage and site stabilisation and rehabilitation.
Power and communications	Construction of the transmission cableyard will involve civil earthworks and assembling facilities and equipment as required. Construction of the construction power supply connections will involve site establishment, upgrades to existing infrastructure and assembly of infrastructure and equipment as required. Construction of the communications cable will involve shallow trenching activities to bury the cable and rehabilitate.

3.3.2 Construction adits

Adits are required to provide access during construction and for maintenance purposes. Construction adits are generally considered to be temporary tunnels. They therefore may be subject to change in alignment and cross-section to meet the contractor's preferred construction methodology. Adits will be required to access the underground power station complex, as well as the Talbingo intake and Tantangara intake (as shown on Figure 3.3 and Figure 3.6).

3.3.3 Construction compounds

Temporary construction compounds are required to enable construction works. The main construction facilities will be at Lobs Hole in an area that is previously disturbed and expected to result in lower environmental impacts than alternate locations (Lobs Hole is also the site for the accommodation camp and construction compound for Exploratory Works). Additional construction compounds are required at Tantangara Reservoir to support the construction of the headrace tunnel and Tantangara intake, at Marica Trail for the power station ventilation shaft and the headrace surge shaft, and at the Talbingo adit (as shown on Figure 3.3 and Figure 3.6). A construction logistics site (Rock Forest) is also required outside the boundary of KNP for the storage or materials and vehicles, in particular to manage staging of deliveries during restricted periods (eg severe weather). Subject to construction suitability and contractor requirements, further areas both within and outside of the project area may be sought as additional compound areas. However, these areas would be subject to landowner consultation and would be determined with the construction contractor.

Infrastructure to be established at the construction compounds may include: offices, laydown areas, excavated rock stockpiles, water management infrastructure, workshops, construction equipment, fuel farm and bowsers, magazine (explosives), water supply infrastructure, waste water (sewage) infrastructure, water storage, power supply infrastructure, backup diesel electricity generation, lighting, concrete batching plant and material stockpiles, crushing and screening, steel rolling mill, materials testing laboratory, fire-fighting facilities, first aid facilities, parking, helipad and communications.

3.3.4 Accommodation camps

The remote nature of the project necessitates the implementation of numerous temporary facilities within the project area to ensure all construction activities can be carried out within program requirements. This includes the need to provide on-site accommodation for workers. Three accommodation camps are needed to deliver the Main Works:

- Lobs Hole accommodation camp (an expansion of the accommodation camp proposed in the Exploratory Works EIS will be required due to the significant increase in workforce necessary for Main Works);
- Marica accommodation camp, generally located above the underground power station; and
- Tantangara accommodation camp, located on the western side of Tantangara Reservoir.

The Lobs Hole accommodation camp will continue to provide the same facilities as those described in the Exploratory Works EIS, however, with an increased scale to an estimated 1,500 to 2,000 personnel. This will be dependent on the construction contractor's methodology and will be further refined.

The accommodation camp at Tantangara will include the following:

- single-dwelling accommodation units (capacity for up to 500 workers);
- administration/retail, kitchen, central facilities, gym/recreation and maintenance;

- limited bus and car parking;
- service infrastructure including a water treatment plant (WTP), sewer treatment plant (STP) diesel-powered generators and fuel farm and waste facility; and
- water management infrastructure.

Minor earthworks by way of benching is anticipated to achieve a flat topography for the site.

The Marica accommodation camp will have capacity to house about 100 people.

3.3.5 Construction access roads

Construction access roads are temporary roads required for construction purposes. They are needed to provide safe access for construction vehicles, delivery of equipment and transfer of materials. Proposed access roads are shown on Figure 3.1 and Figure 3.3 to Figure 3.6.

Construction access roads are summarised in Table 3.5, and have been determined based on the construction methodology assumed for the reference design. These roads may be optimised, removed or additional roads added by the construction contractor to suit their construction methodology and to minimise environmental impacts identified throughout the EIS process. As identified in Section 3.2.6, bridges will be required at some locations to cross existing waterways. Several roads identified in Table 3.5 also form part of Exploratory Works. These are: Mine Trail Road, Lobs Hole Ravine Road, Middle Bay Road and Camp Road. Roads constructed for Exploratory Works may require additional upgrades for the Main Works.

Table 3.5 New roads and upgrades needed for construction

Road	Reason for new road/road upgrade
Tantangara Camp Road	Access to construct Tantangara accommodation camp
Tantangara Road*	Access to construct Tantangara intake
Quarry Trail *	Access to construct Tantangara intake and to the rock emplacement area
Marica Trail*	Access to the Snowy Mountains Highway from the surge shaft and to link to Talbingo Reservoir
Marica West Trail *	Access to the surge shaft construction area
Mine Trail Road*	Access to construct the MAT and ECVT
Lobs Hole Ravine Road*	Access from Link Road to Talbingo Intake, MAT and ECVT
Middle Bay Road *	Access from Lobs Hole Ravine Road to construct the Talbingo intake and access from the Middle Bay boat ramp to construct the MAT and ECVT
Ravine Bay Road	Access from Lobs Hole Road to rock emplacement areas at Ravine Bay and Middle Creek
Camp Road	Access to the Lobs Hole accommodation camp
Pipeline Road	Access to the construction water intake structure
Talbingo Intake Road *	Access to construct the Talbingo intake structure

Note: * indicates the road will become a permanent access road for use during operation.

3.3.6 Excavated rock management

i Reuse and disposal of extracted rock

It is estimated that approximately 8,000,000 m^3 to 12,000,000 m^3 of bulked rock and soil will be excavated associated with the construction of the tunnel excavations, power station complex caverns and intakes. Excavated rock will be systematically tested and a determination made as to its suitability for:

- re-use as a construction material for the project as aggregate, manufactured sand or pad construction;
- placement within Tantangara and Talbingo reservoirs; and
- temporary or permanent land-based disposal off-site outside of the KNP.

Until the suitability of its use is determined, extracted material may need to be temporarily stored on land within KNP. The location for storage of excavated rock within KNP would need to be determined and agreed in consultation with NPWS. Similarly, any reuse options identified by NPWS would be determined through consultation.

ii Placement within reservoirs

Placement of excavated material is proposed for locations within Talbingo and Tantangara reservoirs. Details of the locations and methods are still being developed by the construction contractor as part of the design process.

At this stage it is proposed that representative samples of extracted material will be tested following excavation, primarily for its geochemical and leachability properties. Any rock assessed as unsuitable for placement within the reservoirs would instead be reused or stockpiled, or potentially removed from the project area if suitable disposal locations are identified. Suitable material would be transported to the placement areas to be progressively filled from the shore to the reservoir, between MOL and FSL. All placement within the reservoirs would occur within silt curtains and be subject to detailed monitoring before, during, and after placement.

Suitable subaqueous placement areas within Talbingo Reservoir were previously identified for Exploratory Works, with one area identified for an initial placement trial to inform the further development of the placement program. The proposed method for placement within the reservoirs has since been revised in order to provide a method that is practical and efficient to implement, and meets the program requirements. Therefore, the Exploratory Works trial program will be amended to ensure it appropriately reflects the proposed shore-based method for placement during Snowy 2.0 Main Works (subject to modification and consultation with DPE, EPA and DPI Fisheries).

The shore-based placement method aims to improve efficiency of placement, minimise barging activities on both reservoirs and improves the ability to manage impacts at Tantangara by placing material above the water level (ie placing in the dry). Placement areas and methods for Talbingo and Tantangara reservoirs are subject to ongoing investigations to ensure minimal environmental impacts, and subject to ongoing consultation with relevant stakeholders and government agencies.

3.3.7 Supporting services infrastructure and utilities

i Water supply and wastewater

a Temporary water and wastewater

Temporary water supply and wastewater infrastructure will be required for each of the accommodation camps and construction compounds. Wastewater is likely to be generated by the following sources during construction:

- seepage water from tunnel construction; and

- sewage from the accommodation camps and construction compounds.

During construction and operation, process water, retrieved from the tunnels, chambers and shafts, will need to be collected and treated prior to disposal. Any pipelines required for water supply and discharge will generally run adjacent to new and existing access roads.

b Treatment

An STP will be established at each accommodation camp to treat sewage generated to acceptable effluent quality standards.

A WTP is proposed at each tunnel portal to treat tunnel seepage and construction related wastewater. The treated tunnel water will be used for tunnel construction purposes and construction related purposes such as concreting works, dust suppression and topping up of tanks for fire-fighting purposes. It is proposed that any excess treated seepage water would be discharged to either Talbingo or Tantangara Reservoir. The treatment plants proposed are modular package treatment units. Treatment modules are likely to be installed in stages so that additional units can be brought on line depending on the quality and quantity of seepage water encountered.

ii Construction power supply

Only one construction supply point is proposed, a 80 MVA substation at Lobs Hole, which would become a permanent supply point for Snowy 2.0 (discussed earlier in Section 3.2.6). The Lobs Hole substation will be established during the Exploratory Works and its construction forms part of a separate application for a modification to the Exploratory Works (see Application number SSI-9208-Mod-1). Diesel generators would be used until the construction supply is established.

Transmission of power from the substation to work sites during construction at Talbingo, Marica and Talbingo will be via a combination of above-ground (temporary only) and trenched infrastructure. The route will follow existing and proposed road alignments in order to minimise impacts.

iii Communication infrastructure

Communications infrastructure to be established as part of the Snowy 2.0 Main Works will consist of a communications loop linking the construction compounds and accommodation camps with the existing communications system at the Tumut 3 power station. This will involve a buried conduit linking the Talbingo intake, the underground power station, penstock guard valve chamber, headrace tunnel surge shaft and Tantangara intake.

A fibre optic service is proposed during the Exploratory Works phase of the development. This involves a submarine cable from Tumut 3 power station to Middle Bay in Talbingo Reservoir and then via a buried conduit to Lobs Hole and the exploratory tunnel. This service will be extended to the Main Works to provide a buried conduit linking the Talbingo intake, power station, valve chamber, head race tunnel surge shaft and Tantangara intake. This service will be buried in a small trench predominantly along existing roads and tracks.

3.4 Construction details

3.4.1 Site access and movement

i Construction and workforce access

Site access for the delivery of plant and equipment will primarily be via road, including for large and oversized equipment. Road widening and realignment is therefore expected to be able to accommodate these oversized loads.

Site access for the workforce will primarily be by existing roads and via the proposed construction access roads.

ii Public access restrictions and road closures

During construction, some roads will need to be closed or restricted to the public for safety reasons. These potential road closures will restrict public access to parts of KNP. Roads identified as potentially requiring closure or restrictions to the public during construction include:

- Lobs Hole Ravine Road (continued closure, initially closed for the duration of Exploratory Works); and
- Tantangara Road (possible restriction or closure).

In addition, there will also be closure and restriction to parts of Talbingo and Tantangara reservoirs throughout construction of Main Works.

Detailed consultation will be carried out with NPWS to understand the potential impacts to recreation and park operations, and to determine suitable management measures to implement during construction.

3.4.2 Transport of materials

i Transport of equipment and materials to site

It is expected that construction materials will be sourced from different locations including nearby towns such as Cooma and Tumut, with some items and equipment being sourced from major centres such as Canberra, Sydney and Melbourne. The largest loads - the transformers, generators, turbines and TBMs - will be imported into Australia and are expected to be transported by road from Botany Bay in Sydney, Port Kembla in Wollongong or the Port of Eden. Some minor road works (such as temporary roundabout levelling) will be required for transportation of oversize loads.

ii Aggregate and sand sources

It is currently expected that approximately 600,000 m^3 to 800,000 m^3 of both aggregate and sand are required for concrete production. Some quantities of 'manufactured' sand would be retained by crushing suitable excavated material. The remainder of the required material will be supplied from quarries external to the project area. At this stage the external sources of aggregate and sand are still under consideration.

iii Conveyors

Conveyors, providing an alternative means of transporting extracted material from the excavation front to the disposal location, may be included in the final design for Snowy 2.0. While access roads are still required, conveyors have an advantage over other means of primary transport in locations where terrain is particularly rugged and where biodiversity or other values are high. They also allow a reduction in the number of construction heavy vehicle movements.

3.4.3 Workforce

It is currently expected that a construction workforce for Snowy 2.0 Main Works will be approximately 1,500 to 2,000 people at its peak. These workers will be accommodated within the accommodation camps during construction (as discussed at Section 3.3.4). It is expected that the majority of workers will fly in and out of Cooma or Canberra airports and then travel to the accommodation camps via bus. Workforce numbers and arrangements will be confirmed during the final design and included within the EIS.

3.4.4 Schedule and hours of construction

It is planned that construction of Snowy 2.0 Main Works will commence in 2020 and be completed by 2026, and require a 24-hour-a-day, seven-days-a-week operation. A detailed schedule will be included in the EIS. If approved, the Snowy 2.0 Main Works would likely commence prior to the completion of Exploratory Works.

3.5 Rehabilitation and decommissioning requirements

Given that most of Snowy 2.0 Main Works is within the boundaries of the KNP, Snowy Hydro will liaise closely with NPWS to determine the extent of decommissioning of temporary construction facilities and rehabilitation activities to be undertaken following construction of Snowy 2.0 Main Works. This approach will be taken to ensure that decommissioning allows for integration with future planned recreational uses of these areas and to maintain the values of KNP.

Rehabilitation will be considered during all phases of construction, from design and site preparation, through to stabilisation and revegetation. Likely rehabilitation activities are shown in Table 3.6.

Table 3.6 Planned rehabilitation activities

Surface Works element	Rehabilitation
Road access works	All areas disturbed by road works will be stabilised through revegetation, erosion and sediment control.
Accommodation camps	To be demobilised and infrastructure removed. Site to be revegetated and returned to a agreed condition.
Construction portals	Portal area to be sealed from entry using suitable fill material, shaped, stabilised and rehabilitated by applying organic matter and planting.
Construction compounds and supporting infrastructure	To be demobilised and all infrastructure removed. Site to be revegetated and returned to agreed state.
Tunnel entries	Construction or works area is to be limited and revegetated. The tunnel entry batters will be stabilised and revegetated.
Temporary stockpiles	Stockpile areas to be rehabilitated and the surface repaired to a suitable standard.
Intake structures	The intake structures at both Tantangara and Talbingo reservoirs will have a façade treatment above minimum operating level (MOL) that appropriately stabilises the batters and is of a finish and appearance that mitigates the visual impact of the structure.

4 Strategic and statutory context

4.1 Strategic context and the need for Snowy 2.0

4.1.1 Historical development of the Snowy Scheme

The Snowy Scheme was initially designed to collect and store water, divert it through trans-mountain tunnels and power stations and then release it west of the Snowy Mountains into the catchments of the Murray and Murrumbidgee rivers. This long-term water regulation was designed to counteract the effects of severe drought sequences and increase agricultural productivity in the Murray Darling Basin (Snowy Hydro 2017). The additional potential for the Snowy Scheme to generate hydro-electricity was realised early on and embedded into the design. Snowy 2.0 involves linking Talbingo and Tantangara reservoirs. This tunnel link can be seen to have been contemplated by a number of historical plans for the Snowy Scheme, but was not built at the time.

The *Snowy 2.0 Feasibility Study* (Snowy Hydro 2017) identified that a key study regarding the connection of the two reservoirs was a study completed in 1991, titled *Snowy Mountains Scheme Augmentation Ranking Study* (Dunn 1991). This analysis included a summary of studies undertaken before 1991, and stated that augmentation studies of pumped storage schemes were first considered in 1966 during the design and construction phase of the Snowy Scheme. Further studies concerned with energy reserve capability and mostly of pumped storage schemes were undertaken from 1980-1986.

The Snowy Scheme plays a critical role in the NEM today and has been modernised and well maintained over the decades since its construction. To meet the future needs of a rapidly-changing NEM, a major pumped-hydro expansion of the Scheme would enable the delivery of significant quantities (ie up to 2,000 MW) of electricity to major load centres at any time within minutes, and store large amounts of energy (ie up to 350 GWh) in times of low demand.

Snowy 2.0's fast start, dispatchable generation would provide energy security and reliability across the NEM at times of high energy demand. It is expected that as the economy continues to decarbonise, the demand for the energy products and services that Snowy Hydro provides today backed by the existing Scheme will increase significantly. Snowy 2.0 has been proposed to respond to the rising challenges facing the NEM.

The existing Snowy Scheme has been operating since 1949. KNP which was established in 1967, encompasses the Scheme assets. All activities within KNP must be consistent with the *Kosciuszko National Park Plan of Management 2006* (PoM). The PoM incorporates the Snowy Management Plan, which outlines the environmental management obligations of Snowy Hydro within KNP. The Snowy Management Plan would need to be reviewed and updated as required for Snowy 2.0 Main Works.

4.1.2 Current national and State energy policies

Under Australian constitutional arrangements, the regulation of energy is the responsibility of the various states and territories. In NSW, the minister with responsibility for general matters relating to electricity is the Minister for Energy and Utilities, with the electricity system, comprising generation, transmission and distribution through to retail business spread across separate operators.

These assets and transmission lines form part of a larger interconnected network that covers Australia's eastern and south eastern seaboard and forms the NEM. The NEM provides transmission of electricity to almost 10 million homes and businesses across state and territory based networks and six cross-border connections.

The NSW energy system (and broader NEM) is facing several challenges through rising energy costs, deterioration in energy system security and reliability, and a transition in the generation mix away from coal-fired, dispatchable, baseload power to renewable wind and solar power characterised by intermittency. This energy transition is driven by several strategic plans and policies set out by the Australian and NSW governments.

An Integrated System Plan for the NEM was recently released by the Australian Energy Market Operator (AEMO 2018). The plan evaluates the likely changes to the NEM over the next 20 years. Snowy 2.0 is identified in the plan as a development in the medium term to enhance trade between regions, provide access to storage, and support extensive development of renewable energy zones. Some of the other key legislation, plans and policies encouraging and supporting the transition to renewable energy (and directly relevant to Snowy 2.0) are:

- Commonwealth *Renewable Energy (Electricity) Act 2000* – which aims to encourage additional generation of electricity from renewable sources, to reduce emissions of greenhouse gases in the electricity sector and to ensure that renewable energy sources are ecologically sustainable;

- Australian Renewable Energy Target scheme – a scheme intended to reduce emissions of greenhouse gases in the electricity sector and encourage additional generation of electricity through investment in sustainable and renewable sources;

- the Paris Agreement – a global agreement signed by the Commonwealth Government that sets in place a durable and dynamic framework for all countries to take climate action from 2020;

- NSW Renewable Energy Action Plan (2014) – a plan that positions NSW to increase the use of energy from renewable sources at least cost to the energy customer and with maximum benefits to NSW, and designed to support broader environmental objectives to reduce carbon emissions; and

- NSW Energy Security Taskforce and Energy Zones – investigates and recommends management of NSW's energy security and resilience over the long-term. Energy zones in NSW have been recommended to provide opportunities to better match supply and demand across the NEM, minimising transmission losses.

4.1.3 Need and benefits of Snowy 2.0

Snowy 2.0 is a critical project for the NEM as it moves to a low-emissions future. As the transition to renewables accelerates, reliable supply cannot be achieved without large scale energy storage. Snowy 2.0 is the least cost option to build large scale storage and is centrally located between the NEM's two biggest load centres, Sydney and Melbourne.

Snowy 2.0 would build on the Snowy Scheme's existing capabilities and meet the needs of the market and consumers by providing fast-start, clean energy generation to address supply volatility, as well as fast-start capability and large-scale storage to address the intermittency issues associated with renewables.

The high degree of urgency with which Snowy Hydro is progressing the project reflects the rate of change being experienced across the NEM and the critical need for the energy market products that Snowy Hydro sells. The falling costs of new renewable projects makes them economically favourable, even with a cost added for 'firming'.

As the transition to renewables accelerates, the need for energy storage will only increase and pumped-hydro projects across the NEM, gas and diesel peakers, commercial scale batteries and demand-side solutions will play a role.

Snowy 2.0's 350 GWh of energy storage is enough to underpin the stability and reliability of the NEM even during prolonged weather events, such as wind or solar 'droughts'. The Independent Review into the Future Security of the National Electricity Market - Blueprint for the Future (Finkel et al 2017) (also known as the Finkel review) concluded that a secure power system is a necessary condition for a reliable supply of electricity to consumers and recommended options for improving security, including large-scale pumped hydro-electric storage.

Snowy 2.0 would bring much-needed competition to the market by not only adding new generation supply but also underpinning the supply of additional 'firmed' energy. This will turn place downward pressure on peak energy prices, providing economic benefits to the consumer.

Snowy 2.0 has the capacity to service numerous retailers and generators in the market, covering the needs of each at different times. A large, centrally-connected asset is more cost effective than individual companies all building their own plants to cover the absolute peak demand within their portfolios, which does not often occur. Given the peaks and troughs in energy loads, some portion of their assets will be underutilised and the system will be 'over-built' at a cost that will be ultimately be borne by consumers.

If Snowy 2.0 is not developed, the likely alternative is that a combination of gas-fired and diesel peak electricity generating plants would be built. This option would cost twice as much as building Snowy 2.0.

Compared with other alternatives, Snowy 2.0 provides:

- increased supply of energy generation and competition for the NEM putting downward pressure on energy prices;
- increased efficiency of the NEM by absorbing excess energy;
- increased storage capacity, longer lifespan for storage, and cheaper full life cycle cost when compared to current lithium-ion storage batteries;
- more efficient dispatch of electricity to major load centres and less emission generation when compared to traditional electricity generating plants; and
- improved security and reliability of supply when compared to the intermittency of primary renewable energy sources (such as wind and solar).

While Snowy 2.0 is a critical project for the NEM, more developments will be needed to meet the future needs of a decarbonising NEM. Other pumped-hydro projects, gas and diesel peakers, commercial scale batteries and demand-side solutions will all be needed.

The *Snowy 2.0 Feasibility Study* delivered in December 2017 confirmed that Snowy 2.0 is economic, technically feasible and financeable (Snowy Hydro 2017). Snowy Hydro progressed to a Financial Investment Decision (FID) in December 2018 to proceed with the project, with shareholder approval confirmed in March 2019.

4.2 Operation of Snowy 2.0 within existing scheme

4.2.1 Existing authorisations

The existing Snowy Scheme has been operating since 1949. The rights of Snowy Hydro to occupy and operate the existing Snowy Scheme within the KNP are guaranteed through the:

- Snowy Hydro Corporatisation Act 1997 (NSW) (SHC Act);
- Snowy Park Lease issued under Part 6 of the SHC Act;
- Snowy Water Licence issued under Part 5 of the SHC Act;
- Roads Maintenance Agreement between Snowy Hydro and NPWS;
- Schedule of Existing Scheme Development proclaimed under Part 7 of the SHC Act;
- Snowy Management Plan included in the PoM; and
- National Parks and Wildlife Regulation 2009 (NSW) (NPW Regulation) which includes provisions specific to the Snowy Scheme and the activities of Snowy Hydro; including an obligation on Snowy Hydro under clause 46 of the NPW Regulation to comply with the provisions of the Snowy Management Plan.

The SHC Act came into force on 28 June 2002. It enabled the corporatisation of the former Commonwealth Snowy Mountains Hydro-electric Authority, such that it became Snowy Hydro Limited, and entitled Snowy Hydro to the key operating instruments referenced above to enable the continued operation of the existing Snowy Scheme. Concurrent corporatisation legislation was also passed in each of the Commonwealth and Victorian parliaments.

Part 7 of the SHC Act has the effect of deeming the *"existing Scheme development"* to have planning approval under the EP&A Act. The parameters of the *"existing Scheme development"* are contained within the *Snowy Hydro Corporatisation Act 1997 No. 99 – Proclamation* and *Snowy Hydro Corporatisation Act 1997 – Schedule of Existing Developments.* Relevantly, these parameters are relatively unconstrained, except to the extent that Full Supply Levels are specified.

4.2.2 Release obligations under the Snowy Water Licence will be unchanged

The Snowy Water Licence is issued under Part 5 of the SHC Act. It embodies the operating and accounting principles of the Snowy Scheme.

In particular, the Snowy Water Licence confers on Snowy Hydro the following rights in accordance with section 23 of the SHC Act:

- the right to collect all water from the rivers, streams and lakes within the Snowy water catchment;
- the right to divert that water;
- the right to store that water;
- the right to use that water to generate electricity, and for purposes that are incidental or related to the generation of electricity or to the management of that water in the Company's works; and

- the right to release water from storage in accordance with the arrangements made by the licence for the release of that water.

The “Snowy water catchment” includes:

- the catchment of the Swampy Plain River upstream of Khancoban Pondage and the course of that river 200 m downstream of that pondage; and

- the catchment of the Murrumbidgee River upstream of Tantangara Dam and the course of that river 200 m downstream of that dam, and the Goodradigbee River catchment above the Goodradigbee River Aqueduct; and

- the catchment of the Snowy River upstream of Jindabyne Dam and the course of the Snowy River 200 m downstream of the Jindabyne Dam and the catchments of the Mowamba River and Cobbon Creek above the Mowamba River Aqueduct and the Cobbon Creek Aqueduct; and

- the catchment of the Tumut River upstream of the Jounama Dam; and

- the catchment of the Tooma River above the junction of the Tooma River and Sparkes Creek.

Under the existing Snowy Scheme, the primary factor determining lake levels in the 16 major and various minor reservoirs that comprise the Snowy Scheme are inflows into the Snowy water catchment (both rainfall and Snow melt). These inflows will not be affected in any way as a result of the construction and operation of Snowy 2.0.

The second factor determining lake levels in the existing Snowy Scheme are Snowy Hydro’s releases. Under the Snowy Water Licence, Snowy Hydro is obliged to release a minimum volume of water into the River Murray and the Tumut and Murrumbidgee River catchments each year. Snowy Hydro is also obliged to make (smaller) environmental releases, principally from Jindabyne Dam and Tantangara Dam. These releases also will not be altered or affected in any way as a result of the construction and operation of Snowy 2.0.

4.2.3 Water storage variability within the existing Snowy Scheme

Under the current operations of the existing Snowy Scheme, the levels within the various reservoirs are subject to significant variability over both the short and long terms due to the interplay of a number of factors relating to the design and construction of dams, the environmental releases required by the Snowy Water Licence as well as the variations of annual flows into the existing Scheme.

In order to meet the release obligations under the Snowy Water Licence, water is diverted in the existing Scheme (in accordance with the rights under the Snowy Water Licence) through various types of water management infrastructure (principally tunnels, power stations and pumps) through the ‘Snowy-Murray Development’ and ‘Snowy-Tumut Development’ (see Figures 4.1, 4.2 and 4.3 below).

These Developments each operate as a closed system up until the point that water is released from the Scheme. Furthermore, water available to a particular development must be released from that development because Snowy Hydro is not authorised to transfer water between developments without government approval.

Figure 4.1 **Snowy-Tumut Development and Snowy-Murray Development overview**

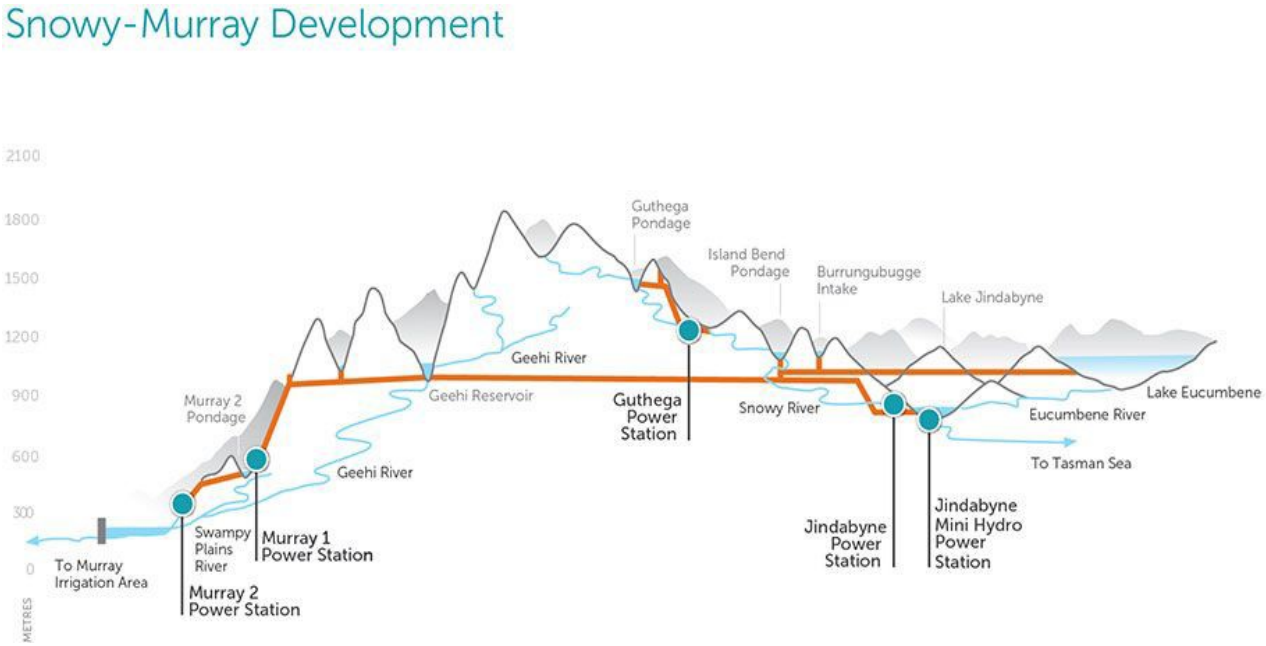


Figure 4.2 **Indicative section of the Snowy-Murray Development**

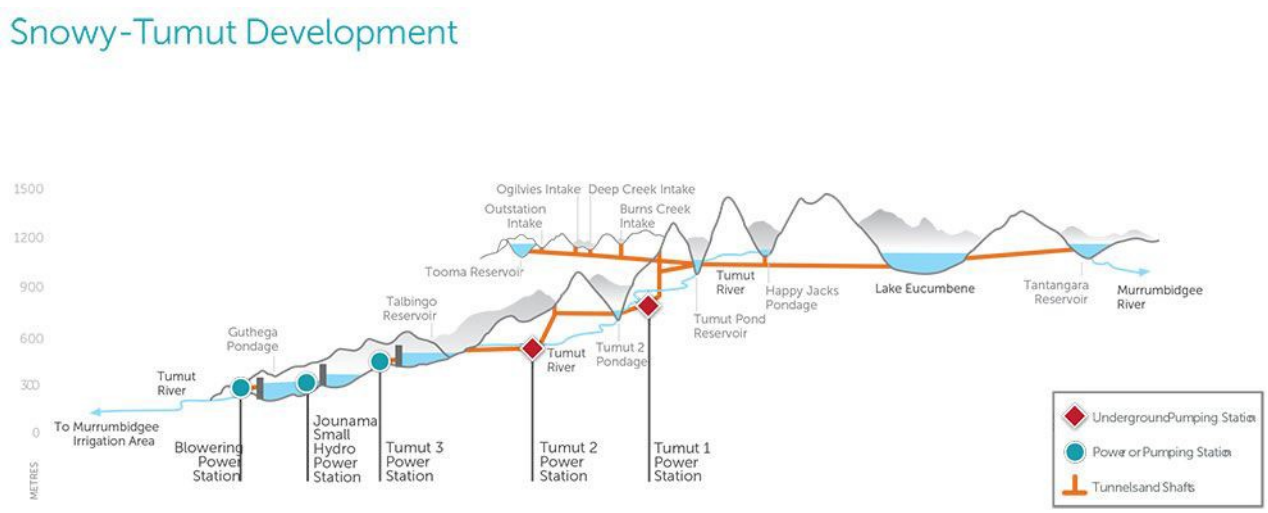


Figure 4.3 Indicative section of the Snowy-Tumut Development

In operating the existing Snowy Scheme, other than ensuring that it meets its water accounting and release obligations under the Snowy Water Licence, Snowy Hydro is not otherwise constrained in operating its facilities to the full extent of its physical capabilities (that is, to Full Supply Level) to meet its operational and commercial objectives related to the operation of a peaking hydroelectric facility and providing long term reliability for the western rivers.

This flexibility is authorised because Snowy Hydro has deemed planning permission under the SHC Act and *Schedule of Existing Developments* to operate each reservoir within the Snowy Scheme up to Full Supply Level in order to collect inflows, divert water and meet release obligations. Although Snowy 2.0 has the potential to change the variability patterns below Full Supply Level in a number of reservoirs, Snowy 2.0 does not propose any change to the Full Supply Levels currently authorised under the existing Snowy Scheme.

It is also important to note that Snowy Hydro's releases are also influenced by its operations in the National Electricity Market based on the market forces of supply and demand. While the Snowy Water Licence imposes minimum annual release obligations, and conditional minimum release requirements for the months of December to April, it does not regulate storage levels in the Scheme. Accordingly, subject to these requirements, Snowy Hydro is free to manage water resources in the scheme in a way which maximises its commercial profitability. This is critical as it is the only means by which Snowy Hydro can generate revenue to maintain and operate the water infrastructure of the Snowy Scheme. As such, Snowy Hydro is entitled to (for example):

- move water to a storage that provides the head-waters of a particular power station if it anticipates the requirement to use that power station; and
- move water out of a storage that provides the tail pond of a power station to create airspace if it anticipates the requirement to use that power station.

Snowy Hydro diverts and stores water in order to ensure the most efficient use of that water for the generation of electricity, whilst meeting its water release obligations.

As detailed in Section 4.1, the NEM is undergoing unprecedented transition. This will continue over the coming decades with increasing amounts of intermittent variable renewable energy (for example, from wind and solar) entering the market, and existing coal-fired power stations progressively retiring.

As part of this transition, the NEM is facing challenges through rising energy costs and deterioration in system security and reliability. Snowy 2.0 is proposed as a critical piece of infrastructure to meet the future needs of the NEM for dispatchable generation and storage.

It is important to note that even if Snowy 2.0 did not proceed, the operation of the existing Snowy Scheme would need to adapt to the changing NEM. This flexibility is already provided for, and authorised, within the existing Snowy Scheme.

4.2.4 Continued water storage variability as part of Snowy 2.0

Snowy 2.0 proposes a pumped hydro power station between two existing reservoirs (Tantangara and Talbingo) which will provide new and different capabilities to the Snowy Scheme.

In operating the power station that results from the Snowy 2.0 project, Snowy Hydro will move water directly between Tantangara and Talbingo (rather than via Eucumbene, Tumut Pond and T2 Dam), and as a consequence will store water at different locations in the Snowy-Tumut Development (ST Development). For example, more water is likely to be held in Tantangara rather than Eucumbene.

However, there will be no more water in the ST Development as a whole, and the flexible storage of that water across the storages within the ST Development below FSL is currently approved under the EP&A Act (by virtue of the deeming provisions within the SHC Act).

As a result of the operation of Snowy 2.0, the water level in Tantangara Reservoir will be more variable than historically. Notwithstanding this, operations will not affect release obligations under the Snowy Water Licence nor will it involve any change to the currently imposed FSLs. No additional land will be affected by virtue of the inundation of the reservoirs through Snowy 2.0 operations. Water storages will continue to be held wholly within the footprint of the existing FSLs.

The inundation of land below the FSL and the variability in storage levels has existed within the existing Snowy Scheme since the scheme was implemented and is deemed to have been approved under the EP&A Act. This will continue under Snowy 2.0.

Accordingly, no further assessment of any variations in storage levels in the ST Development below FSL (whether for vegetation, aquatic ecology or recreational users) is proposed to be undertaken as part of the EIS.

4.3 Coexisting with Kosciuszko National Park and other land uses

4.3.1 Kosciuszko National Park

The existing Snowy Scheme has been operating within the KNP since 1949. The existing Scheme and assets have long been part of the landscape and are a key feature in park recreation and visitation.

The KNP is reserved as a national park under Part 4, Division 3 of the NSW *National Parks and Wildlife Act 1974* (NPW Act). NSW national parks are the responsibility of the NPWS which is a part of the OEH.

KNP contains unique sub-alpine values and declared Wilderness Areas and is listed on the Australian National Heritage List. All activities within KNP must be consistent with the *Kosciuszko National Park Plan of Management 2006* (PoM) in accordance with Part 5 of the NPW Act. The PoM incorporates the Snowy Management Plan, which is set out in Schedule 2 of the Snowy Management Plan Procedures Agreement dated 3 June 2002. Snowy Hydro is required, under Part 4 of the NPW Regulation, to comply with the environmental management obligations imposed on the company under the Snowy Management Plan. The Snowy Management Plan Procedures Agreement would need to be reviewed and updated as required for Snowy 2.0 Main Works.

Various references are made to the Snowy Scheme in the PoM including within the Park Zoning provisions. The Park Zoning covers the whole of the KNP and is intended to:

- protect the values of the park, as set out in the PoM under the headings of Natural Values, Cultural Values and Recreational Values;
- optimise opportunities for a wide range of recreational activities and visitor experiences; and
- minimise conflict between participants in different recreational activities, and between visitors, management operations and other authorised uses.

KNP has five management zones:

- **Wilderness Zone** - Wilderness areas declared under the NSW *Wilderness Act 1987*;
- **Back Country Zone** - Those parts of the KNP without public road access and not within declared wilderness areas;
- **Minor Road Corridors** - Corridors along minor public roads and associated visitor developments;
- **Major Road Corridors** - Corridors along major sealed and unsealed public roads and associated visitor developments; and
- **Visitor Services Zone** - Alpine resorts, development nodes and operational centres.

An extract of the zoning scheme map relevant to Snowy 2.0 Main Works is shown at Figure 5.1. Most of the infrastructure associated with the Snowy Scheme is in the Back Country Zone that covers approximately half of the total area of KNP and (with the exception of land within the Wilderness Zone) contains those parts of KNP that are relatively remote and display high degrees of naturalness. The intent for these areas is that they are to be retained in a relatively unmodified state.

The management focus for land in this zone is to retain these parts of KNP free from further development and, where appropriate, restore their ecological integrity. Recreation management in this zone differs from that within the Wilderness Zone in that horse riding, motorised boating and various commercial recreational activities and special events are allowed in certain areas, cycling is permitted on most management trails, and the variety, standard and capacity of recreational facilities provided is greater.

Some of the roads that provide access into and across the Back Country Zone are included in the Minor Road Corridors Zone. These roads include Lobs Hole Ravine Road, Tantangara Road and some other minor roads within the project area; predominantly unsealed minor roads that are open for public vehicular use. Many of these roads are suitable for conventional vehicles with only a few offering recreational driving opportunities in which a four wheel drive is required. These roads are to be managed in a manner that provides a range of day and overnight recreational opportunities in which people can enjoy and appreciate the values of KNP while still experiencing a sense of isolation.

Further to the intent and management strategies set out in the KNP zoning, the rights of Snowy Hydro to occupy and operate the existing Snowy Scheme within KNP are guaranteed through the existing authorisations discussed in Section 4.2.1.

Part 6, Section 37(2) of the SHC Act entitles Snowy Hydro to the grant of a lease, licence, easement or right of way over KNP, for the purposes of the existing Snowy Scheme development. The Snowy Park Lease was granted to Snowy Hydro by the NSW Minister for Environment in 2002 and has a term of 75 years. The lease covers land where surface infrastructure associated with Snowy Hydro has been constructed. Section 41(5) of the SHC Act provides that development that is for a purpose for which a lease has been granted under Part 6 of the Act, is taken to be authorised under the NPW Act.

New surface infrastructure works within KNP associated with Snowy 2.0 Main Works are not covered by the existing Snowy Park Lease. Therefore, amendments will be required to the SHC Act to enable extension of the Snowy Park Lease to include the areas that will be accessed and occupied by Snowy Hydro during the works.

The Snowy Water Licence is issued under Part 5 of the SHC Act. It embodies the operating and accounting principles of the Snowy Scheme. The Snowy Water Licence confers a number of rights and obligations on Snowy Hydro for the collection of all water from the rivers, streams and lakes within the Snowy Water Catchment. Snowy Hydro has the right to divert, store and use that water to generate electricity and for purposes that are incidental or related to the generation of electricity, and the obligation to release water to meet annual release targets to the Swampy Plains and Tumut Rivers each year as well as other requirements such as environmental flows to the Snowy River and other locations within the Snowy Water Catchments.

4.3.2 Other land uses

While the project area is predominantly contained within the KNP, there are some ancillary facilities and sites located outside the boundaries of KNP. This includes Rock Forest, adjacent to the KNP boundary on the Snowy Mountains Highway to the south, which comprises rural land uses. This site would be used primarily for laydown and staging of trucks and materials.

Excavated rock may be placed on land outside of KNP. However, the location of these sites, if required, have yet to be determined. Land use across the project area is shown on Figure 4.4.

4.4 NSW planning framework

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

4.4.1 Critical State Significant Infrastructure

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

On 7 March 2018 the NSW Minister for Planning declared Snowy 2.0 to be SSI and CSSI. The declaration came into effect on 9 March 2018 and is reflected in clause 9 of Schedule 5 of the *State Environmental Planning Policy (State and Regional Development*) 2011 (SRD SEPP).

Clause 9 of Schedule 5 of the SRD SEPP identifies Snowy 2.0 as follows:

9 Snowy 2.0 and Transmission Project

(1) The Snowy 2.0 and Transmission Project is a proposed program of works for the expansion of the generating capacity of the Snowy Mountains Hydroelectric Scheme and for associated upgrades and additions to the electricity transmission network. The object of this clause is to declare development for the purposes of the Snowy 2.0 and Transmission Project that is set out in this clause to be State significant infrastructure and critical State significant infrastructure.

(2) This clause applies to development on land in any of the following local government areas:

(a) Cootamundra-Gundagai Regional,

(b) Goulburn Mulwaree,

(c) Snowy Monaro Regional,

(d) Snowy Valleys,

(e) Upper Lachlan Shire,

(f) Yass Valley.

(3) **Snowy 2.0**

Development for the purpose of pumped hydro and generation works to be known as Snowy 2.0 on land between Tantangara Reservoir and Talbingo Reservoir that involves:

(a) the carrying out of exploratory geotechnical works or engineering investigations, and

(b) the construction and operation of an underground hydroelectric power and pump station capable of supplying approximately 2,000 megawatts of hydroelectric power, and

(c) the construction of water and access tunnels, surge tank and intake and outlet structures at and between the two reservoirs.

(4) **Transmission works**

Development that involves:

(a) the construction and operation of new electricity transmission lines and an electricity substation to the west of the Talbingo Reservoir to connect Snowy 2.0 to the existing electricity transmission network at Nurenmerenmong, east of Tumbarumba, and

...

(5) The development referred to in this clause does not include:

(a) the carrying out of surveys, sampling, environmental investigations, geotechnical borehole drilling, test drilling, test excavations, or other tests or investigations, for the purposes of feasibility assessment and the preliminary design of the Snowy 2.0 and Transmission Project, or

(b) the carrying out of works to upgrade or modify electricity transmission lines, works within existing switchyards, and the installation of communications infrastructure.

(6) **Ancillary development**

Development that is ancillary to any other development in this clause, including the carrying out of works to upgrade or construct access roads, utilities infrastructure, construction accommodation, construction compounds and construction power supply.

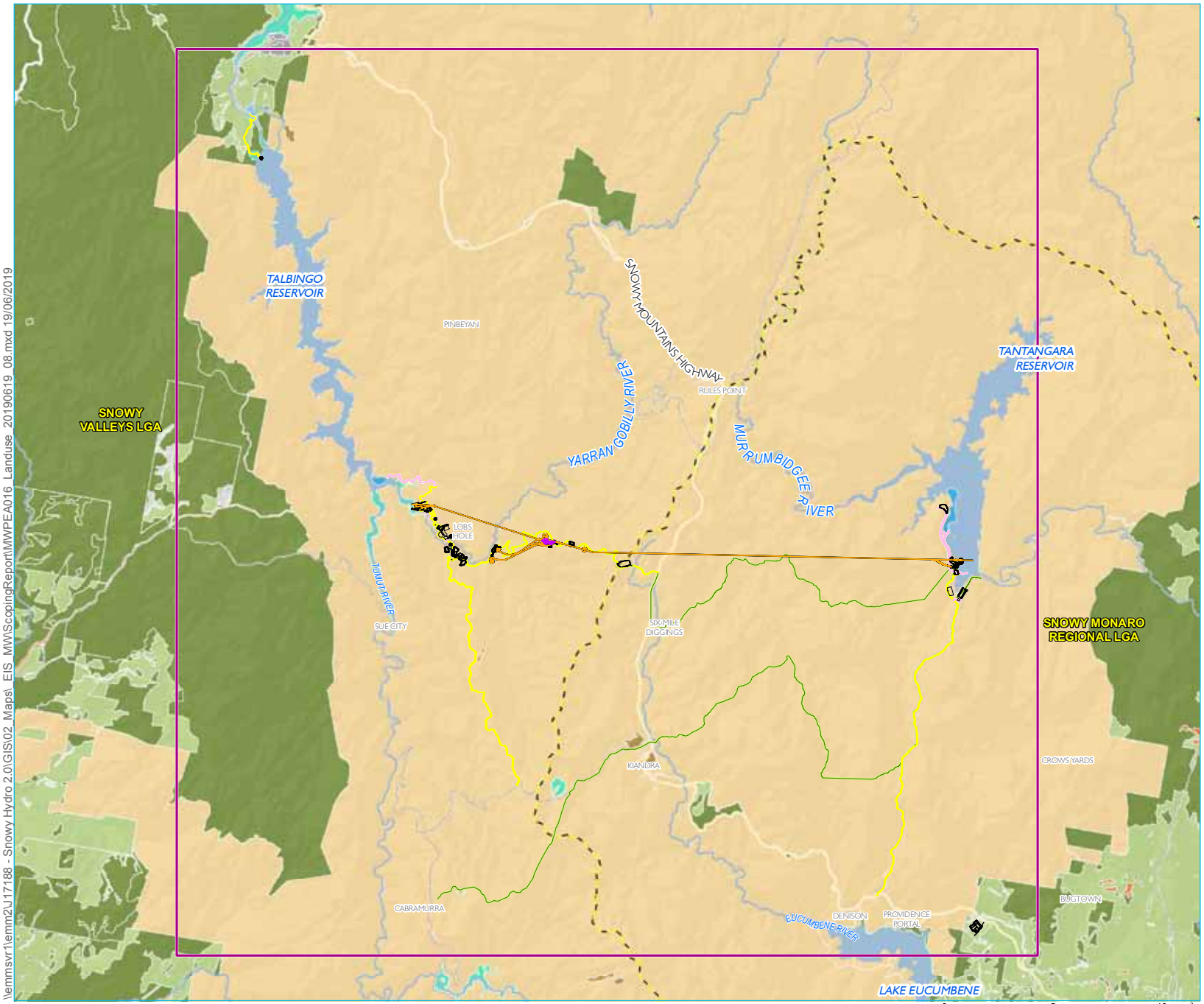
Snowy 2.0 is development of the kind specified in Schedule 5, clause 9, subclause (3) of the SRD SEPP and, therefore, may be carried out without obtaining development consent under Part 4 of the Act and is declared to be SSI and CSSI. As such, the project requires assessment and approval under Division 5.2 of the EP&A Act.

4.4.2 Approval pathway

Division 5.2 of the EP&A Act sets out the assessment and approval framework for SSI and CSSI and is shown in Figure 4.5. The NSW Minister for Planning is the determining authority for CSSI.

4.4.3 Other State approvals and licences

Under sections 5.23 and 5.24 of the EP&A Act, certain separate environmental approvals would not be required for the project or would be required to be issued consistent with the planning approval granted the project. Each of these separate environmental approvals is considered in Table 4.1. Further environmental and other approvals may be required in addition to those referred to under section 5.23 and 5.24 of the EP&A Act, and these would be considered and outlined where relevant to the assessment of the project as part of the EIS.



KEY

- Main Works project area

Snowy 2.0 operational elements

- Tunnels, portals, intakes, shafts
- Power station
- Utilities
- Permanent road

Snowy 2.0 construction elements

- Temporary construction compounds and surface works
- Temporary access road
- Indicative rock emplacement area

Existing environment

- Main road
- Local road
- Watercourse
- Waterbodies
- Local government area boundary

Land use (OEH, 2011)

- Conservation area
- Grazing
- Mining & quarrying
- Power generation
- River & drainage system
- Transport & other corridors
- Tree & shrub cover
- Urban

\\emmsvr1\emm2\J17188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_MW\ScopingReport\MWPEA016_Landuse_20190619_08.mxd 19/06/2019

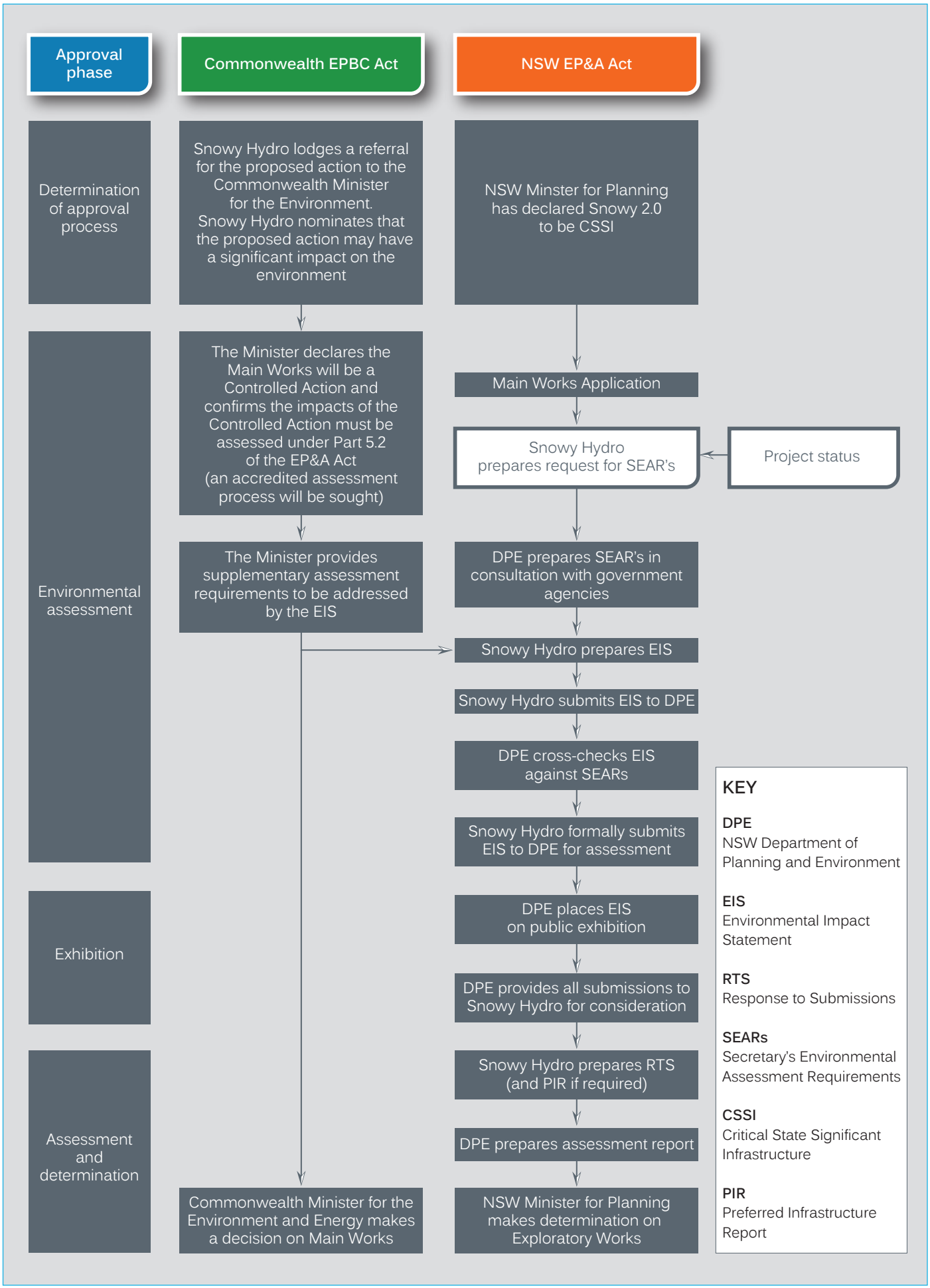
Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

Land use and property within the project area

Snowy 2.0
Scoping Report
Main Works
Figure 4.4

snowy 2.0

EMM
creating opportunities



snowy 2.0

EMM creating opportunities

Approvals assessment process

Snowy 2.0
Scoping Report
Main Works
Figure 4.5

Table 4.1 Other State approvals and licenses

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

4.4.4 Consistency with State and regional policies

A number of State and regional policies are relevant to Snowy 2.0 Main Works. Consideration of its consistency with these policies and plans is given in Table 4.2. It is noted that EPIs, including SEPPs, do not apply to SSI by virtue of section 5.22(2) of the EP&A Act. Nevertheless, the SEPPs that would have otherwise applied to Snowy 2.0 in the absence of section 5.22(2) of the EP&A Act are detailed in Table 4.2.

Table 4.2 Consideration of relevant State policies and plans

Policy/Plan	Relevant project elements	Consistency of Snowy 2.0 Main Works
State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007	Extractive industry activities included excavation of rock and placement of excavated material.	Consideration of Part 3 matters will be given in the EIS.
State Environmental Planning Policy No. 33 – Hazardous and Offensive Development	Storage and transport of dangerous goods.	Consideration of DPE's guideline *Applying SEPP 33* (2011) and, if required, preparation of a Preliminary Hazard Assessment will be undertaken.
State Environmental Planning Policy No. 44 – Koala Habitat Protection	Clearance of potential Koala habitat	A biodiversity assessment will be undertaken which will include surveys for Koalas to determine whether Koala habitat would be impacted.
State Environmental Planning Policy No 55 – Remediation of Land	Historic mining and agricultural activities have potential for land contamination.	A contamination assessment will be undertaken which will identify any land contamination.

It is also worth noting that, while in close proximity to the Selwyn Snow Resort, the Snowy 2.0 Main Works are outside of the application area for the *State Environmental Planning Policy (Kosciusko National Park – Alpine Resorts) 2007*.

4.5 Commonwealth approvals

The EPBC Act is the primary Commonwealth legislation that governs the protection of the environment. Snowy Hydro became a 'Commonwealth agency' for the purposes of the Commonwealth EPBC Act on 2 July 2018 following the acquisition of all remaining shares of Snowy Hydro by the Commonwealth.

An approval under the EPBC Act is required for Snowy Hydro, which is a Commonwealth agency for purposes of the EPBC Act, to undertake the Snowy 2.0 Main Works if:

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

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

Table 4.3 MNES under the EPBC Act

MNES	Matters relevant to Snowy 2.0
World heritage properties	Not applicable – there are no world heritage within the project area.
National heritage places	There are two national heritage places within the project area: • Australian Alps National Parks and Reserves; and • Snowy Mountains Scheme.
Wetlands of international importance	Not applicable – there are no wetlands of international importance within the area. However, the Ginini flats wetland complex is within 10 km of the project area.
Commonwealth listed threatened ecological communities	One community is known to occur within the area: • Alpine Sphagnum Bogs and Associated Fens Three other listed threatened communities may occur or are likely to occur within area and are listed at Appendix B.
Commonwealth listed threatened species	A number of threatened species are known to occur within the area, including: • One fish species: Macquarie Perch (*Macquaria australasica*) • Four frog species: – Booroolong Frog (Litoria booroolongensis) – Alpine Tree Frog, Verreaux's Alpine Tree Frog (*Litoria verreauxii alpina*) – Southern Corroboree Frog (*Pseudophryne corroboree*) – Northern Corroboree Frog (*Pseudophryne pengilleyi*) • Five mammal species: – Mountain pygmy-possum (*Burramys parvus*) – Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (*Dasyurus maculatus maculatus*) – Broad-toothed Rat, Tooarrana (*Mastacomys fuscus mordicus*) – Greater Glider (*Petauroides volans*) – Smoky Mouse, Konoom (*Pseudomys fumeus*) • Nine plant species: – Mauve Burr-daisy (*Calotis glandulosa*) – Hoary Sunray, Grassland Paper-daisy (*Leucochrysum albicans var. tricolor*) – Bago Leek-orchid (*Prasophyllum bagoense*) – Brandy Marys Leek-orchid (*Prasophyllum innubum*) – Kelton's Leek-orchid (*Prasophyllum keltonii*) – Blue-tongued Orchid, Kiandra Greenhood (*Pterostylis oreophila*) – Monaro Golden Daisy (*Rutidosis leiolepis*) – Austral Toadflax, Toadflax (*Thesium australe*) – Swamp Everlasting, Swamp Paper Daisy (*Xerochrysum palustre*)

Table 4.3 MNES under the EPBC Act

MNES	Matters relevant to Snowy 2.0
	A number of threatened species are likely to occur or may occur within the project area, including: • Seven bird species; • Three fish species; • Three frog species; • One insect species; • Three mammal species; • Seven plant species; and • Five reptile species. A full list of species is provided in Appendix B.
Commonwealth listed migratory species	One migratory marine bird is likely to occur within the area: • Fork-tailed Swift (*Apus pacificus*) Three migratory terrestrial species are known to occur within the area: • White-throated Needletail (*Hirundapus caudacutus*) • Satin Flycatcher (*Myiagra cyanoleuca*) • Rufous Fantail (Rhipidura rufifrons) Two migratory terrestrial species may or are likely to occur within the area: • Black-faced Monarch (*Monarcha melanopsis*) • Yellow Wagtail (*Motacilla flava*) Seven migratory wetland species may occur within the area: • Common Sandpiper (*Actitis hypoleucos*) • Sharp-tailed Sandpiper (*Calidris acuminata*) • Curlew Sandpiper (*Calidris ferruginea*) • Pectoral Sandpiper (*Calidris melanotos*) • Latham's Snipe, Japanese Snipe (*Gallinago hardwickii*) • Eastern Curlew, Far Eastern Curlew (*Numenius madagascariensis*) • Osprey (Pandion haliaetus)
Commonwealth marine areas	Not applicable – there are no Commonwealth marine areas within the area.
The Great Barrier Reef Marine Park	Not applicable – the project is not within the Great Barrier Reef marine park.
Nuclear actions (including uranium mines)	Not applicable – the project does not involve a nuclear action.
A water resource, in relation to coal seam gas development and large coal mining development	Not applicable – the project is not a coal seam gas development or a large coal mining development.

Accordingly, MNES with the potential to be impacted by Snowy 2.0 Main Works include:

- national heritage places;
- nationally threatened species and ecological communities; and
- migratory species protected under international agreements.

While considerable survey work has been carried out to date, additional detailed surveys are needed to determine potential impacts of Snowy 2.0 Main Works on MNES and the environment generally. Accordingly, Snowy Hydro, on a precautionary basis, referred Snowy 2.0 Main Works to the Commonwealth Minister for the Environment and nominated that Snowy 2.0 Main Works has potential to have a significant impact on MNES and the environment generally. On 5 December 2018, the Snowy 2.0 Main Works were deemed a controlled action. Potential impacts of Snowy 2.0 Main Works are to be fully addressed in the EIS which will be prepared and assessed under an accredited process under section 87(4) EPBC Act, where the Commonwealth accredits the assessment process under Division 5.2 of the EP&A Act. This will enable DPE to manage the assessment of Snowy 2.0 Main Works, including the issuing of the assessment requirements for the EIS.

The use of an accredited assessment process does not alleviate the approval requirements of the Commonwealth Minister for the Environment under the EPBC Act. While the NSW Minister is the determining authority for Snowy 2.0 Main Works under the EP&A Act, the Commonwealth Minister for the Environment remains the person who must decide whether or not to approve the controlled action under the EPBC Act.

5 Scoping of key issues

5.1 Issues identification

5.1.1 Scoping process

Preliminary environmental investigations have been carried out to identify the relevant matters to be addressed in the EIS for Snowy 2.0, and the required level of assessment. This process was guided by the draft guidelines for scoping an environmental impact statement as prepared by the DPE (2017) and informed by the series of workshops undertaken between Snowy Hydro and the Project Team (previously discussed in section 2.4). This process included:

- involving the DPE, the community and other stakeholders early in the process;
- undertaking a process of identifying and characterising relevant matters, taking into account an initial scientific and technical assessment and stakeholder responses; and
- reporting the outcomes of that assessment in this Scoping Report.

A checklist of matters was provided (DPE 2017) and a preliminary impact and mitigation assessment was carried out based on available information. The full list of matters considered in the scoping assessment is provided in Table 5.1. Those matters relevant to the construction, operation and decommissioning of Snowy 2.0 Main Works have been identified and allocated to one of the following categories:

- key matters or issues – these have been defined as requiring detailed assessment, ie. will require detailed field surveys and/or quantified modelling techniques to fully understand the impacts and identify project-specific mitigation and/or alternatives. It is assumed at this stage of assessment that each of the listed key issues will require separate technical responses and will be separately attached to the EIS;
- other matters or issues – characterised as matters where the assessment approach and measures to manage impacts are well understood and routinely used on similar projects. Each of these issues will need to be addressed through the EIA process and require investigation, but which may or may not require a technical study; and
- scoping only issues – matters in this group have been considered in this initial scoping assessment and justification provided as to why it is proposed that they not be investigated further.

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

Table 5.1 Checklist of matters identified in the Scoping Worksheet

Potential matters listed in the Scoping Worksheet that could be affected by the project		Proposed approach to assessment in EIS as identified in the Scoping Worksheet	Reference in this Scoping Report
AIR	particulate matter	Standard Assessment + CIA	5.11.1
	gases	Scoping Report	5.11.1
	atmospheric emissions	None (explanation in Scoping Report)	Scoping Worksheet (Appendix A)
AMENITY	noise	Detailed Assessment + CIA+ focussed engagement	5.8.1
	vibration	Detailed Assessment + CIA	5.8.1
	visual	Detailed Assessment + CIA+ focussed engagement	5.8.2
	odour	Standard Assessment	5.11.1
BIODIVERSITY	conservation areas	Detailed Assessment + CIA+ focussed engagement	5.2
	native vegetation	Detailed Assessment + CIA+ focussed engagement	5.3
	native fauna	Detailed Assessment + CIA+ focussed engagement	5.3
	aquatic ecology (including noxious species)	Detailed Assessment + CIA+ focussed engagement	5.3
BUILT ENVIRONMENT	public domain	Standard Assessment + focussed engagement	5.9
	public infrastructure	Standard Assessment + focussed engagement	5.7, 5.11
	private property	Standard Assessment + focussed engagement	4.2.2, 5.2, 5.9
CLIMATE	macroclimate	Scoping Report	Scoping Worksheet (Appendix A)
	microclimate	None (explanation in Scoping Report)	Scoping Worksheet (Appendix A)
ECONOMIC	natural resource use	Standard Assessment	5.10
	livelihood	Standard Assessment + focussed engagement	5.10
	opportunity cost	Standard Assessment + focussed engagement	5.10
	regional economic benefits	Detailed Assessment + CIA+ focussed engagement	5.10
HERITAGE	natural	Detailed Assessment + CIA+ focussed engagement	5.2
	historic	Detailed Assessment + CIA+ focussed engagement	5.4
	Aboriginal cultural	Detailed Assessment + CIA+ focussed engagement	5.4
LAND	stability / structure	Standard Assessment + focussed engagement	5.5
	soil chemistry	Standard Assessment + focussed engagement	5.5
	land capability	Standard Assessment + focussed engagement	5.5
	topography	Standard Assessment	5.5

Table 5.1 Checklist of matters identified in the Scoping Worksheet

Potential matters listed in the Scoping Worksheet that could be affected by the project		Proposed approach to assessment in EIS as identified in the Scoping Worksheet	Reference in this Scoping Report
RISKS	effects of climate change	Standard Assessment + focussed engagement	5.11.3
	coastal hazards	None (explanation in Scoping Report)	Scoping Worksheet (Appendix A)
	effects of flood waters	Standard Assessment + focussed engagement	5.6
	bushfire	Standard Assessment + CIA	5.11.3
	effects of subsidence	Standard Assessment	5.11.3
	steep slopes	Standard Assessment	5.11.3
SOCIAL	health	Scoping Report	Scoping Worksheet (Appendix A)
	safety	Standard Assessment + focussed engagement	5.9
	community services / facilities	Detailed Assessment + CIA+ focussed engagement	5.9
	housing availability	Detailed Assessment + CIA+ focussed engagement	5.9
	social cohesion	Scoping Report	Scoping Worksheet (Appendix A)
TRANSPORT AND ACCESS	access to property	Standard Assessment + focussed engagement	5.7
	port / airport facilities	Standard Assessment + CIA	5.7
	road and rail network	Detailed Assessment + CIA+ focussed engagement	5.7
	offsite parking	Standard Assessment	5.7
WATER	hydrological flows (incl. Flooding and geomorphology)	Standard Assessment + focussed engagement	5.6
	surface water quality	Detailed Assessment + CIA+ focussed engagement	5.6
	ground water quality	Detailed Assessment + CIA+ focussed engagement	5.6
	water availability	Standard Assessment	5.6

Notes: *Cumulative impact assessment (CIA).

5.1.2 Issues requiring assessment

The identification of relevant matters as described in this chapter has benefited from:

- consultation with the DPE as the determining authority, including the Secretary's Environmental Assessment Requirements (SEARs) prepared for the preceding phase of the development covering the scope of activities assessed in the Exploratory Works EIS (EMM 2018a);
- community and stakeholder consultation that included government agencies, industry and environment groups, business and local communities that has covered issues initially associated with the Snowy 2.0 project generally and then the Exploratory Works (including community and stakeholder submissions received on the Exploratory Works EIS). This included regular and ongoing consultation established during Exploratory Works with NPWS, OEH, EPA and DPI Fisheries and carried forward to the development of Main Works for Snowy 2.0; and
- detailed investigations of the proposed Exploratory Works as included in the Exploratory Works EIS (EMM 2018a) and Exploratory Works Response to Submissions Report (EMM 2018b).

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

- conservation areas, primarily KNP;
- biodiversity, including:
  - terrestrial ecology,
  - aquatic ecology;
- heritage, including:
  - Aboriginal cultural heritage;
  - historic heritage;
- amenity, including:
  - noise and vibration;
  - landscape and visual amenity;
- land, including:
  - geology and soils;
  - contamination;
- water, including:
  - ground water;
  - surface water, including geomorphology and flooding;

- transport and access;
- social; and
- economic.

Other issues or matters requiring assessment, but may not require a standalone or detailed technical assessment in the EIS are:

- air quality;
- built environment; and
- climate change and other risks.

5.2 Conservation areas

The majority of the project area is within KNP, where the predominant land use is conservation (OEH 2011). A number of the key issues discussed throughout Chapter 5 are relevant to KNP. While not explicit in the Scoping Worksheet (Appendix A), these key considerations for Snowy 2.0 Main Works within the KNP relate to:

- conservation - including impacts to biodiversity, heritage and geodiversity;
- amenity – including changes to landscape and visual setting;
- recreation – including impacts to camping, hiking, fishing, boating and many other activities; and
- management – including impacts to NPWS park operation, maintenance and administration.

Scoping of these issues are addressed in the respective sections of Chapter 5 in this Scoping Report (eg biodiversity is addressed in Section 6.3). This following section focuses on those impacts primarily relating specifically to recreation and park management.

5.2.1 Existing environment

KNP is part of the 1.6 million hectare (ha) chain of national parks and reserves across parts of NSW and Victoria that capture and conserve much of Australia's sub-Alpine environments. KNP is also unique in Australia as it contains Australia's highest mountains, unique glacial landscapes and unusual assemblages of plants and animals. The area has a rich Aboriginal and European history, evidenced by the existence of older homesteads, farming and mining activity located within the project area. The region is also well-known for its recreational pursuits including snowfields and the alpine resorts that make KNP Australia's pre-eminent skiing destination.

The project area contains significant natural and cultural features of KNP, including species and communities of flora and fauna (biodiversity), rocks and landforms (geodiversity), and cultural heritage items (heritage). These features are recognised in the KNP PoM. The project area also contains several recreational areas and visitor facilities, including Tantangara and Talbingo reservoirs which are used for water-based activities, including fishing and water-skiing.

Activities throughout KNP are also managed under the PoM, and the PoM sets out a number of management zones. Snowy 2.0 Main Works project area contains the following management zones identified in the PoM (as shown in Figure 5.1):

- Back Country Zone (the primary management zone across the project area);

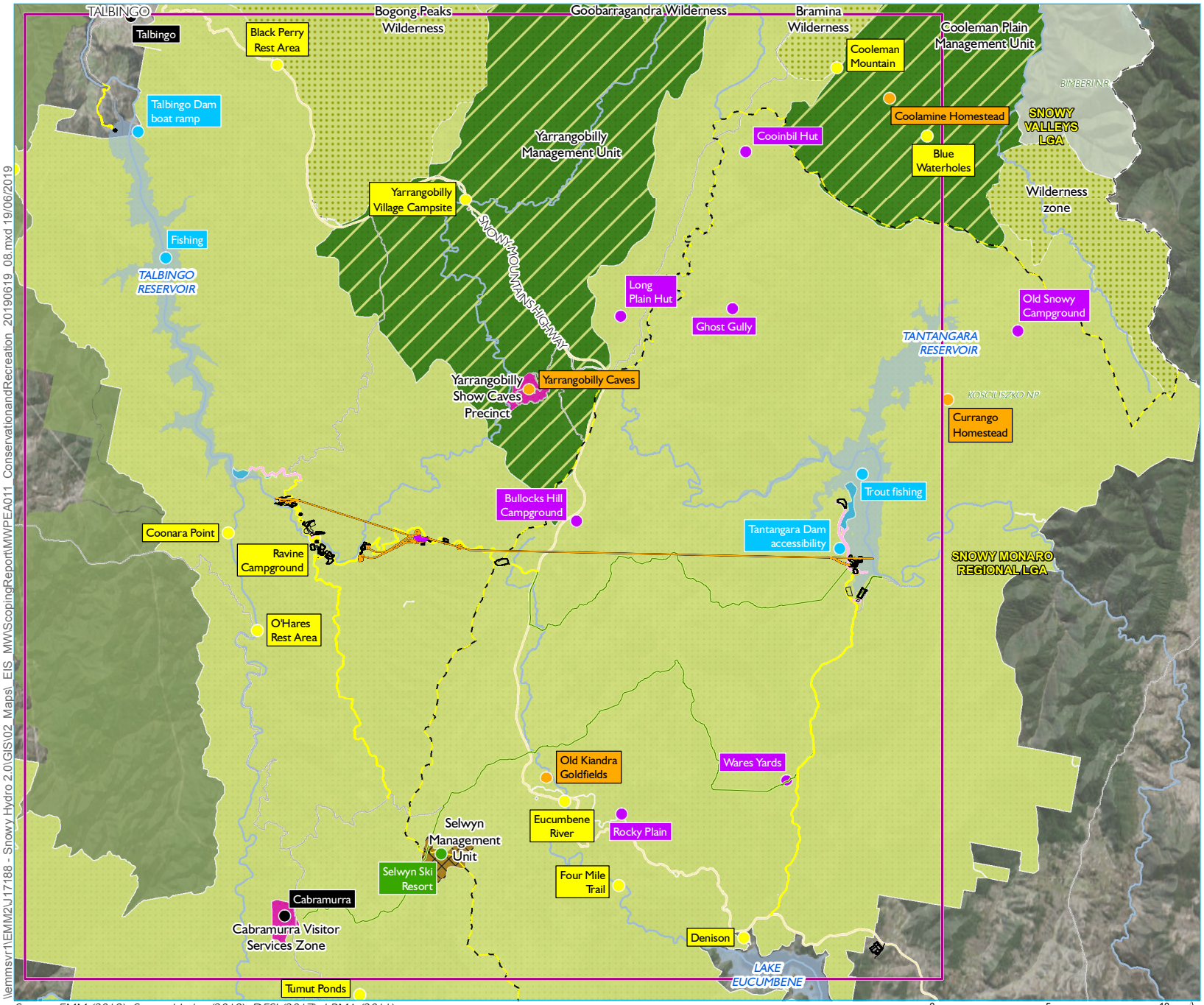
- Wilderness Zone (in the northern parts of the project area);
- Visitor Services Zone (localised areas associated with Yarrangobilly Caves and Cabramurra);
- areas of recreational significance (management area) (localised area associated with Selwyn Snow Resort); and
- areas of exceptional natural and cultural significance (management unit) (these relate to the Yarrangobilly and Cooleman Plain karst areas in the northern part of the project area).

The northern area of KNP in which the Snowy 2.0 Main Works is located is known for summer recreational activities, as well as skiing at Selwyn Snow Resort during winter. Common activities include horse riding, fishing, walking, camping and car touring/sightseeing. Much of this activity occurs to the north of the Snowy Mountains Highway. In comparison to the higher use southern parts of KNP, recreational activity is low-key in nature, with moderate levels of visitation and limited facilities, including considerable areas where visitors may recreate without facilities.

5.2.2 Existing Snowy Scheme

On the basis of the analysis in Chapter 4.2, the biodiversity, ecological and recreational impacts associated with the inundation of reservoirs to Full Supply Level are not required to be assessed as part of the EIS because those impacts are already being experienced (and are authorised) as part of the existing Snowy Scheme and are not altered as a result of Snowy 2.0 given the nature of the impact at the time of inundation.

However, other environmental impacts associated with inundation to Full Supply Level that are not currently experienced as part of the existing Snowy Scheme, such as water quality changes arising from the transfer of water from the Talbingo Reservoir in the course of operating Snowy 2.0, will be comprehensively assessed as part of the EIS.



KEY

- Main Works project area

Recreational use areas
- Camping
- Camping - horses permitted
- Fishing and boating
- Place of interest
- Ski resort
- Township

Snowy 2.0 operational elements
- Tunnels, portals, intakes, shafts
- Power station
- Utilities
- Permanent road

Snowy 2.0 construction elements
- Temporary construction compounds and surface works
- Temporary access road
- Indicative rock emplacement area

Kosciuszko National Park zoning scheme
- Wilderness zone
- Visitor services zone
- Back country zone
- Areas of recreational significance (management area)
- Areas of exceptional natural and cultural significance (management unit)

Existing environment
- Main road
- Local road
- Watercourse
- Waterbodies
- Kosciuszko National Park
- NPWS reserve
- State forest
- Local government area boundary
- State boundary

\\emmsvr1\EMM2\J117188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\ScopingReport\MWPEA011 ConservationandRecreation 20190619 08.mxd 19/06/2019

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

Conservation and recreation of KNP

Snowy 2.0
Scoping Report
Main Works
Figure 5.1

snowy 2.0

EMM creating opportunities

5.2.3 Summary of potential issues

i Construction phase

a Roads and recreation closure

A number of roads and tracks will be closed or restricted to visitors during the construction phase. Those likely to have an impact on recreation/visitor use include Tantangara and Lobs Hole Ravine roads.

Changes to access to some popular activity areas will limit areas available for some activities. One of the impacts is likely to be on horse-riding due to potential closures or restrictions to Tantangara Road that will impact a campsite suited to horses, which is currently well-used. Under the current PoM, horse riders are restricted to limited areas in the north end of the park and thus have limited alternative options. Access to Currango Homestead could also be an issue if it is precluded by the possible Tantangara Road closure although noting access would still likely be available using Port Phillip Trail and Long Plain Road.

The restriction of access to some parts of Talbingo Reservoir will impact people camping on the edge of the reservoir and accessing it for fishing, water skiing and other water-based recreational activities.

Road construction, upgrades and facility construction will impact on areas that are currently remote and generally only accessible on foot, by horse or bicycle. These areas are enjoyed by park users for their undeveloped and natural state and their isolation. It is difficult to determine the level of use of tracks given the limited data collected by NPWS. Some trails that are potentially affected include a section of the Australian Alps Walking Track, which follows the Bullocks Hill Trail, the Bicentennial National Trail as well as the Gooandra Fire Trail, which is understood to be used for walking, horse-riding and biking in summer. Conflicts with existing uses will need to be identified and mapped.

Increased traffic volume as a result of construction vehicles and construction worker traffic on access roads near Selwyn Snow Resort may slow access and reduce roadway performance, especially in winter when roads are affected by snow and ice.

b Access restrictions to Talbingo and Tantangara reservoirs

As previously mentioned some access restrictions will apply to certain parts of Talbingo and Tantangara reservoirs during construction. This may impact recreational activities associated with the reservoirs such as camping, boating, fishing and other water sports.

ii Operation phase

Some of the issues identified in the construction phase will remain during operation, including residual road and land and water based recreation area closures or restrictions. Water levels in Tantangara Reservoir will continue to vary within the existing storage operational range and this may then also impact on the amount of terrain available around the reservoir for vehicle-based camping, and access across the northern part of the reservoir via the Port Phillip Trail. Increased visitation to some areas due to improved access (Lobs Hole, Tantangara Reservoir) will be a residual effect of the operation of Snowy 2.0. There will also be some benefits to recreational users of KNP in the long term including improved road access due to road establishment and upgrades.

iii Decommissioning

The decommissioning phase offers the opportunity to reinstate the natural values of the KNP and improve the cultural heritage and recreational facilities within the park, including reinstating previous sites to improved condition.

5.2.4 Possible cumulative impacts

The primary cumulative impact will be in the development of entrenched recreation use patterns and new visitor sites in areas to which visitors are displaced from their previous location. There will be some overlap in construction timing between Main Works and Exploratory Works which will lead to concurrent impacts. In addition, TransGrid, as part of a separate project, will be providing transmission connection to Snowy 2.0 and will also impact KNP. Consideration of potential cumulative impacts within KNP will be carried out as part of the EIS.

5.2.5 Approach to assessment in the EIS

All works proposed for Snowy 2.0 Main Works will need to consider, and as far as possible, be consistent with, the PoM, ensuring the values and sites identified in the PoM are recognised, assessed and managed to avoid or minimise impacts as far as possible. Snowy 2.0 has been developed in consultation with NPWS from the outset and consultation is ongoing to ensure positive outcomes continue to be met.

An assessment will be undertaken to determine the compatibility of Snowy 2.0 Main Works with the existing PoM, recognising the unique location of the Snowy Scheme and the proposed Snowy 2.0 Main Works within the boundaries of the KNP. This assessment will address:

- KNP values, including biodiversity, Aboriginal and historic heritage, rocks and landform (geodiversity) and other values identified in the PoM (refer to sections 5.3, 5.4 and 5.5 for further details);
- land use and land title issues - Native Title;
- existing recreation facilities and identify possible compensatory opportunities; and
- current working arrangements with NPWS with reference to existing legislation and agreements and operation of both KNP and the Snowy Scheme.

There may be other issues that are not identified in this document which emerge through consultation with park users in the development of the EIS, and these will be incorporated into the assessment.

5.3 Biodiversity

5.3.1 Terrestrial ecology

i Existing environment

The Snowy 2.0 Main Works are located mostly within the boundaries of the KNP and spans the NSW Western Slopes, South Eastern Highlands and Australian Alps Interim Biogeographic Regionalisation of Australia (IBRA) regions.

The seasonal presence of snow sets the Australian Alps apart from most other places on mainland Australia, with intact remnant vegetation extending across the Australian Alps, providing a high degree of connectivity. These factors combine to support a significant and diverse assemblage of flora and fauna species and vegetation communities; many of which are unique to the region, including several state and federally-listed threatened flora and fauna species.

The project area includes significant biodiversity features including the upper slope and inverted treelines and associated subalpine treeless flats and valleys across changes in elevation and lithology, resulting in different and unique flora and fauna assemblages.

There are also numerous aquifers in the region that support groundwater dependent ecosystems (GDEs).

Preliminary and detailed survey work has been undertaken, including detailed plant community type mapping and targeted flora and fauna surveys. These surveys have resulted in the identification of threatened ecological communities within the broader project area; Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions, listed as an endangered ecological community under the NSW *Biodiversity Conservation Act 2016* (BC Act), and Alpine Sphagnum Bogs and Associated Fens, listed as an endangered ecological community under the EPBC Act.

Known and expected plant community types (PCTs) mapped for the broader project area are shown in Figure 5.2.

More than 25 threatened species have been recorded during targeted surveys undertaken to date. Notable threatened species include fauna species such as:

- Smoky Mouse (*Pseudomys fumeus*) - BC Act and EPBC Act;
- Broad-toothed Rat (*Mastacomys fuscus*) - BC Act and EPBC Act;
- Booroolong Frog (*Litoria booroolongensis*) - BC Act and EPBC Act;
- Alpine Tree Frog (*Litoria verreauxii alpina*) - BC Act and EPBC Act;
- Alpine She-oak Skink (*Cyclodomorphus praealtus*) - BC Act and EPBC Act; and
- Gang-gang Cockatoo (*Callocephalon fimbriatum*) – BC Act.

Notable flora species include:

- Mauve Burr-daisy (*Calotis glandulosa*) - BC Act and EPBC Act;
- Kiandra Leek Orchid (*Prasophyllum restroflexum*) - BC Act and EPBC Act;
- Clover Glycine (*Glycine latrobeana*) – BC Act and EPBC Act; and
- Monaro Golden Daisy (*Rutidosis leiolepsis*) - BC Act and EPBC Act.

Known threatened flora and fauna records for the broader project area are shown in Figure 5.2.

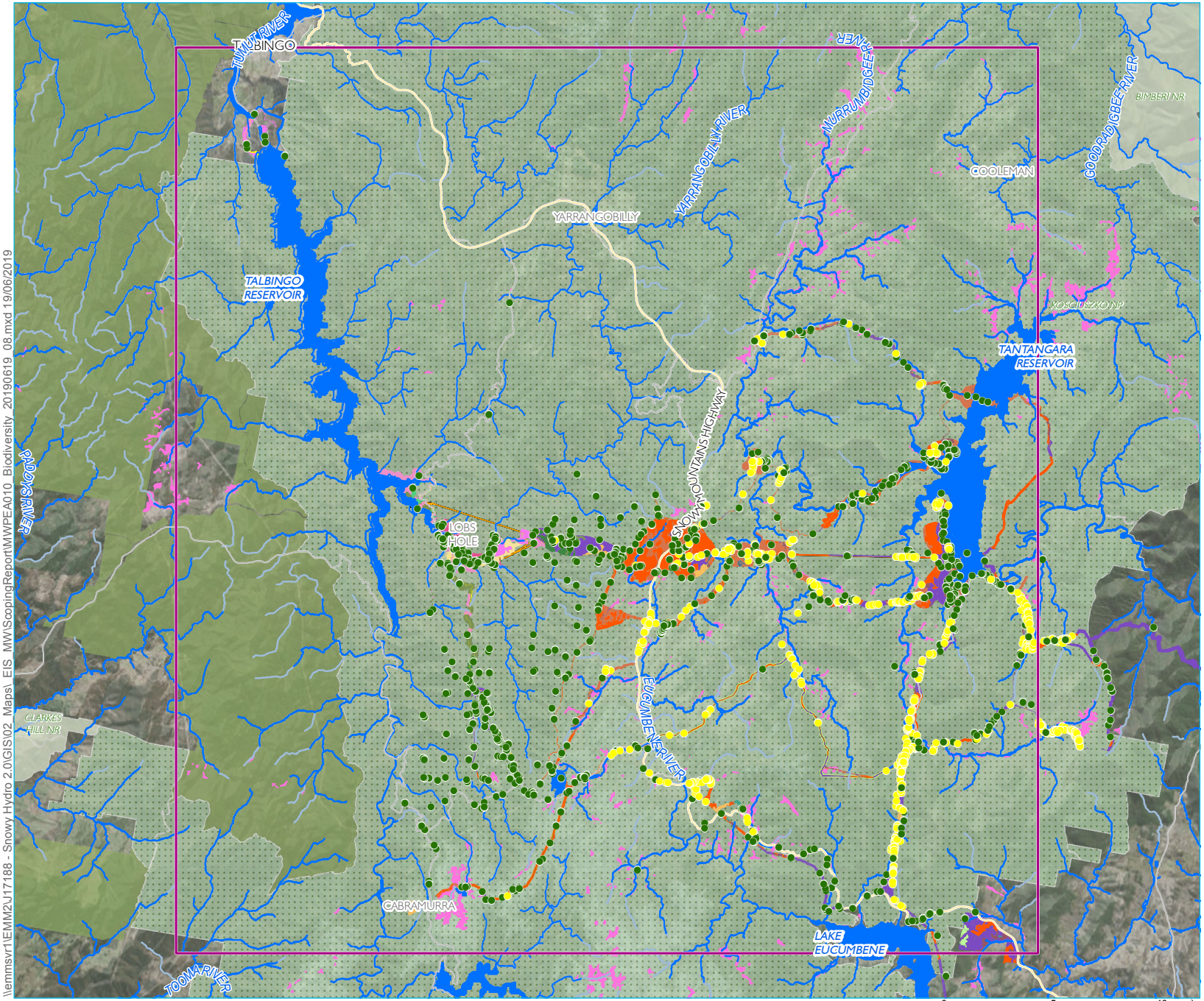
ii Summary of potential issues

a Construction phase

Without mitigation, the project has the potential to impact overall biodiversity, including threatened communities and flora and fauna species during construction. The primary impacts associated with the project would arise from direct impacts such as removal of vegetation and fauna habitat. The project also has potential to result in indirect impacts such as reduction in quality of retained habitat, impacts to connectivity, impacts to fauna populations. There are also potential impacts which may arise from groundwater drawdown, particularly to groundwater dependent ecosystems, including Alpine Sphagnum Bogs and Associated Fens.

b Operation phase

The project has limited potential to impact biodiversity during the operational phase. However, inadvertent impacts could occur as a result of increased visitation to remote areas. Subsequent impacts of operation including an increase in light and noise pollution may also decrease overall habitat quality and have carry on effects to native flora and fauna populations.



KEY

- Main Works project area

Snowy 2.0 operational elements
- Tunnels, portals, intakes, shafts
- Power station
- Utilities
- Permanent road

Snowy 2.0 contruction elements
- Temporary construction compounds and surface works
- Temporary access road

Existing environment
- Main road
- Local road
- Watercourse
- Waterbodies
- Kosciuszko National Park
- NPWS reserve
- State forest

Threatened species
- Fauna
- Flora
- Bogs and Fens (Snowy Hydro, 2017)
- Key fish habitat (DPI, 2009)

Surveyed vegetation communities (PCT number)
- 1191
- 1196
- 1224
- 1225
- 285
- 296
- 299
- 300
- 302
- 303
- 311
- 335
- 637
- 638
- 639
- 643
- 644
- 679
- 729
- 765
- 939
- 952
- 953
- 999

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\ScopingReport\MWPEA010 Biodiversity 20190619 08.mxd 19/06/2019

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 5 10 km

GDA 1994 MGA Zone 55

N

Biodiversity within the project area

Snowy 2.0
Scoping Report
Main Works
Figure 5.2

snowy 2.0

EMM creating opportunities

c Decommissioning

The project has limited potential to impact biodiversity during decommissioning, with decommissioning resulting in the rehabilitation of some sites not required for long-term operation. However, direct impact would occur if decommissioning works were to take place in previously undisturbed areas.

iii Possible cumulative impacts

The biodiversity impacts of Snowy 2.0 Main Works will be in addition to any impacts arising from the Exploratory Works project. It is also acknowledged that TransGrid, as part of a separate and concurrent project, will be providing transmission connection to Snowy 2.0 and will also result in cumulative biodiversity impacts in the context of KNP. Further, the co-location of the project with the existing Snowy Scheme, surrounding communities, KNP visitors and other infrastructure may result in cumulative impacts including a decrease in overall habitat quality, connectivity, and accumulative impacts of populations and communities.

iv Approach to assessment in the EIS

An assessment of the biodiversity values and the likely biodiversity impacts of the project will be undertaken in accordance with the BC Act and EPBC Act, the Biodiversity Assessment Method (BAM) and be documented in a Biodiversity Development Assessment Report (BDAR).

The assessment of biodiversity would be undertaken in accordance with relevant NSW and Commonwealth legislation and guidelines, including:

- *Commonwealth EPBC 1.1 Significant Impact Guidelines – Matters of National Environmental Significance* (Commonwealth of Australia 2013);
- *Commonwealth Department of the Environment – survey guidelines for nationally threatened species* (various);
- *Biodiversity Assessment Method* (OEH 2017);
- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC 2004);
- *Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians* (DECC 2009); and
- *NSW Guide to Surveying Threatened Plants* (OEH 2016).

For the reasons indicated in Section 5.2.2 above, the scope of assessment for Snowy 2.0 will exclude the assessment of impacts of the existing Snowy Scheme which are already authorised.

5.3.2 Aquatic ecology

i Existing environment

The Snowy 2.0 Main Works are located within the catchments of the Tumut, Eucumbene and Murrumbidgee rivers and includes Talbingo and Tantangara reservoirs. Numerous perennial creeks and drainage lines are located within this area, including the Yarrangobilly, Tumut and Murrumbidgee Rivers and other waterways (upstream of the reservoirs) that have been recognised for their high conservation values (Department of Environment and Conservation, 2006).

Desktop review and preliminary surveys suggest that these water bodies provide substantial aquatic habitat that supports native and non-native species of fish and macroinvertebrates. Native species may include species of galaxiids (Family: Galaxiidae) and Two-spined Blackfish (*Gadopsis bispinosus*), as well as a number of threatened species listed under the NSW *Fisheries Management Act 1994* (FM Act) and EPBC Act (ISC 2004), including:

- Macquarie Perch (*Macquaria australasica*) – FM Act and EPBC Act;
- Trout Cod (*Maccullochella macquariensis*) – FM Act and EPBC Act;
- Murray Cod (*Maccullochella peelii*) – FM Act and EPBC Act;
- Stocky Galaxias (*Galaxias tantangara*) – FM Act;
- River Blackfish (*Gadopsis marmoratus*) – Snowy River population of the River Blackfish – FM Act;
- Silver perch (*Bidyanus bidyanus*) – FM Act; and
- native freshwater crayfish species include Murray Crayfish (*Euastacus armatus*), listed under the FM Act, and other native species including Alpine Crayfish (*Euastacus crassus*), Riek's Crayfish (*Euastacus reiki*) and Burrowing Crayfish (*Engaeus cymus*).

The aquatic ecological community in the catchment of the Snowy River is a listed endangered ecological community (EEC) under the FM Act. The listing includes all native fish and aquatic invertebrates within all rivers, creeks and streams. The Eucumbene River is within the EEC listing. The community includes 19 native fish species including the FM Act listed River Blackfish population in the Snowy River and Southern Pygmy Perch (*Nannoperca australis*).

Several non-native species including species of trout (Family: Salmonidae), eastern gambusia (*Gambusia holbrooki*) and redfin perch (*Perca fluviatilis*), have been introduced to the rivers in the region.

ii Summary of potential issues

a Construction phase

Without mitigation, potential impacts to aquatic habitat and threatened species during construction may result from:

- discharge of wastewater to watercourses that will be generated from construction activities, requiring management and discharge;
- construction/upgrade of roads and waterway crossings, temporary obstruction to fish passage during construction of watercourse crossings, and mobilisation of sediments into watercourses;
- subaqueous emplacement of excavated material in Talbingo and Tantangara reservoirs, which would temporarily displace aquatic habitat and temporarily affect water quality;

- construction of intakes and associated dredging works, which could temporarily affect water quality and result in elevated noise and vibration during blasting. The works may also result in localised effects on aquatic habitat availability in the reservoirs;

- reductions to baseflow in watercourses during tunnelling, which could affect streamflow in overlying watercourses; and

- groundwater drawdown may affect the habitat of stygofauna and other GDEs.

b Operation phase

Once operational, Snowy 2.0 will result in changes to the hydrological regime and physical and chemical properties of water in Talbingo and Tantangara reservoirs due to the transfer of water between the reservoirs. This may have associated impacts to aquatic habitat and biota. These may include changes to the quality and availability of aquatic habitat and biota, which could include threatened species, present in the reservoirs and in downstream watercourses. Changed conditions may encourage or discourage the growth of aquatic biota (including pest species) in the reservoirs and potentially in watercourses downstream of the reservoirs.

- There is potential for entrainment and subsequent loss of fish and other aquatic biota during transfer of water between Talbingo and Tantangara reservoirs, which could affect fish, potentially including native species. Murray crayfish is known to occur in Talbingo Reservoir and other threatened species have the potential to occur here.

- Pest species (flora and fauna) could also be transferred between the reservoirs. If these survive, this may result in impacts to native biota within the reservoirs and connected waterways.

- Potential impacts to aquatic ecology associated with groundwater impacts during operation (see Section 5.6.1).

c Decommissioning

Proposed decommissioning includes several measures to rehabilitate surface areas during construction. The contribution of these measures will be considered during the assessment of impacts on aquatic ecology.

iii Possible cumulative impacts

Potential cumulative impacts include the combined displacement and modification of aquatic habitat in Talbingo Reservoir due to placement of excavated material, dredging works and construction activities resulting from both the Exploratory Works and Snowy 2.0 Main Works; while in Tantangara Reservoir, potential cumulative impacts include the displacement and modification of aquatic habitat due to placement of excavated material and construction activities during the construction of the Main Works.

iv Approach to assessment in the EIS

A full assessment of impacts to aquatic ecology including key fish habitat listed under the FM Act and threatened species in the project area will be undertaken as part of the EIS. This will be informed by the collection of baseline data from Talbingo and Tantangara reservoirs and rivers, creeks and streams within the project area, including surveys for fish in reservoirs and watercourses. Several other related technical studies have also been commissioned that will provide specific information on the likelihood of survival of pest fish species through the pumped water transfer system, the potential efficacy of several fish deterrents, containment and sterilisation measures aimed at preventing or minimising potential entrainment and transfer of biota and the potential for disease transfer, among other studies.

Modelling of changes in the hydrological regime and the physical and chemical properties of the reservoirs will also be undertaken to enable assessment of the potential long-term changes in aquatic habitat and biota in the reservoirs due to the ongoing transfer of water between reservoirs associated with the operation of Snowy 2.0.

Potential impacts to aquatic ecology associated with construction include impacts to water quality and flow, barriers to fish passage and displacement of habitat. Identification of avoidance measures where feasible, together with the implementation of standard design and control measures during construction would address a range of potential impacts to aquatic habitat and threatened species. Development of mitigation measures to address impacts associated with, for example groundwater drawdown and reduction to stream baseflows will be further developed as part of the Snowy 2.0 Main Works EIS. All practical controls will be considered. Offsets and/or compensation may be required for residual impacts that cannot be avoided or minimised in accordance with relevant policy requirements.

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

- *Policy and guidelines for fish habitat conservation and management*. Update 2013 (NSW Department of Primary Industries 2013);
- *Commonwealth EPBC 1.1 Significant Impact Guidelines – Matters of National Environmental Significance* (Commonwealth of Australia 2013); and
- *Commonwealth Department of the Environment – Survey guidelines for Australia's threatened fish, Guidelines for detecting fish listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999* (Department of Sustainability, Environment, Water, Populations and Community 2011).

For the reasons indicated in Section 5.2.2 above, the scope of assessment for Snowy 2.0 will exclude the assessment of impacts of the existing Snowy Scheme which are already authorised.

5.4 Heritage

5.4.1 Aboriginal cultural heritage

i Existing environment

The Snowy Mountains area is country to many Aboriginal people, who have cultural and spiritual associations that have long histories embodied in objects which can be seen on the ground and other intangible values related to the past and current concerns and aspirations (NSW DEC 2006). The project area itself is located within the lands of the Wolgalu people (Boot 2000).

Recent archaeological research has confirmed an Aboriginal presence in the Snowy Mountains since the early Holocene, approximately 9,000 years before present (Aplin *et al.* 2010, Theden-Ringl 2016). Previously recorded Aboriginal site types in the Snowy Mountains area include stone artefacts, grinding grooves, rock shelters, scarred or carved trees, quarries, contact sites, ceremonial sites and burials.

An Aboriginal cultural heritage assessment report (ACHAR) was completed in 2018 by NSW Archaeology as part of the EIS relating to the Snowy 2.0 Exploratory Works. The assessment identified areas highly disturbed by previous land use and geomorphological processes, with the archaeology of the area characterised by very low to low density stone artefact sites. Known sites and sites registered on the Aboriginal Heritage Information Management System (AHIMS) are shown on Figure 5.3.

ii Summary of potential issues

a Construction phase

The project has the potential to impact Aboriginal heritage during construction. The clearance of vegetation, construction of infrastructure and any earthworks would cause direct impacts and certain indirect impacts caused by acerbated erosional processes.

b Operation phase

Snowy 2.0 Main Works has limited potential to impact Aboriginal heritage during the operational phase. However, inadvertent impacts could occur as a result of increased visitation to remote areas.

c Decommissioning

Snowy 2.0 Main Works has limited potential to impact Aboriginal heritage during decommissioning. However, direct impact would occur if decommissioning works were to take place in previously undisturbed areas.

iii Possible cumulative impacts

Cumulative impacts to Aboriginal heritage would be limited given that the activity would occur within an extensive national park system. However, consideration will be given to the connection of transmission supply to Snowy 2.0, which is being carried out by TransGrid as a separate but concurrent project.

iv Approach to assessment in the EIS

A comprehensive ACHA would be conducted. The ACHA would develop initiatives to avoid and minimise impacts. Mitigation and management measures would be designed to address any residual impacts which are not able to be avoided.

The assessment would be conducted in accordance with the OEH (2011) *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* and Code *of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (NSW DECCW 2010a).

A process of Aboriginal community consultation has already commenced and is being undertaken in accordance with the OEH *Aboriginal cultural heritage consultation requirements for proponents 2010* (NSW DECCW 2010b). The consultation process is regular and ongoing as the project is developed.

In addition to consultation, the heritage assessment would include a review of the relevant anthropological, historical and archaeological literature, a program of comprehensive field survey and archaeological test excavation.

5.4.2 Historic Heritage

i Existing environment

The Snowy Mountains have a rich history, beginning with the early explorer-settlers in the 1820s, the establishment of pastoralism and summer grazing in the 1830s, the gold rush at Kiandra in 1859-60 and early scientific exploration. Thereafter, throughout the twentieth century, the Snowy Scheme was built, scientific research developed further, and tourism and recreation were promoted.

A wide range of historical items and places are distributed throughout the mountains, including stockman's huts, fences and mine sites. A historic cultural heritage assessment (HCHA) was completed in 2018 by NSW Archaeology as part of the EIS relating to Snowy 2.0 Exploratory Works. Six historical complexes were identified across the project area relating to themes of mining, pastoralism, transport, towns/settlement, and industry, and a total of 127 historic heritage items were identified by the assessment. Known sites and sites registered on publicly-available heritage databases are shown on Figure 5.3.

ii Summary of issues

a Construction phase

Snowy 2.0 Main Works has the potential to impact historic heritage during construction. The clearance of vegetation, construction of infrastructure and any earthworks could cause direct impacts and certain indirect impacts to historic items.

b Operation phase

Snowy 2.0 Main Works has limited potential to impact historic heritage during the operational phase. However, inadvertent impacts could occur as a result of increased visitation to remote areas.

c Decommissioning

The project has limited potential to impact historic heritage during decommissioning. However, direct impact would occur if decommissioning works were to take place in previously undisturbed areas.

iii Possible cumulative impacts

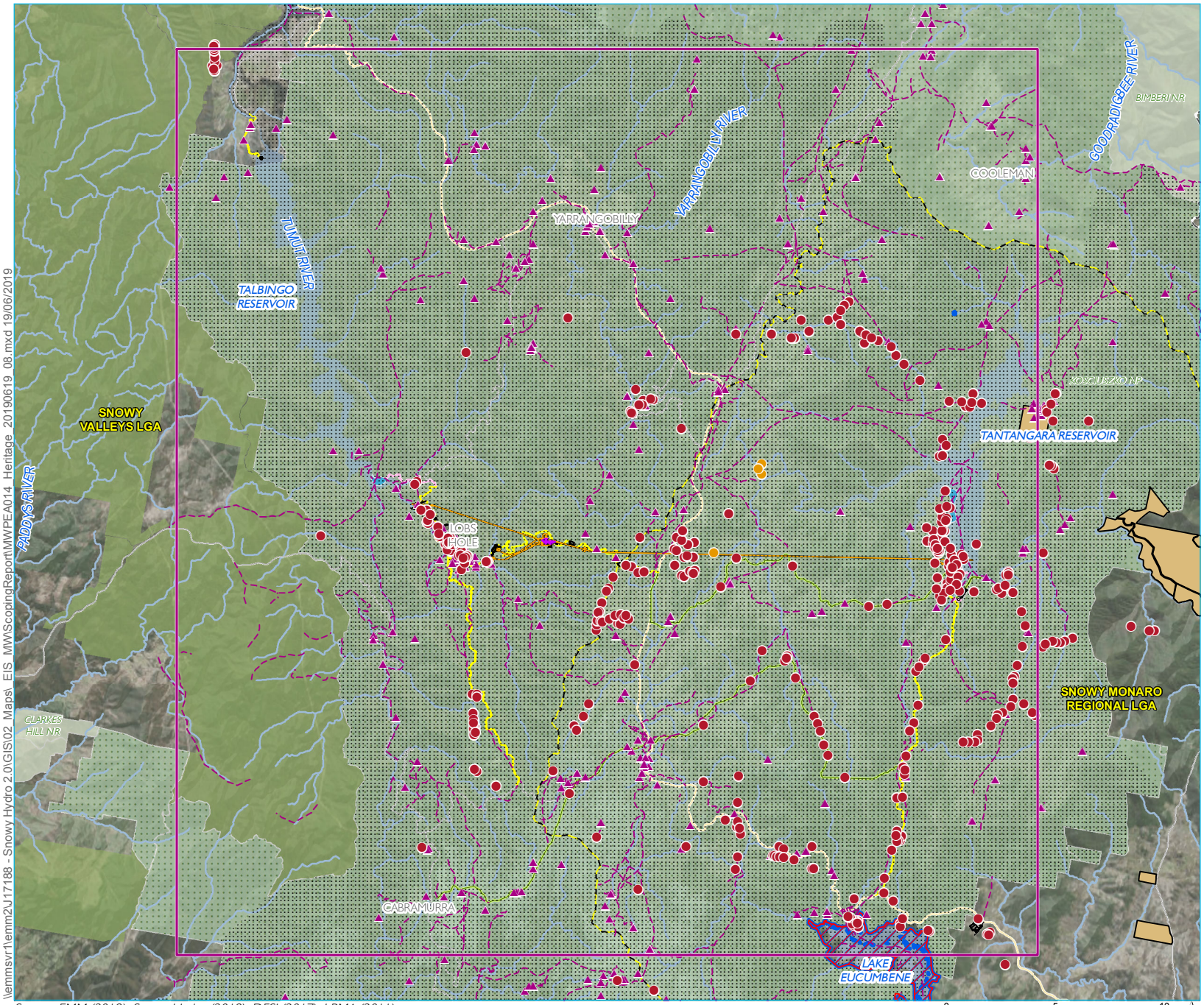
Cumulative impacts to historic heritage would be limited given that the activity would occur within an extensive national park system. However, consideration will be given to the connection of transmission supply to Snowy 2.0, which is being carried out by TransGrid as a separate but concurrent project.

iv Approach to assessment in the EIS

A comprehensive HCHA would be conducted as part of the EIS. The HCHA would develop initiatives to avoid and minimise impacts. Mitigation and management measures would be designed to address any residual impacts which are not able to be avoided.

The assessment of historic cultural heritage assessment would be undertaken in accordance with the principles of the A*ustralia ICOMOS Burra Charter* (Australia ICOMOS 2013a) and its relevant Practice Notes (Australia ICOMOS 2013b, 2013c, 2017). It would also comply with the *Historical Archaeology Code of Practice* (Heritage Council of NSW 2006) and the *NSW Heritage Manual* (1996) and its various updates and other guidelines published by the NSW Heritage Office (1996, 2001, 2009).

The assessment would include a review and synthesis of the historical context of the area based on primary and secondary sources, including historical maps and various published and unpublished sources (eg academic theses and consultant reports).



KEY

- Main Works project area

Snowy 2.0 operational elements

- Tunnels, portals, intakes, shafts
- Power station
- Utilities
- Permanent road

Snowy 2.0 construction elements

- Temporary construction compounds and surface works
- Temporary access road
- Indicative rock emplacement area

Heritage records

- AHIMS registered site
- Surveyed Aboriginal heritage site
- Historic heritage site
- Kosciuszko Huts Association (KHA) historic route
- State Heritage Act

LEP listed heritage

- Item - General
- Conservation Area - General

National heritage list

- Snowy Mountains Scheme (national heritage list)

Existing environment

- Main road
- Local road
- Watercourse
- Waterbodies
- Kosciuszko National Park
- NPWS reserve
- State forest
- Local government area boundary
- State boundary

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 5 10 km

GDA 1994 MGA Zone 55

N

\\emmsvr1\emm2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MWScopingReport\MWPEA014 Heritage 20190619 08.mxd 19/06/2019

Known Aboriginal and historic heritage within the project area

Snowy 2.0
Scoping Report
Main Works
Figure 5.3

snowy 2.0

EMM creating opportunities

5.5 Land

5.5.1 Geology and soils

i Existing environment

The Snowy 2.0 Main Works project spans the NSW Western Slopes, South Eastern Highlands and Australian Alps IBRA regions. The geology of the alpine area (shown on Figure 5.4) comprises granites that have formed faulted and stepped ranges (NPWS 2003). More recent volcanic activity produced basalts and, in the Pleistocene, the cold climate superimposed glacial features on the landscape. The South Eastern Highlands are part of the Lachlan fold belt that runs through the eastern states as a complex series of metamorphosed Ordovician to Devonian sandstones, shales, volcanic rocks and granite body intrusions. Overlying these older units, a regionally extensive weathered zone is assumed to exist.

This complex geology, in association with topography, has resulted in a diverse soil landscape. Soils vary significantly across the bioregions in relation to altitude, temperature and rainfall. The soils of the Australian Alps and Highlands reflect the extreme climatic gradient across the ranges and a relatively large range of soil types is found over a comparatively small area. Main soil orders within the project area include Kandosols, Tenosols, Dermosols, Vertosols, Ferrosols, Organosols, and Rudosols. The alpine soils support unique flora and fauna, with uniform organic soils and peats found at the highest elevations (NPWS 2003).

ii Summary of potential issues

a Construction phase

The Snowy 2.0 Main Works will expose the natural ground surface and subsurface through the removal of vegetation and the excavation of soil for surface infrastructure works and the establishment of access tracks, construction compounds, equipment laydown areas, and other ancillary works. Potential soil capability impacts during construction may include mixing of lower class soils and subsoils with better quality soils. Machinery used in the construction phase could also degrade soil quality as a result of compaction when creating topsoil stockpiles, and on areas used for temporary construction (eg access tracks, laydown areas). More specific impacts are outlined below.

Erosion and sediment

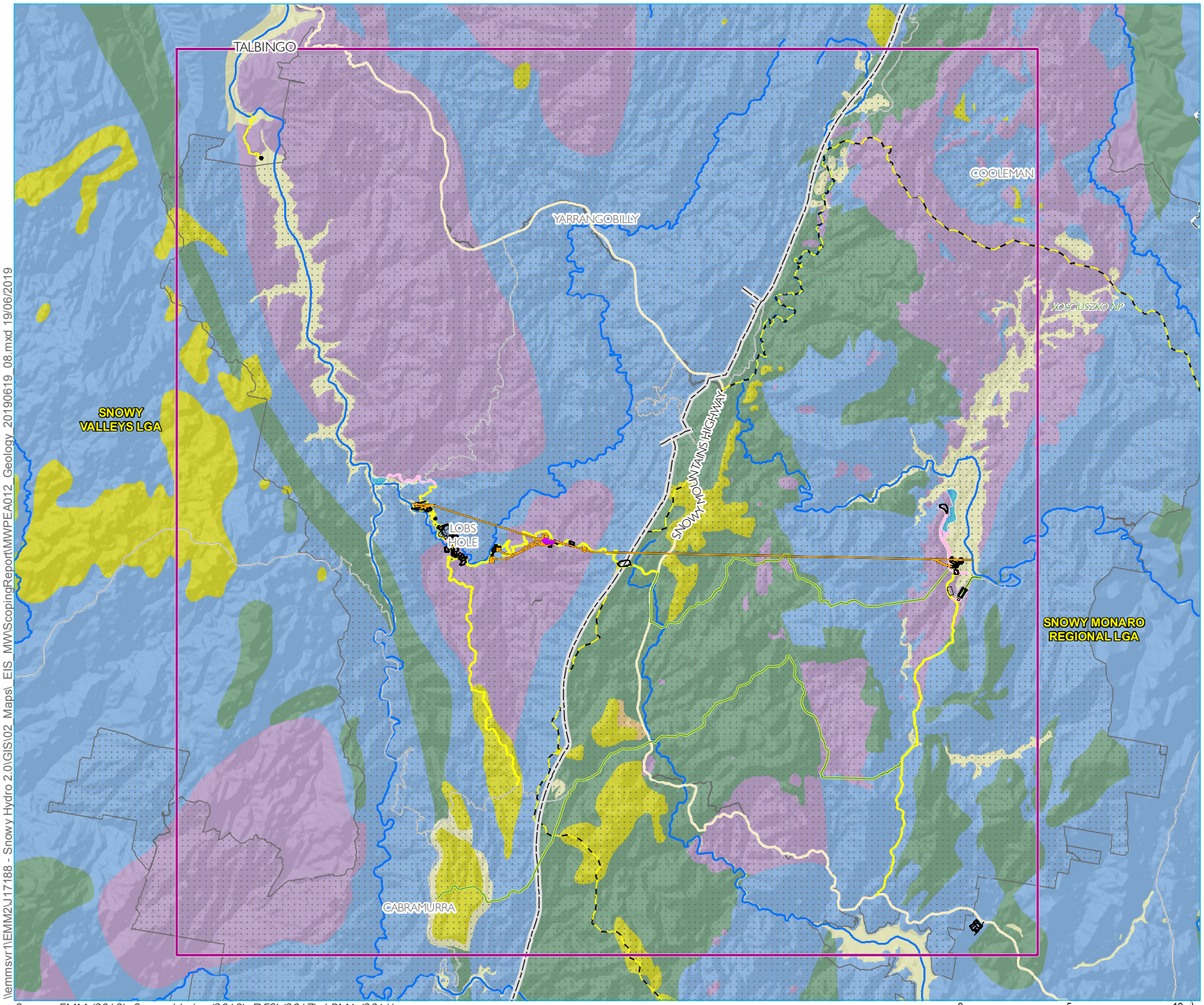
Soils of the highlands are highly vulnerable to severe soil erosion once exposed either by disturbance or even vegetation slashing. Areas experiencing frost may encounter needle-ice erosion, which pushes soil particles apart and can exacerbate wind and water erosion effects. Sediments eroded from soil material at higher elevations can be deposited in different habitat zones further down the mountain, impacting ecosystem functions.

Contamination

Contamination of soils can occur due to spills and leaks from construction equipment and vehicles, the storage of fuel at construction camps and the inappropriate disposal of general waste or litter. Contamination may also occur from the disturbance of acid sulphate soils or naturally occurring asbestos. Further contamination issues, associated with previous mining uses and construction activities, are discussed in Section 5.5.2.

Rehabilitation

In higher altitude areas where plant growth is restricted to a short season, rehabilitation of disturbed areas may be difficult. Replaced topsoil may provide increased opportunity for weed infestation.



\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_MW\ScopingReport\MWPEA012_Geology_20190619_08.mxd 19/06/2019

Source: EMM (2018); Snowy Hydro (2018); DFSI (2017); LPMA (2011)

Geology of the project area

Snowy 2.0
Scoping Report
Main Works
Figure 5.4

snowy 2.0

EMM
creating opportunities

b Operation phase

The project has limited potential to impact soil and land resources during the operational phase. Inadvertent impacts may occur from changes to landform and land use. Maintenance works which involve land disturbance may involve similar impacts to the construction phase described above. Inadvertent soil disturbance and erosion impacts could also occur as a result of increased visitation to remote areas.

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

c Decommissioning

Where disturbance occurs to remove infrastructure and landform emplacements associated with Snowy 2.0 Main Works, similar impacts to those described in the construction phase above may occur. A lack of suitable soil material may result in an inability to meet rehabilitation requirements and enduring changes to landforms as a result of infrastructure placement or material storage may exacerbate erosion.

iii Possible cumulative impacts

Cumulative soil and land resources impacts may arise from future infrastructure or enhancement works in the local area. Unanticipated contamination events will also contribute to impacts. The co-location of the project with the existing Snowy Scheme, other infrastructure, surrounding communities and KNP visitors may result in cumulative impacts including increased rehabilitation failure and erosion risk.

iv Approach to assessment in the EIS

The potential for soil and land resource impacts associated with the Main Works will be investigated through standard assessment approaches and the application of suitable guidelines. A comprehensive soils capability assessment will be undertaken as part of the EIS. The assessment will provide key measures for managing soils during construction, particularly soils required for rehabilitation post works.

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

- *Guidelines for surveying soil and land resources* (McKenzie et al 2008);
- *Acid Sulphate Soils Assessment Guidelines* (DPI 2008);
- *Soil and Landscape Issues in Environmental Impact Assessment* (DLWC 2000);
- *National environment protection (Assessment of site contamination) measure* (NEPC 2013);
- *Managing asbestos in or on soil* (NSWG 2014);
- *The land and soil capability assessment scheme (OEH 2012);* and
- *Site Investigations for Urban Salinity (*Department of Land and Water Conservation 2002).

5.5.2 Land contamination

i Existing environment

The project area was witness to the construction of reservoirs, towns and supporting infrastructure associated with the Snowy Scheme, the construction of which occurred between 1949 and 1972. This includes many of the former structures and access tracks associated with the construction of Tantangara Reservoir in 1960. During construction, multiple potentially contaminating activities were present, such as storage and use of explosives, storage and use of petrol, and the former town sites/work camps associated with construction activities. In 1959, a general store at Tantangara camp housed underground storage tanks (USTs) for fuelling purposes. The area near Tantangara Reservoir also includes a former quarry.

Parts of the project area also contain known locations of naturally-occurring asbestos, some of which may be disturbed during the construction phase of this project. This includes an area at Gooandra identified with aphyric and feldsparphyric basalt, which can contain naturally-occurring asbestos.

An area of known residual contamination at Lobs Hole is associated with the former Lobs Hole Copper Mine, as identified in the Exploratory Works EIS (EMM 2018a). A soil, sediment and surface water investigation was completed for this site in 2014 (URS 2014) which found elevated concentrations of select metals (arsenic, copper and lead) near the former mine. Soils, with potential to be acid-forming, were also present.

ii Summary of potential issues

a Construction phase

Potential contamination impacts during construction may include erosion of soils, disturbance of contaminated land, and contamination of land or water/groundwater due to spills and leaks from construction equipment and vehicles and the storage of fuel at construction camps. Additionally, potential health risks may be identified with the disturbance of naturally-occurring asbestos along the tunnel alignment near Gooandra. Risk identification, management and mitigation plans will be investigated and presented.

Other potentially contaminating activities include the management of excavated rock and its interaction with the natural and surrounding environment. The assessment will identify risks and present mitigation measures to reduce those risks.

b Operation phase

The contamination assessment will outline potentially contaminating activities associated with the operational phase of the project, identify risks and present mitigation and management measures which will reduce those risks to ongoing users of the national park and the environment.

c Decommissioning

The aim of the decommissioning phase will be to ensure that the project areas will be suitable for their intended use. Given that Snowy 2.0 Main Works are principally within the KNP, the project will need to ensure that management and mitigation measures at all stages are implemented to avoid, or minimise, potential impacts on the local environment.

iii Possible cumulative impacts

Unexpected finds or uncontrolled contamination events may contribute to impacts. For example, without proper management measures, the disturbance of soils, or increased infiltration, through mine workings at Lobs Hole could potentially mobilise contaminants.

iv Approach to assessment in the EIS

A contamination assessment of the Snowy 2.0 project area will be completed as part of the EIS, which will involve a detailed assessment of the existing environment considering all media including soil, groundwater, surface water and sediment. The assessment will include a review of the site history, identification of current or historical contaminating activities and potential receptors. The assessment will provide key measures for managing soils during the construction and operational phases, and preparation of the project areas during decommissioning works.

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

- *Acid Sulfate Soils Assessment Guidelines* (Department of Planning, 2008);
- *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and Environment Protection Authority, 1998);
- *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom, 2004);
- *Managing Urban Stormwater: Soils and Construction Volume 2* (Department of Environment and Climate Change, 2008);
- *Guidelines for Consultants Reporting on Contaminated Sites* (Office of Environment and Heritage, 2000);
- *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997* (Department of Environment and Climate Change, 2009);
- *Approved Methods for the Sampling and Analysis of Water Pollutants in NSW* (Department of Environment and Climate Change, 2008);
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC / ARMCANZ, 2000); and
- *Using the ANZECC Guidelines and Water Quality Objectives in NSW* (Department of Environment and Conservation, 2006).

5.6 Water

5.6.1 Groundwater

i Existing environment

The Snowy 2.0 Main Works are located within the Tumut, Eucumbene and Murrumbidgee river catchments, between Talbingo and Tantangara reservoirs. The project spans the NSW Western Slopes, South Eastern Highlands and Australian Alps IBRA regions.

The soils of the Australian Alps Bioregion reflect the extreme climatic gradient across the ranges. The lowlands consist mainly of texture contrast soils, grading to uniform, organic soils and peats at the highest elevations (NPWS 2003). The soils of the South Eastern Highlands Bioregion vary significantly in relation to altitude, temperature and rainfall.

The geology of the broader assessment area comprises Ordovician to Devonian granites, volcanics, and metamorphosed sedimentary sequences that have formed faulted, stepped ranges at the point where the South Eastern Highlands (part of the Lachlan Fold Belt) in NSW transition west into Victoria (NPWS 2003). More recent Tertiary volcanic activity produced basalts and, in the Pleistocene, the cold climate superimposed glacial features on the landscape (NPWS 2003). The Australian Alps Bioregion was the only part of the mainland to have been affected by Pleistocene glaciation and contains a variety of unique glacial and periglacial landforms above 1,100 m altitude (NPWS 2003).

There are eight karst areas in KNP, all of which are developed in Silurian, Devonian or Quaternary limestones (DEC 2006). These include Yarrangobilly Caves, a known GDE and karst area, and Coolemans Plain karst area; both are recognised in the PoM for their cultural and natural significance. KNP also contains other GDEs including Alpine Sphagnum Bogs and Associated Fens which are listed as endangered under the EPBC Act. These systems are thought to store rainfall, allowing slow release to creeks, rivers and springs. They also store shallow groundwater, which maintains wet soil conditions for most of the year. In addition, assemblages of stygofauna may be present in environmentally suitable aquifers.

The area of Snowy 2.0 Main Works between Talbingo and Tantangara reservoirs is also structurally deformed, with numerous folds and several major faults associated with the north-south trending Long Plain Fault.

ii Summary of issues

Snowy 2.0 will be located within a variety of fractured rocks that are part of the Lachlan Fold Belt. The interconnection of groundwater systems and flow paths associated with these rock types are complicated because the occurrence and intersection of faults and fractures in three dimensions is complex.

The groundwater systems can be categorised as either:

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

Snowy 2.0 will be constructed and operated within the regional groundwater system. Perched zones that are generally disconnected from the regional groundwater system are generally unaffected by dewatering that may be occurring at depth. However, site investigations are required to assist in determining whether there is connectivity between the shallowest zones and the deep depressurised zone.

a Construction phase

Snowy 2.0 will partially dewater the regional groundwater system at depth and potentially affect adjacent local systems, where hydraulically connected, resulting in water level changes at sensitive surface receptors, including alpine bogs and fens, and rivers and creeks. Such changes may result in a significant impact to the availability of water that maintains many of the bogs and fens, and flows in river and creek systems that are connected to local and regional groundwater systems. These water features provide habitat for several endangered species and have high conservation value.

Key groundwater issues for construction include:

- loss of spring flows that may be sustaining creeks, rivers and GDEs;
- loss of baseflow in permanent streams;
- lowered regional groundwater levels;
- high groundwater inflows when heavily fractured or faulted geology is encountered;

- degraded inflow water quality because of construction activities (eg sediment and explosive residues);
- management of groundwater captured by construction dewatering activities;
- maintaining a viable shallow and deep groundwater monitoring network; and
- groundwater licensing (accounting for water take, as the construction works are an aquifer interference activity).

b Operation phase

Once tunnels are lined and treatment is applied to the walls of the caverns and adits, 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. These contributions could result in lowered regional groundwater levels compared to pre-construction levels.

Key groundwater issues for operations include:

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

c Decommissioning

Decommissioning works will include removal of temporary infrastructure and the rehabilitation of areas disturbed by construction. There are unlikely to be any groundwater issues associated with decommissioning.

iii Possible cumulative impacts

The natural (fractured rock) groundwater systems and regional water table are generally a subdued reflection of the topography. These systems were disrupted when the original Snowy Scheme was constructed. Since its completion, the regional groundwater system has reached a new equilibrium based on the additional reservoirs, tunnel depths and alignments, and associated power station caverns.

There will be some overlap in construction timing between Main Works and Exploratory Works which will lead to concurrent impacts. Cumulative impacts to groundwater arising from the concurrent construction of Exploratory Works and Main Works will be considered in the EIS. There are no groundwater users within the KNP, apart from the environment.

iv Approach to assessment in the EIS

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

- a spatial groundwater monitoring network of monitoring bores and piezometers, with baseline water level and water quality datasets;
- temporal data from the monitoring network of at least 12 months duration;
- other hydrological data, such as rainfall and evaporation;

- permeability testing of monitoring bores and test production bore pumping tests; and
- numerical flow modelling to replicate the current head distribution (based on known hydrogeological characteristics) and to predict future impacts during construction and operation.

A groundwater impact assessment will be undertaken of all the proposed project activities as part of the Snowy 2.0 Main Works EIS. The assessment will involve refinement of the conceptual hydrogeological model and the expansion of the numerical groundwater model developed for the Exploratory Works program. All aspects of the assessment will be integrated with the engineering design of the project and other relevant studies. The assessment will also on focus on sensitive ecosystem areas if there is likely to be a groundwater component to their existence and sustainability. Groundwater management controls will be established to mitigate identified groundwater changes. All practical controls will be considered. These mitigation measures during construction may involve:

- pre-grouting of known highly fractured or faulted zones;
- progressive lining of headrace and tailrace tunnels;
- maintaining baseflows to permanent streams, bogs and fens (as required); and
- treatment of groundwater inflows.

There are no groundwater impact mitigation measures proposed once Snowy 2.0 is operational. The regional groundwater systems will reach a new equilibrium and even though there may be some local variability in baseflow contributions to streams, the overall losses are expected to be small compared to runoff from rainfall and snow melt.

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

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

5.6.2 Surface water

i Existing environment

Snowy 2.0 Main Works are in the Australian Alps. The majority of project infrastructure will be located between the Tantangara and Talbingo reservoirs, within the catchments of the Yarrangobilly, Eucumbene and Murrumbidgee rivers. Receiving waters are shown on Figure 5.5 include:

- the Yarrangobilly, Eucumbene and Murrumbidgee rivers and some of their tributaries; and
- Talbingo and Tantangara reservoirs.

The rivers and their tributaries include a variety of watercourse typologies including ephemeral bogs and fens, minor watercourses and major regional rivers. These watercourses may provide habitat for endangered species and have a high conservation value.

Talbingo and Tantangara reservoirs are part of the Snowy Scheme. Aside from their operational functions the reservoirs are used for recreational purposes, including boating, swimming and fishing.

Water from Talbingo Reservoir is released through the Tumut 3 power station into Jounama Pondage, which releases water into Blowering Reservoir. Blowering Reservoir is operated by Water NSW and releases water into the Tumut River to supply a variety of consumptive users but primarily large irrigation schemes. The Tumut 3 power station also can pump water from Jounama Pondage back into Talbingo Reservoir.

Water from Tantangara Reservoir is either released downstream into the Murrumbidgee River or diverted to the Eucumbene Reservoir. Water from Eucumbene Reservoir is diverted into either the Tumut or Murray River schemes.

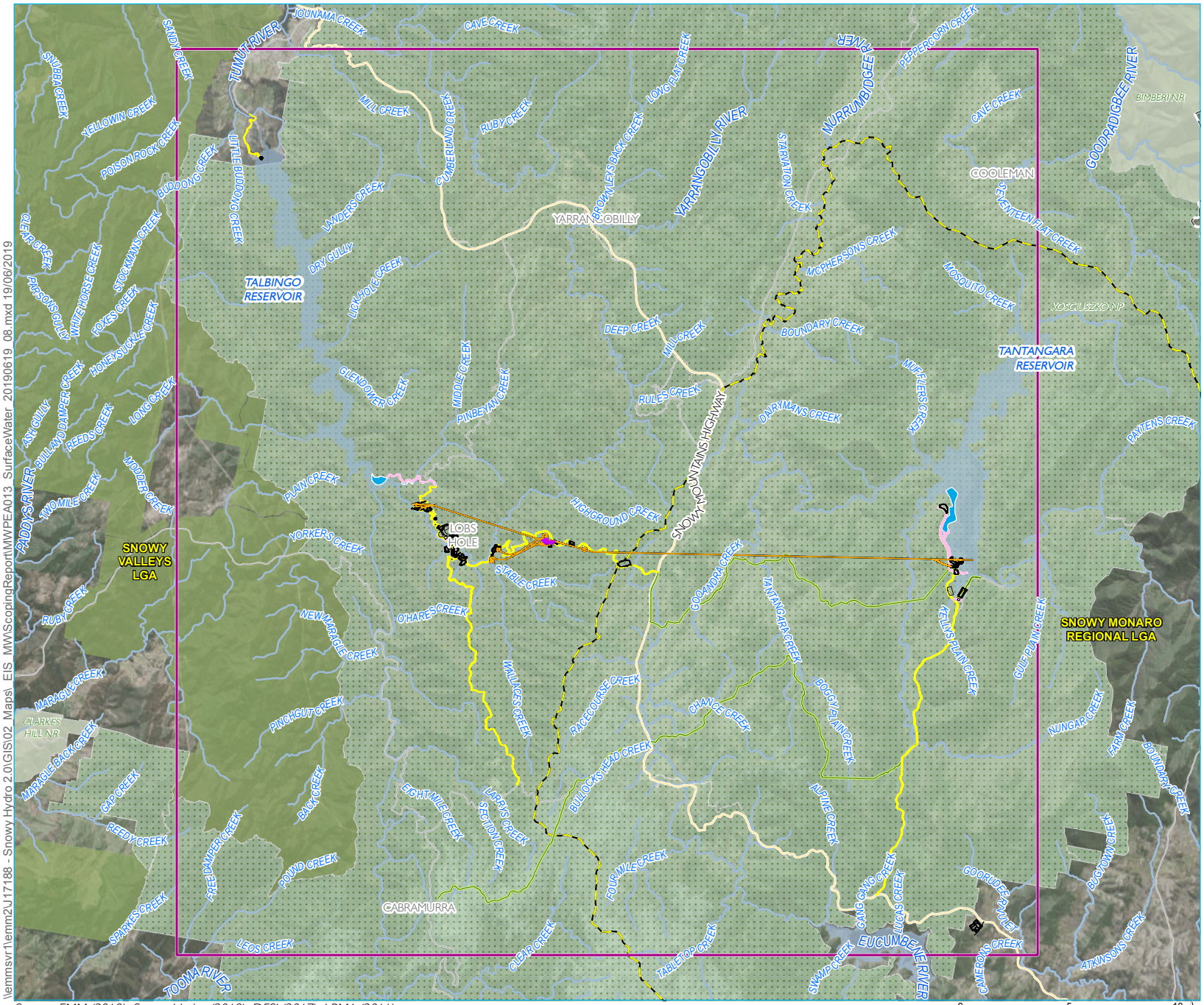
There are no permanent waterbodies within Rock Forest, adjacent to KNP. Drainage across the site flows to the Goorudee Rivulet catchment.

ii Summary of issues

a Construction phase

Key surface water issues during construction include:

- runoff quality from construction areas including roads, lay-down areas, construction compounds and accommodation camps;
- management of water used by and produced by construction activities. This will include water that is dewatered from the tunnels;
- management of waste water produced at accommodation camps;
- changes to surface flow regimes due to surface works, controlled discharges and groundwater impacts;
- watercourse impacts due to works within riparian zones and changes to flow regimes;
- water availability for use in construction and associated licensing; and
- potential flood impacts and management risks.



KEY

- Main Works project area

Snowy 2.0 operational elements

- Tunnels, portals, intakes, shafts
- Power station
- Utilities
- Permanent road

Snowy 2.0 construction elements

- Temporary construction compounds and surface works
- Temporary access road
- Indicative rock emplacement area

Existing environment

- Main road
- Local road
- Watercourse
- Waterbodies
- Kosciuszko National Park
- NPWS reserve
- State forest
- Local government area boundary
- State boundary

Source: EMM (2018); Snowy Hydro (2018); DFSI (2017); LPMA (2011)

\\emmsvr1\emm2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\ScopingReport\MWPEA013 SurfaceWater 20190619 08.mxd 19/06/2019

Surface water features of the project area

Snowy 2.0
Scoping Report
Main Works
Figure 5.5

snowy 2.0

EMM
creating opportunities

b Operation phase

Key surface water issues during operation include:

- runoff quality from permanent surface infrastructure;
- changes to surface flow regimes due to surface works and groundwater impacts; and
- potential flood impacts due to permanent infrastructure and management risks.

c Decommissioning

Decommissioning works will include removal of temporary infrastructure and the rehabilitation of areas disturbed by construction. Key surface water issues during decommissioning include:

- runoff quality during decommissioning works; and
- long term stability and water quality risks of rehabilitated landforms.

iii Possible cumulative impacts

Cumulative impacts are not anticipated for the project. However, consideration will need to be given to the location and method of construction for the Snowy 2.0 transmission connection project proposed by TransGrid, in relation to potential cumulative surface water issues.

iv Approach to assessment in the EIS

The existing surface water environment will be characterised by the following assessments:

- water quality objectives (WQOs) will be established for each receiving water with reference to the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ 2000) and site specific water quality data;
- flow regimes for each receiving water will be established using available data;
- geomorphic characterisation of select watercourses will be undertaken; and
- flood modelling will be undertaken to establish flood characteristics in proximity to the proposed infrastructure.

A surface water impact assessment will be undertaken. The assessment will be integrated with the engineering design of the project and other relevant studies. Water management controls will be established to mitigate identified impacts. All practical controls will be considered. Residual impacts will be described and quantified with reference the WQOs and other surface water characteristics. Consideration of water availability and required license arrangements will also be identified, and with regard to ongoing Snowy Hydro operational requirements of the reservoirs.

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

- *Australian Rainfall and Runoff* (Commonwealth of Australia, 2016);
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ 2000);

- *Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom 2004) and Volume 2 (A. Installation of Services; B. Waste Landfills; C. Unsealed Roads; D. Main Roads; E. Mines and Quarries)* (DECC 2008); and
- *NSW Government's Floodplain Development Manual* (2005).

For the reasons indicated in Section 5.2.2 above, the scope of assessment for Snowy 2.0 will exclude the assessment of impacts of the existing Snowy Scheme which are already authorised.

5.7 Transport and access

5.7.1 Existing environment

The key transport and access locations within the project area most likely to be affected by Snowy 2.0 Main Works are shown on Figure 5.6, and include:

- the Snowy Mountains Highway between Tumut and Cooma;
- other connecting roads to the north and west of Tumut and the north and east of Cooma;
- Miles Franklin Drive at Talbingo (providing alternative access only, if needed);
- Link Road, between the Snowy Mountains Highway and Lobs Hole Ravine Road; and
- Tantangara Road.

Snowy 2.0 will potentially affect existing road traffic movements over a wide area of the national park, including the communities and smaller townships of Talbingo, Tumbarumba, Batlow, Cabramurra and Adaminaby. The existing road users who are using the project area road networks for a combination of local and regional access and recreational travel, include local residents and tourists and business operations and other visitors to the region.

Tantangara and Talbingo reservoirs are used for a variety of recreational boating activities, particularly in the warmer months of the year.

5.7.2 Summary of potential issues

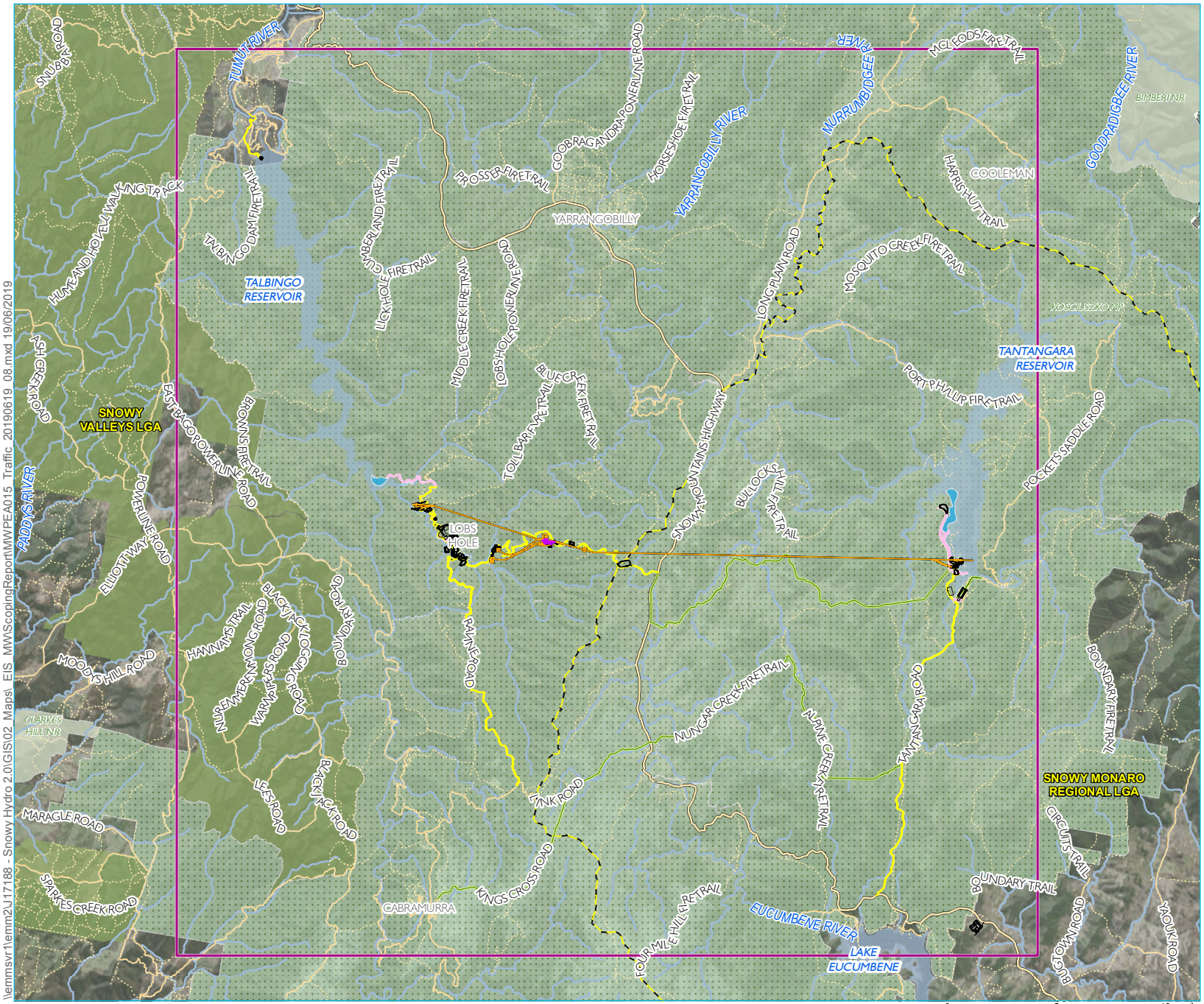
i Construction phase

There will be an increase in traffic on the external road network for the duration of construction, in particular an increase in heavy vehicles due to deliveries of materials to site. For safety reasons, in the immediate vicinity of the proposed construction work, a number of existing roads and tracks will be effectively closed to public access for the duration of the project construction work due to the need to intensively utilise these roads for the project construction access.

Closures to parts of the reservoirs during Snowy 2.0 Main Works is likely to impact on recreational boating activities.

ii Operation phase

No significant increase to traffic movements are expected during operation. However, some roads internal to operational infrastructure may need to remain closed for public safety. Consultation will be carried out with NPWS prior to any permanent closure arrangements.



KEY

- Main Works project area

Snowy 2.0 operational elements
- Tunnels, portals, intakes, shafts
- Power station
- Utilities
- Permanent road

Snowy 2.0 construction elements
- Temporary construction compounds and surface works
- Temporary access road
- Indicative rock emplacement area

Road network
- Main road
- Local road
- Tracks

Existing environment
- Watercourse
- Waterbodies
- Kosciuszko National Park
- NPWS reserve
- State forest
- Local government area boundary
- State boundary

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 5 10 km

GDA 1994 MGA Zone 55

N

\\emmsvr1\emm2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MWScopingReport\MWPEA015 Traffic 20190619 08.mxd 19/06/2019

Existing traffic network within the project area

Snowy 2.0
Scoping Report
Main Works
Figure 5.6

snowy 2.0

EMM creating opportunities

iii Decommissioning

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

5.7.3 Possible cumulative impacts

Cumulative impacts to traffic are related to concurrent construction activities occurring as part of Exploratory Works and TransGrid's transmission connection supply to Snowy 2.0, both part of separate applications. No cumulative operational impacts are expected.

Liaison will be undertaken with the appropriate NSW and local government agencies to identify any potential comparable construction or other major projects within the Snowy Mountains area or other adjoining regions of Southern NSW, for which it would be appropriate to undertake cumulative construction stage or operational traffic impacts with Snowy 2.0 Main Works.

5.7.4 Approach to assessment in the EIS

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

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

The existing road network and traffic conditions assessment will also consider the requirements for maintaining local resident road access and vehicle and other access to active and passive recreation areas in the national park including Yarrangobilly Caves, Bullocks Hill, Tantangara Creek, Tantangara Dam, Wares Yard, Selwyn Snow Resort, Coonara Point, O'Hares rest area, and Talbingo and Tantangara reservoirs.

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

- NSW Roads and Traffic Authority (now RMS) 2002, *Guide to Traffic Generating Developments*;
- *Austroads Guides to Road and Intersection Design* (various publications) 2009 and 2010;
- *Austroads Guides to Traffic Management* (various publications);
- Australian Standard AS 2890 Parts 1 and 2, requirements for the design of access and car parking areas for cars and commercial vehicles; and
- *Australian Code for Dangerous Goods Transport*.

5.8 Amenity

5.8.1 Noise and vibration

i Existing environment

There are several communities and smaller townships near the project area including Talbingo, Tumbarumba, Batlow, Cabramurra and Adaminaby. Additionally, KNP accommodates a wide variety of areas for the purpose of passive and active recreational uses and items of historic and Aboriginal heritage. There are also several towns and residences located outside the project area, but are located along key transport routes. These areas have the potential to be exposed to noise and vibration associated with construction of Snowy 2.0 Main Works.

The ambient noise environment in the majority of the study area is defined by natural elements and limited human activity. Observations and measurements undertaken for the Exploratory Works EIS in Talbingo confirmed the acoustic environment is typical of a rural area with natural noise sources (birds and insects), some human activity, domestic pets (dog barks) and occasional local car movements.

Other assessment locations identified in the study area were passive and active recreation areas in KNP. These include Yarrangobilly, Bullocks Hill and Tantangara Creek Bush campgrounds (to the north), Tantangara Reservoir (to the east), Wares Yards campground (to the south-east), Selwyn Snow Resort (to the south), Coonara Point and O'Hares rest area (to the west), Talbingo Reservoir (to the northwest), Tantangara Dam (to the east) and Yarrangobilly Caves (to the north). The noise environment in these regions would be typical of natural areas with limited or no human disturbance and ambient noise controlled by wind in trees, birds, insects, etc.

ii Summary of potential issues

Areas within the KNP for passive and active recreation are the closest and most potentially affected assessment locations for noise emissions from the construction sites. The noise assessment would need to consider dedicated walking and fire trails within the study area. A number of residences are located in proximity to Rock Forest and may also be affected by noise generating activities occurring at the site.

The assessment locations most likely to be affected by construction road traffic noise are residences and camp grounds in the vicinity of the main transport route from Cooma, where it is anticipated the majority of deliveries would travel from (as described in Section 3.4). Other assessment locations in the vicinity of The Link Road, between the Snowy Mountains Highway and Lobs Hole Ravine Road, and Tantangara Road (Wares Yards campground), may also be affected by road traffic noise.

Construction vibration from the works has potential to impact Aboriginal and historic heritage sites in and around Lobs Hole Ravine, electricity transmission line pylons and dam infrastructure. Yarrangobilly Caves has also been identified as a sensitive site requiring consideration of potential far field impacts.

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

- construction noise impacts on nearest noise sensitive receivers such as residents in Cooma and recreation parks, camping grounds and tourist destinations along the Snowy Mountains Highway and in KNP including designated walking trails;
- assessment of adverse weather conditions for daytime and out of hours construction activities;
- blast vibration and overpressure impacts at residences;

- vibration impacts from blasting and from construction plant and equipment on existing infrastructure (eg roads and dams) and historic and Aboriginal heritage items; and,

- road traffic noise impacts on public roads due to project related traffic.

a Construction phase

During the construction phase principle noise and vibration issues will relate to operation of fixed and mobile plant and equipment, batch plants, ventilation tunnelling and blasting activities. Potential for noise impacts will be largely restricted to the main surface work locations and areas of roadway that require upgrade works. Other construction works would be conducted underground including excavation of the tunnels and adits and power station caverns and could result in vibration impacts at assessment locations.

Road traffic noise related to construction activities has the potential to impact a number of residential properties and active/passive recreation areas. Increased road traffic on local roads is expected from materials supply and excavated rock haulage. In addition, due to the relatively large work force required for the project, it is anticipated that there would be fly-in, fly-out workers from Cooma or Canberra airports and associated bus transfers to get workers to the respective accommodation camps and worksites. Where road noise impacts are predicted an assessment will be conducted to ensure it satisfies the requirements of the *Road Noise Policy* (RNP) (DECCW, 2011).

b Operation phase

In terms of operational noise, the power station is to be located underground and noise at the surface infrastructure is not anticipated. Accordingly, operation of Snowy 2.0 is not expected to give rise to any adverse noise impacts. Where plant or equipment is required to be installed on the surface or vent to the atmosphere, an assessment would be conducted to ensure it satisfies the requirements of the EPA 2017, *NSW Noise Policy for Industry* (NPfI).

c Decommissioning

Given works are predominately within KNP, Snowy Hydro will liaise closely with NPWS to determine the extent of decommissioning and types of rehabilitation to be undertaken. Plant and equipment required for decommissioning works is expected to require a smaller fleet and lower overall sound power levels to those required for construction activities, accordingly any noise impacts are expected to be limited.

iii Possible cumulative impacts

Cumulative operational impacts are not anticipated for the project as there is no planned future or current projects within the study area. Additionally, construction sites for the project are typically located sufficiently far apart that cumulative noise from multiple sites is unlikely to result in additional adverse noise impacts. However, where for example road works occur concurrently with nearby compound activities and concurrently with Exploratory Works, this will be assessed cumulatively.

iv Approach to assessment in the EIS

Baseline ambient noise levels for Talbingo township were established as part of the Exploratory Works EIS. It is envisaged that some additional noise monitoring may be required at discrete locations. However, most of the study area is located within the KNP, accordingly minimum rating background noise levels (RBLs) as outlined in the NSW NPfI could reasonably be adopted.

Construction noise levels for Snowy 2.0 Main Works would be predicted using a computer-generated model using Brüel & Kjær Predictor software (the model). The model calculates total noise levels at assessment locations from concurrent operation of multiple noise sources. It considers factors that influence noise propagation such as the lateral and vertical location of plant, source-to-receptor distances, ground effects, atmospheric absorption, topography of the site and surrounding area and applicable meteorological conditions. The model would assess prevailing adverse weather conditions including temperature inversions in accordance with the requirements of the NPfI.

The assessment of noise and vibration would be prepared following the appropriate guidelines, policies and industry requirements, as follows:

- NSW Department of Environment Climate Change (DECC) 2009, *The Interim Construction Noise Guideline* (ICNG);
- NSW Department of Environment Climate Change and Water (DECCW) 2011, *Road Noise Policy* (RNP);
- Australian and New Zealand Environment Council 1990, *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration;* and
- Department of Environment and Conservation (DEC) NSW 2006*, Assessing Vibration: a technical guideline*;
- German Standard DIN 4150 Part 2 1975;
- Australian Standard AS 2187.2 - 2006 "*Explosives* - Storage *and Use - Use of Explosives*"; and
- EPA 2017, NPfI.

5.8.2 Visual amenity

a Existing environment

As previously discussed, Snowy 2.0 Main Works will predominantly be undertaken in KNP, which is a part of the Australian Alps national heritage listing and contains landscapes with high scenic values. The Australian Alps landscape is characterised by peaked ranges, and broad, forested valleys, and is the only true alpine environment in NSW (NPWS 2003). Elevation across the project area is highest near Tantangara Reservoir at around 1,220 m and lowest near Talbingo Reservoir at around 550 m elevation. Several recreational sites are located throughout KNP, contributing to visitation of the park during peak holiday periods. Other parts of KNP are less visited and contain remote wilderness qualities.

b Summary of potential issues

ii Construction phase

Snowy 2.0 Main Works will be sited in several areas of KNP currently accessible and visible to the public. It should be noted the public generally access these areas for the amenity values of the park. However, due to safety reasons, some of these areas will likely be closed during construction. Nonetheless it is expected that there will be areas of construction visible to several sensitive receivers, in particular construction works associated with the intake structure at Tantangara Reservoir is expected to be visible from the reservoir and some publicly accessible areas.

iii Operation phase

Snowy 2.0 will introduce new permanent elements into the landscape. This includes above-ground structures such as tunnel portals, intake structures and new roads. These elements will result in changes to existing views and landscape settings within localised areas of the KNP.

iv Decommissioning phase

The removal of temporary infrastructure would enable opportunities for rehabilitation of the landscape.

a Possible cumulative impacts

A separate project application to be submitted by TransGrid will be providing transmission supply connection to Snowy 2.0. Snowy 2.0 Main Works has potential to result in cumulative impacts with the connection works, due to the introduction of new infrastructure into the landscape setting of KNP.

b Approach to assessment in the EIS

A landscape and visual impact assessment (LVIA) of Snowy 2.0 Main Works will be prepared as part of the EIS. The assessment will consider potential changes to the landscape character and visual setting of KNP, as well as visual impacts of the project in relation to identified sensitive receptors, including recreational users of KNP. The LVIA will focus on those locations where permanent infrastructure is proposed, as well as discuss temporary impacts during construction.

There are no Commonwealth, NSW or local government planning policies, guidelines or standards applicable to visual impact assessment. The visual impact assessment will therefore be prepared with regard to industry standards included within the UK document *Guidelines for Landscape and Visual Impact Assessment (GLVIA) Third Edition* (2013), prepared by the Landscape Institute and Institute of Environmental Management and Assessment. The visual impact assessment will also be prepared with regard to the Standards Australia (AS4282) *Control of Obtrusive Effects of Outdoor Lighting*.

5.9 Social

5.9.1 Existing environment

The social area of influence for Snowy 2.0 Main Works includes KNP and the surrounding towns and communities that have the potential to experience change during the construction and operation of the project.

i Community profile

The nearest large local towns are Cooma and Tumut. Both towns have a population of around 6,100 to 6,400 people, with 56% and 57% (respectively) of the labour force working full time, but above average unemployment rates. The major employment sector in Cooma is retail trade, and the major employment sector in Tumut is manufacturing. Health care and social assistance are also major contributors to local employment, with the towns containing the nearest major social services for the region. This includes regional airports, hospitals and medical centres, primary and high schools, emergency services, and shops and major retail outlets.

Apart from these local towns, there are several smaller communities which may be affected during Snowy 2.0 Main Works, including Talbingo, Cabramurra, Adaminaby, Providence Portal, Tumbarumba and Batlow. The major industries of employment in these towns are manufacturing, public administration and safety, and agriculture, forestry and fishing. The communities have a range of lower order services.

Talbingo and Cabramurra were built for the original Snowy Scheme workers and their families. Talbingo has since developed into a popular place for holiday-makers. Cabramurra was modernised and rebuilt in the early 1970s and accommodates many Snowy Hydro employees and contractors. Adaminaby was relocated from its original location (now known as Old Adaminaby) in 1957 due to the construction of Lake Eucumbene.

ii Recreation

KNP is the sixth-most visited national park in NSW, with almost 2.2 million domestic visitors in 2016. Recreational activities undertaken in the northern area of KNP include drive touring, picnicking, camping, walking, horse riding, cross-country skiing, downhill skiing, snowboarding and snow play, cycling, climbing, caving, canoeing and rafting, boating and fishing. Popular sites for recreational activities are shown on Figure 5.1. Recreation within KNP has been discussed in detail in Section 5.2.

Recreational use of the north end of the park is centred around several geographical precincts, each of which have different uses and users. Those likely to be affected by the Snowy 2.0 Main Works include Lobs Hole Ravine, Talbingo Reservoir, Wares Yards and Tantangara Reservoir. Other precincts and their use may be indirectly impacted by displacement of visitors from these areas.

5.9.2 Summary of potential issues

i Construction phase

Construction of the Snowy 2.0 Main Works has the potential to have the following social impacts:

- increased demand on housing, accommodation, community services and commercial operators as a result of an influx of workforce to the local area;
- amenity impacts associated with construction traffic and noise;
- changes to recreational uses and impacts to recreational users; and
- hazard and risks to public safety.

Snowy 2.0 Main Works could potentially impact housing and accommodation given the potential introduction of new workers into the local area. Potential long-term housing impacts are possible as a result of those workers choosing to relocate to the local area during the construction phase. Potential short-term accommodation impacts are possible as a result of those workers that would stay within the local area and region. Similarly, the Snowy 2.0 Main Works have the potential to impact access to community services and facilities and service providers as a result of the increased workforce.

The construction works could potentially impact a number of commercial operators and recreational users in KNP as a result of restrictions on access to, and usage of, recreational areas, road closures and restrictions, and general construction activity. Similarly, increased construction activity associated with Snowy 2.0 Main Works (compared with Exploratory Works) could impact on recreational users on and surrounding Talbingo and Tantangara reservoirs.

Construction activities that interact with or near publicly assessable areas (ie along public roads) could potentially result in adverse hazards and risks to public safety.

ii Operation phase

The potential social impacts of Snowy 2.0 during the operational phase are likely to be focused on changes to the recreational usage of the Talbingo and Tantangara reservoirs as a result of:

- improved access to the reservoirs (as a result of upgrades to access roads such as Lobs Hole Ravine and Tantangara roads); and

- restrictions on the usage around the intake structures.

Improvements to reservoir access will likely result in additional visitors to these areas. However, continued water level changes and restrictions around the intake structures, may result in changes to recreational usage of the reservoirs. Potential changes to recreational usage of the reservoirs will be investigated further through recreational user surveys.

Workforce and housing and accommodation impacts are unlikely given that it is expected that only a small number of additional operational employees at Snowy Hydro (over and above the number of existing employees) are required to operate Snowy 2.0.

iii Decommissioning phase

The decommissioning of large construction projects can have a significant impact on a local community or communities, especially for more remote communities when the source of some local employment and revenue is reduced. The scale of the impact depends on a range of factors, particularly the scale of contribution that a project makes to employment and revenue within the local economy. Accordingly, the decommissioning of the construction phase of Snowy 2.0 Main Works has the potential to have an impact on the local community as employment and spending is reduced.

5.9.3 Possible cumulative impacts

Cumulative social impacts may arise from Snowy 2.0 Main Works, in addition to those arising from the Exploratory Works, if there are other factors impacting on the social aspects of the local community at the same time as the construction of the project, including other construction projects. In addition, it is possible that the impacts of an increased workforce in the area could be exacerbated by concurrent construction projects, such as the transmission connection to Snowy 2.0 to be carried out by TransGrid.

5.9.4 Approach to assessment in the EIS

An assessment of the potential social impacts of Snowy 2.0 Main Works will be undertaken to address the above issues. The assessment will be undertaken in accordance with the International Association for Impact Assessment's (IAIA) *Social Impact Assessment: Guidance for assessing and managing the social impacts of projects*, published in 2015.

The key objectives of the social assessment will be to:

- understand how and where Snowy 2.0 Main Works will be undertaken;

- understand the demographic profile of areas potentially impacted by Snowy 2.0 Main Works;

- engage with stakeholders to identify community values, opportunities, issues and concerns associated with the Snowy 2.0 Main Works;

- predict and analyse the potential impacts of the Snowy 2.0 Main Works including impacts on access to, and demand for, local services and infrastructure including onsite and offsite housing requirements for construction and operational staff;

- consider the outcomes and key findings of other technical investigations such as investigations into noise, air quality, surface water and traffic to identify potential amenity impacts; and
- develop appropriate mitigation and enhancement strategies.

For the reasons indicated in Section 5.2.2 above, the scope of assessment for Snowy 2.0 will exclude the assessment of impacts of the existing Snowy Scheme which are already authorised.

5.10 Economic

5.10.1 Existing environment

The population of the Snowy Monaro Regional LGA in 2016 was 20,218, and in the same year the population for the Snowy Valleys LGA was 14,395 (ABS 2016). The population of the towns of Cooma and Tumut were 6,379 and 6,154 respectively in 2016. The largest industry of employment in the Snowy Monaro Regional LGA is accommodation and food services followed by agriculture, forestry and fishing and retail trade (SMRC 2016). The largest industry of employment in the Snowy Valleys LGA is agriculture, forestry, retail trade and paper/cardboard manufacturing. The largest industries by employment reflect the region's economic strengths in tourism, agriculture including sheep and cattle farming, and forestry. The winter snow season is a major factor in the region's economy and tourism-focused businesses and infrastructure are common.

The unemployment rates for Snowy Monaro Regional and Snowy Valleys LGAs in 2016 were 3.3% and 5.4% respectively, which were lower than the regional NSW unemployment rate (6.3%) at the time (ABS 2016). Median weekly household income in Snowy Monaro Regional and Snowy Valleys LGAs was $1,200 and $1,120 respectively and are both below the Australian and NSW median weekly household incomes (ABS 2016).

5.10.2 Summary of potential issues

i Construction phase

As a result of Snowy 2.0 Main Works, a significant amount of expenditure will be spent within the local, regional and NSW economies during the construction phase over a relatively short period of time. The expenditure is estimated to be between $3.8 and $4.5 billion over a six year period. In addition, the construction phase will generate between 1,500 to 2,000 full-time equivalent jobs over the six year construction period.

Accordingly, it is expected that Snowy 2.0 Main Works will have positive impacts on the local, regional and NSW economies during the construction phase through capital costs, contractor and employee salaries and associated local spending.

ii Operation phase

During the operational phase, capital expenditure will significantly reduce. Notwithstanding this, it is expected that during operations Snowy 2.0 will generate significant economic benefit to the national economy by stabilising system and energy reliability in the NEM. As a result, is expected that Snowy 2.0 will have the following economic benefits during operations.

Table 5.2 Economic benefits during operations

Market segment	Benefits
Wholesale energy market	• Orderly use of base-load generation • Lower costs of generation operation • Longer term reliability • Provision of a firming service for wholesale electricity supply • Increased sharing of generation between states • Increased generation inertia and greater system reliability • Availability of spinning generation for the provision of spinning reserve
Retail	• Lower cost and availability in firming intermittent generation • Lower energy procurement costs • Increased retail competition
Customers/consumers	• Improved security and reliability • Lower retail prices
Snowy Hydro	• Price arbitrage in the spot market • Sale of hedging contracts • Growth platform to grow and augment the product suite

Source: Snowy Hydro (2017)

iii Decommissioning phase

As Snowy 2.0 Main Works transitions from construction to operations, there will be reduction in the amount of capital expenditure and employment. Notwithstanding this, the decommissioning phase is expected to generate economic benefits with the local, regional and state economies.

5.10.3 Possible cumulative impacts

It is possible that the impacts of increased expenditure and workforce in the area could be exacerbated by concurrent construction projects, such as the transmission connection to Snowy 2.0 to be carried out by TransGrid.

5.10.4 Approach to assessment in the EIS

Infrastructure and energy projects have had different requirements when it comes to economic assessment in NSW, and all have used very different economic assessment methods. The proposed scope of the economic assessment for Snowy 2.0 Main Works would include two main components:

- an Input-Output (IO) analysis to address local economic effects, drawing on information from the social assessment and modelling the likely wage expenditure and other purchases in the local economy; and
- a Computable General Equilibrium (CGE) analysis to address broader economic effects, with impacts modelled for the local area, the remainder of NSW, the remaining NEM states, and the rest of Australia.

5.11 Other issues

5.11.1 Air quality

i Existing environment

The project area for Snowy 2.0 Main Works is in a relatively isolated location between and including the Tantangara and Talbingo reservoirs, at the northern end of KNP. The project area is well clear of the more popular visitor areas, including the main skiing and resort areas to the south and the nearest townships of Cabramurra and Talbingo, approximately 15 km north and 20 km from the project area respectively.

The area is used for low-key recreational pursuits and the intention (as stated in the PoM) is to retain the Back Country status of the area, providing limited access and facilities. As a result, the project area and surrounds are very sparsely populated with recreational users of KNP being the nearest sensitive receivers. Consequently, existing sources of air pollution in the area are limited and are primarily comprised of dust and vehicle exhaust emissions associated with recreational use of the KNP. At a regional level, both Snowy Monaro Regional and Snowy Valleys LGAs contain high levels of agriculture which are likely to influence regional air quality. Additionally, vegetation burning events (hazard reduction burns and bushfires) and dust storm transportation of particulate matter are key drivers of air quality in the region.

ii Summary of potential issues

The potential air quality impacts of Snowy 2.0 Main Works are primarily limited to construction, and are considered to be limited and of relatively low risk. The primary air quality impacts would be impacts on local air quality due to excavated rock management and placement, the use of construction plant and equipment, dust generating construction activities and increased vehicle movements. The proposed accommodation camps will feature STPs and therefore have some potential to generate odorous emissions to ambient air. Of the air quality impacts identified, potential dust generation from the management and placement of excavated rock and the construction of access roads were identified as having priority for further investigation.

Given the relative isolation of Snowy 2.0 Main Works, possible cumulative impacts are likely to be limited to project based air emissions occurring during adverse events or conditions (such as during a bushfire or dry and windy weather).

iii Approach to assessment in the EIS

An air quality impact assessment will be undertaken as part of the preparation of the EIS and will assess the potential impacts of dust emissions from Snowy 2.0 Main Works on sensitive receivers. The assessment will identify potential air quality impacts associated with the project in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2016) which lists the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in NSW.

While not expected to be significant, the potential for odour impacts at the accommodation camp from the proposed sewage treatment plant will be assessed. While likely to be minor, annual greenhouse gas emissions will be considered using the National Greenhouse Accounts Factors (July 2017).

5.11.2 Built environment

A number of the key issues discussed throughout Chapter 5 are relevant to the built environment. Scoping of these issues are predominantly addressed in Section 5.2 (KNP) as well as Section 5.7 (Traffic and access) and Section 5.9 (Social).

5.11.3 Climate change and other risks

i Existing environment

a Climate

Climate patterns in the area are primarily influenced by weather systems that move from west to east across the southern part of the Australian continent. The north-south aligned Snowy Mountains cut across a westerly air stream, which brings rain and snow to the western escarpment and to a lesser degree the eastern slopes.

In summer and autumn this westerly air stream weakens allowing for moist easterly air that brings rainfall predominantly to the eastern parts of the park. Storms are also a common occurrence during the summer months.

Precipitation in KNP increases with elevation, with the exposed western crest of the Main Range receiving more than 2,300 millimetres (mm) of rainfall per year. The western side of KNP receives considerably higher rainfall than the east, which is a distinctive rain shadow region. Snow is a significant contributor to total precipitation received in the high alpine area and typically covers the ground for 3-5 months of the year, with snowdrifts only occasionally persisting through summer. The mantle of snow that seasonally blankets up to 2,500 square kilometres (km^2) of the park represent the most extensive snow-covered area in Australia (NPWS 2006). Specifically, in the project area, average annual rainfall is approximately 980 mm. However, this area experiences large year-to-year variability (Snowy Hydro 2017).

Mean monthly maximum temperatures range from 7.0°C in July to 23.3°C in January. Mean monthly minimum (overnight) temperatures range from -3.9°C in July to 6.5°C in January (Snowy Hydro 2017).

Snowy Hydro (2017) identified key climate change projections for the region:

- mean, maximum and minimum air temperature are projected to rise by an average of ~2°C (by 2060-2079) with an increased frequency of extreme hot days;
- precipitation is projected to decrease on average, dominated by reduced cool-season precipitation (and snow cover);
- inflow is projected to decrease by 13% on average (by 2060) with an increased frequency of drought events;
- precipitation is projected to become more intense; and
- severe bushfire weather is projected to become more frequent, with a lengthening of the fire season.

b Bushfire

The project area was previously affected by a major bushfire during the 2002-03 fire season. This was the most significant fire event experienced within KNP since records have been kept and the most spatially extensive fire recorded since 1939 (NPWS 2008). The main existing sources of ignition of unplanned fires in both the Snowy Monaro BFMC area and the Riverina Highlands BFMC area are reported to be lightning strikes, accidental ignition from high voltage power lines and vegetation management, escapes from legal and illegal burning, as well as campfires, and arson.

c Topography/steep slopes/landform/risks

The geomorphic history of the project area is complex and has resulted in a landscape of disrupted drainage patterns, swampy basins and erosion surfaces (Snowy Hydro 2017). This complexity is seen in the diverse landforms present in the area ranging from valleys to mountain ranges. The alpine area comprises granites that have formed faulted, stepped ranges at the point where the South Eastern Highlands in NSW turn west into Victoria. More recent volcanic activity produced basalts in the north, which are characterised by flat-topped hills. The sedimentary rocks of the Byadbo country have eroded into steep-sided valleys and ridges, while the limestone landscapes of Cooleman Plain and Yarrangobilly are pocketed with sinkholes and caverns (NPWS 2006). Moreover, in the Pleistocene, the cold climate superimposed glacial features on the landscape, adding to the diverse topography (OEH 2017).

ii Summary of potential issues

a Climate change and natural hazards

Climate change risks during construction would primarily be associated with the occurrence of severe weather events, such as increased frequency and severity of rainfall events, as well as drought events, placing increased pressure on erosion and sediment control measures and/or flooding events in the tunnels or at the work sites (Snowy Hydro 2017).

Climate change risks during the operation of Snowy 2.0 are likely to include:

- an increase in the incidence of bushfires in the areas of vegetation surrounding the project area; and
- changes in the seasonality of the region and the amount of annual precipitation and runoff, which can be captured in Snowy Scheme storages.

b Bushfire risk

The construction phase of Snowy 2.0 Main Works has the potential to result in unplanned fires, creating a risk to project staff as well as to members of the public. Key considerations include:

- potential sources of ignition (most likely from equipment such as diesel generators, fuel bowsers, magazine (explosives) storage and transport and LPG gas tanks);
- limited access and isolated development which poses significant challenges from a bushfire risk and management perspective; and
- ensuring adequate construction standards and asset protection zones.

The implementation and management of bushfire protection measures will continue to be required for the operation phase of the project.

c Subsidence risk

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

- built infrastructure such as roads (Snowy Mountains Highway) and transmission lines;

- natural features such as creeks (Nungar, Tantangara and Gooandra creeks), rivers (Eucumbene and Yarrangobilly rivers), steep slopes and cliffs; and
- historic and Aboriginal heritage features.

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

iii Approach to assessment in the EIS

a Climate risk

The risk and vulnerability of Snowy 2.0 to climate change will be assessed with reference to the NSW Government's climate projections and in accordance with the Australian Government's *Climate Change Impacts and Risk Management – A Guide for Business and Government* (2006). The EIS will also outline measures recommended to improve the resilience capacity of Snowy 2.0 to any identified risks or vulnerabilities.

b Bushfire risk

The potential for bushfire hazard and risk impacts of Snowy 2.0 Main Works will be investigated further through the EIS and through a detailed Bushfire Risk and Hazard Assessment (BFRHA) prepared in accordance with the relevant guidelines and standards. As the project occurs on bushfire-prone land and is development that is potentially exposed to a bushfire threat, the BFRHA will be prepared in accordance with the NSW RFS *Planning for Bush Fire Protection. A guide for Councils, planners, fire authorities and developers* (2006) (PBP). The BFRHA will consider and incorporate the procedures detailed in the *Kosciuszko National Park Fire Management Strategy 2008-2013* (NPWS 2008), where relevant to the project.

c Subsidence risk

There is a growing amount of knowledge of the geology in the project area. Geotechnical and seismic data being collected will assist in the provision of baseline information for the preparation of the EIS. This will identify the ground conditions for earthworks and tunnelling and clarify and confirm potential subsidence, or ground movement, impacts.

6 Community and other stakeholder engagement

6.1 Introduction

Stakeholder engagement and consultation for Snowy 2.0 commenced in advance of the preparation of the EIS for the Exploratory Works. Stakeholder activities have been led by Snowy Hydro with the support of EMM and technical specialists as required.

6.2 Stakeholder engagement framework

To ensure its objectives are addressed, Snowy Hydro developed an end-to-end framework for stakeholder engagement based on the International Association for Public Participation (IAP2) *Public Participation Spectrum* (2014). The key phases and how they have been implemented for Snowy 2.0 to date are:

- identify - identification of stakeholders and impacts;
- design and prepare - definition of desired level of engagement (to inform, consult, involve, or collaborate), and the development of corresponding stakeholder engagement tools and methods;
- engage - commence stakeholder engagement in line with the level identified in the previous phase, and implement relevant methods;
- provide feedback - create mechanisms for timely two-way feedback on stakeholder needs and concerns; and
- review - implement a continuous improvement loop to assess the adequacy and effectiveness of engagement, and where required, change the nature of engagement.

This framework will be applied during development of the Snowy 2.0 Main Works EIS and throughout the lifespan of Snowy 2.0, with the ability to adapt as Snowy 2.0 progresses from Exploratory Works to the construction and operational phases of Main Works.

6.3 Stakeholder identification

Identified stakeholder groups with an interest in the project include:

- nearby towns, townships and communities including Tumut, Adaminaby, Talbingo, Tumbarumba, Cabramurra and Cooma;
- NPWS as owner and manager of KNP;
- State and Commonwealth government agencies;
- Snowy Monaro Regional and Snowy Valleys councils;
- Aboriginal groups;
- recreational park users;

- environmental groups;
- irrigators;
- chambers of commerce and community groups;
- tourism operators;
- the general public; and
- media.

6.4 Stakeholder engagement

Stakeholder engagement for Snowy 2.0 has been comprehensive to date and reflects the importance Snowy Hydro places on this aspect of its business.

Stakeholder engagement commenced with the introduction of Snowy 2.0 to all stakeholders in mid-to-late 2017, including provision of information on Snowy Hydro's website, publication of newsletters and booklets, a round of community drop-in sessions held in Adaminaby, Cooma, Talbingo and Tumut in November 2017, briefing sessions and meetings. These engagement activities have continued throughout the development of Main Works.

Further details of the engagement activities undertaken to date are contained in the EIS for Exploratory Works (EMM 2018a).

6.5 Ongoing stakeholder engagement

Snowy Hydro is committed to continuing to engage with stakeholders during the approval process for Snowy 2.0.

Engagement targeted specifically for Snowy 2.0 Main Works will comprise several initiatives, as follows:

- two rounds of community consultation sessions to be held in key local communities. One round was completed in late 2018 and one round will be held mid 2019;
- Chamber of Commerce-led engagement with businesses around impacts and opportunities associated with Snowy 2.0 Main Works;
- engagement with Indigenous leaders, groups, and organisations around mobilisation for opportunities associated with Snowy 2.0 Main Works;
- discussions with potentially-affected commercial operators in KNP; and
- discussions with recreational groups around potential impacts to recreational usage associated with Snowy 2.0 Main Works.

In addition to these direct stakeholder and community engagement initiatives project information will also be provided to the local community and targeted stakeholders via the following:

- project information booklets and video;
- Snowy 2.0 pages on the Snowy Hydro website (www.snowyhydro.com.au);
- emails to key groups including groups registered on the Snowy 2.0 Business Directory;
- Snowy 2.0 display in the Snowy Hydro Discovery Centre, Cooma.
- Snowy Hydro quarterly newsletter will contain project updates; and
- a project email address to directly respond to concerns and enquiries (snowy2.0@snowyhydro.com.au).

7 Conclusion

7.1 Request for assessment requirements

The purpose of this Scoping Report is to request and inform the content of the SEARs for the Snowy 2.0 Main Works. The SEARs will specify the requirements for the EIS that will be prepared to accompany the application for the Snowy 2.0 Main Works.

7.2 Scope of Snowy 2.0 Main Works

Snowy 2.0 is being developed in phases with this Scoping Report addressing the second phase of the project, known as the **Snowy 2.0 Main Works**. The scope includes the construction and operation of Snowy 2.0 Main Works, including construction and operation of:

- an underground pumped hydro-electric power station complex;
- water intake structures at Tantangara and Talbingo reservoirs;
- power waterway tunnels, chambers and shafts;
- access tunnels;
- new and upgraded roads to allow ongoing access and maintenance; and
- power and communication infrastructure, including:
    - a cableyard to facilitate connection between the NEM electricity transmission network and Snowy 2.0; and
    - permanent auxiliary power supply connection; and
    - permanent communication cables.

To facilitate construction of the above elements, the following construction infrastructure and activities are required:

- construction compounds at Talbingo, Lobs Hole, Marica and Tantangara;
- construction adits at Talbingo and Tantangara;
- a construction logistics site at Rock Forest;
- site-based accommodation camps at Lobs Hole, Marica and Tantangara;
- road establishment and other access improvements and upgrades to allow access to construction areas;
- management of excavated rock from tunnelling activities, including:
    - permanent storage within Talbingo and Tantangara reservoirs; and
    - temporary and/or permanent on-land storage within the KNP and temporary and/or permanent storage outside of KNP;

- supporting services infrastructure including construction power, water and wastewater infrastructure, and communication infrastructure; and

- continued access to Talbingo Reservoir for laying of the communications cable and establishment of barge access infrastructure at Tantangara Reservoir for construction of the intake and placement of excavated material.

Some construction activities associated with Snowy 2.0 Main Works may also be undertaken outside of the project area at Rock Forest. Once Snowy 2.0 Main Works are completed, temporary construction elements (such as construction compounds and accommodation camps will be removed and on-going rehabilitation and revegetation programs implemented.

Operation of Snowy 2.0 will involve the transfer of water through a series of newly established power waterway tunnels and the underground power station to provide for energy generation, as well as large scale energy storage. Energy will be generated when water is transferred from Tantangara Reservoir, through the headrace tunnel into the underground power station, before being transferred to Talbingo reservoir through the tailrace tunnel. Storage of energy will be possible by pumping water back through the tailrace tunnel, from Talbingo Reservoir up to Tantangara Reservoir, where it can be used again for energy generation when needed.

Impacts associated with the first phase of Snowy 2.0, the Exploratory Works, are excluded from this Scoping Report, and have been addressed in a separate EIS and application (EMM 2018a, see Application Number SSI 18_9208). However, certain elements of the Exploratory Works are relevant to the Snowy 2.0 Main Works, such as continued use of the accommodation camp and construction compound at Lobs Hole. These relevant elements have been specified where applicable in this Scoping Report.

There are other works that may be required by Snowy 2.0 Main Works but which are also excluded from this Scoping Report. These works include the outcomes of ongoing investigations for quarries to supply both aggregate and sand required for concrete production as well as some revisions requested by the construction contractor.

7.3 Approval requirements

Snowy 2.0 has been declared SSI and CSSI in accordance with the provisions of the EP&A Act with the declaration coming into effect on 9 March 2018. As a result, Snowy 2.0 Main Works may be carried out without development consent under Part 4 of the EP&A Act. However, the project is subject to Division 5.2 of the EP&A Act that requires preparation of an EIS and approval from the NSW Minister for Planning.

With respect to the provisions of the EPBC Act, further detailed survey work is needed to determine potential impacts of Snowy 2.0 Main Works on MNES and the environment generally. Therefore, Snowy Hydro nominated Snowy 2.0 Main Works has the potential to result in a significant impact on MNES and considered the action is likely to be a controlled action. Snowy 2.0 Main Works was deemed a controlled action on 5 December 2018 and the Commonwealth has accredited the NSW assessment process under Division 5.2 of the EP&A Act. This accreditation will enable DPE to manage the assessment process of Snowy 2.0 Main Works, including the issuing of SEARs and the assessment of the EIS.

Accordingly, it has been assumed that a single EIS will be required for Snowy 2.0 Main Works, and that the EIS will address the requirements of all State and Commonwealth agencies. The EIS will be supported by comprehensive technical reports attached as appendices to the main report.

Glossary

Term	Meaning
Access road extension	A new access road that is an extension of an existing access road
Access road upgrade	Upgrade works (realignment, widening or no widening) of existing access roads
Accommodation camp	Area used for temporary housing and facilities for construction personnel
Barge access infrastructure	A ramp and associated facilities to allow the loading and unloading of barge(s) on reservoirs
Base-load	Represents the minimum continuous level of energy demand in a grid system
ECVT	Emergency egress and cable ventilation tunnel
Exploratory Works	A program of exploratory works for Snowy 2.0, subject of the Exploratory Works for Snowy 2.0 EIS
Firming generation/capacity	Energy available within the network to respond to demand when other energy sources, such as intermittent renewables are not operating (due to low wind or low sunlight)
Headrace surge tank	A series of vertical shafts at the end of the headrace tunnel providing pressure release for the power waterway
Headrace tunnel	Upstream tunnel that will lead west from Tantangara intake and terminate at the machine hall of the power station complex
Hydro-electric	Generation of electricity using flowing water (typically from a reservoir held behind a dam or barrage) to drive a turbine which powers a generator
Kosciuszko National Park	A National Park protected under the NSW National Parks and Wildlife Act 1974 and managed by NSW National Parks and Wildlife Service. It covers an area of 673,543 hectares and forms part of Australia's only Alpine area
Lobs Hole	A former settlement location within Kosciuszko National Park, and primary location of Exploratory Works and elements of Main Works
Lobs Hole accommodation camp	Area used for temporary housing and facilities for construction personnel at Lobs Hole
Lobs Hole construction compound	Main area used for construction facilities at Lobs Hole, including ancillary facilities, laydown, storage, and environmental controls
Lobs Hole Mine	The site of a former copper mine circa 1908, located at Lobs Hole
Lobs Hole Ravine Road	The existing access road to Lobs Hole connecting to Link Road
Lobs Hole Road	The road at Lobs Hole, not the main access down to Lobs Hole
Machine hall	Section of the power station containing the pump/turbines
Main Works	The second phase of Snowy 2.0. This phase of the project covers the major elements of Snowy 2.0, including the underground power station, power waterways, access tunnels and access, power and communications infrastructure, as well as supporting infrastructure to enable construction.
Marica construction compound	Area used for construction facilities near the existing Marica track, including ancillary facilities, laydown and storage, and environmental controls
Middle Bay Road	The access road from Lobs Hole to the Middle Bay barge ramp.
Miles Franklin Drive	Existing road leading to Spillway Road, travelling through Talbingo township
Mine Trail Road	The access road from the intersection with Lobs Hole Ravine Road leading to the MAT and ECVT
Power station	An industrial facility for the generation of electric power

Term	Meaning
Project area	The area required to access and build project infrastructure, including surface and tunnel components of the project
Snowy 2.0	A pumped-hydro expansion of the Snowy Scheme that will link the two existing reservoirs of Tantangara and Talbingo through underground tunnels, and include a new underground power station with pumping capabilities.
Subaqueous rock emplacement area	The location for rock emplacement within Talbingo and Tantangara reservoirs
Subaqueous rock placement trial program	An initial trial program of rock emplacement within Talbingo Reservoir of up to 50,000 m3 will be carried out during Exploratory Works. The program will be implemented in accordance with a detailed management plan. The program may be continued to include subaqueous placement of a greater proportion of excavated rock (ie up to 750,000 m3) subject to further consultation with relevant authorities.
Tailrace tunnel	Downstream tunnel that will lead east from the Talbingo intake and terminate at the machine hall of the power station complex
Talbingo construction adit	The construction adit near the Talbingo intake providing access to the tailrace tunnel
Talbingo intake	Water intake at Talbingo Reservoir
Tantangara accommodation camp	Area used for temporary housing and facilities for construction personnel near Tantangara Reservoir
Tantangara construction adit	The construction adit near the Tantangara intake providing access to the headrace tunnel
Tantangara construction compound	Area used for construction for the Tantangara intake and Tantangara adit, including ancillary facilities, laydown and storage, and environmental controls
Tantangara intake	Water intake at Tantangara Reservoir
Transformer hall	Section of the power station containing the transformers
Tumut 2 power station	Underground power station south of Talbingo Reservoir that discharges into Talbingo Reservoir at Sue City
Tumut 3 power station	Power station at the northern end of Talbingo Reservoir that moves water from Talbingo Reservoir into Jounama Reservoir
Variable renewable generation	Intermittent renewable wind and solar energy sources that are non-dispatchable and fluctuating in nature
Water intakes	Intake structures at Tantangara Reservoir and Talbingo Reservoir enabling the conveyance of water into the power waterways

Abbreviations

ABS	Australian Bureau of Statistics
AC	Acid consuming
ACHA	Aboriginal cultural heritage assessment
AEP	Annual exceedance probability
AHD	Australian height datum
AHMIS	Aboriginal heritage management information system
AMP	Asbestos management plan
ANZEC	Australian and New Zealand Environment Council
APZ	Asset protection zone
AQGGA	Air quality and greenhouse gas assessment
AQMP	Air Quality Management Plan
BAM	Biodiversity Assessment Method
BC Act	NSW *Biodiversity Conservation Act 2016*
BCA	Building Code of Australia
BDAR	Biodiversity Development Assessment Report
BFMP	Bushfire Management Plan
BFRHA	Bush fire risk and hazard assessment
BOS	Biodiversity Offset Scheme
CBA	Cost Benefit Analysis
CBP	Concrete batching plant
CEMP	Construction environment management plan
CHMP	Cultural heritage management plan
COPCs	Contaminants of potential concerns
CSSI	Critical state significant infrastructure
CTMP	Construction traffic management plan
DEC	NSW Department of Environment and Conservation
DECCW	NSW Department of Environment Climate Change and Water
DEE	Commonwealth Department of the Environment and Energy
DIDO	Drive-in drive-out
DNA	Deoxyribonucleic acid
DPE	NSW Department of Planning and Environment
DPI	NSW Department of Industry

DoI Water	NSW Department of Industry – Lands & Water
DSM	Digital surface model
ECVT	Emergency egress, cable and ventilation tunnel
EIS	Environmental impact statement
EMM	EMM Consulting Pty Limited
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EP&A Regulation	*NSW Environmental Planning and Assessment Regulation 2000*
EPA	NSW Environment Protection Authority
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EPIs	Environmental planning instruments
EPL	Environment protection licence
ERP	Emergency Response Plan
ESCP	Erosion and sediment control plan
FIFO	Fly-in fly-out
FM Act	NSW *Fisheries Management Act 1994*
FMS	*KNP Fire management strategy*
FSL	Full supply level
FHWA	Federal highways
g	Gram
GDEs	Groundwater dependent ecosystems
GL	Gigalitre
GL/year	Gigalitres per year
GWh	Gigawatt hour
ha	Hectares
HDPE	High density polythene
HHIMS	Historic heritage information management system
IAP2	International Association for Public Participation, Public Participation Spectrum
IBRA	Interim biogeographic regionalisation of Australia
ICI	Imperial chemical industries
ICOMOS	Australia International Council on Monuments and Sites
ICNG	Interim construction noise guideline
kL	Kilolitre
km	Kilometre
km^2	square kilometre
KNP	Kosciuszko National Park

L	Litres
L/s	Litres per second
LGA	Local government area
LSC	Land and soil capability
m	Metre
m^2	Square metre
m^3	Cubic metre
MAT	Main access tunnel
MNES	Matters of national environmental significance
MOL	Minimum Operating Level
MOU	Memorandum of Understanding
MW	Megawatt
MWh	Megawatt hour
NCC	Nature Conservation Council
NEM	National electricity market
NML	Noise management level
NPA	National Parks Association
NPW Act	NSW *National Parks and Wildlife Act 1995*
NPW Regulation	NSW *National Parks and Wildlife Regulation 2009*
NPWS	NSW National Parks and Wildlife Service
NSW	New South Wales
NSW Archaeology	New South Wales Archaeology Pty Ltd
NTSCORP Limited	Native Title Services Corporation Limited
NVA	Noise and vibration assessment
OEH	NSW Office of Environment and Heritage
OOH	Out of hours
PAF	Potentially acid forming
PBP	*Planning for Bush Fire Protection Guideline*
PCTs	Plant community types
PMF	Probably maximum flood
PoM	Plan of management
PV	Photovoltaic
RAPS	Registered Aboriginal Parties
REE Act	*Renewable Energy (Electricity) Act 2000*
RFS	NSW Rural Fire Service

RMS	NSW Roads and Maritime Services
RNP	*Road noise policy*
SEARs	Secretary's environmental assessment requirements
SEPP	State Environmental Planning Policy
SHC Act	NSW *Snowy Hydro Corporatisation Act 1997*
SMP EMP	The Snowing Management Plan Environmental Management Plan
Snowy Scheme	Snowy Mountains Hydro-electric Scheme
Snowy Hydro	Snowy Hydro Limited
SLPs	Service level providers
SEPP	State Environmental Planning Policy
SRD SEPP	*State Environmental Planning Policy (State and Regional Development) 2011*
STP	Sewage treatment plant
TEC	Total Environment Centre
TECs	Threatened ecological community
TRC	TRC Tourism Pty Ltd
TSP	Total suspended particles
VPA	Voluntary planning agreement
WMP	Water management plan

References

Aplin, K, Ford, F & Hiscock, P 2010, Early Holocene human occupation and environment of the southeast Australian Alps: new evidence from the Yarrangobilly Plateau, New South Wales. In S. Haberle, J. Stevenson and M. Prebble (eds). *Altered Ecologies: Fire, Climate and Human Influence on Terrestrial Landscapes*, Terra Australia 32 Canberra: ANU E-Press, 187-212.

Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand (ANZECC/ARMCANZ) 2000, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality: Sediment Quality Guidelines*, National Water Quality Management Strategy.

Australian Energy Market Operator (AEMO) 2018, *Integrated System Plan July 2018 for the National Electricity Market.*

Australia International Council on Monuments and Sites (ICOMOS) 2013a, *Australia ICOMOS Burra Charter,* International Council on Monuments and Sites.

- 2013b, Understanding and Assessing Cultural Significance. International Council on Monuments and Sites.
- 2013c, The Burra Charter and Archaeological Practice. International Council on Monuments and Sites.
- 2017, Intangible Cultural Heritage and Place. International Council on Monuments and Sites.

Blakers, A., Stocks, M., Lu, B., Anderson, K. and Nadolny, A., 2017. *An atlas of pumped hydro energy storage.*

Boot, P 2000, *An archaeological assessment of proposed track upgrade, pit toilet construction and camping area construction at Denison, Lake Eucumbene, Kosciuszko National Park. A report to South West Slopes Region*, NSW National Parks and Wildlife Service, Tumut.

Dunn, B., 1991. *Snowy Mountains Scheme Augmentation Ranking Study*, Cooma.

EMM Consulting Pty Limited (EMM) 2018a, *Environmental Impact Statement: Exploratory Works for Snowy 2.0*, Vol 1, prepared for Snowy Hydro Limited.

- 2018b, Response to Submissions: Exploratory Works for Snowy 2.0, Vol 1, prepared for Snowy Hydro Limited.

Heritage Council of NSW 1996, *NSW Heritage Manual,* NSW Office of Environment and Heritage.

- 2001, *Guidelines: Assessing Significance*, NSW Office of Environment and Heritage.
- 2009, *Assessing Significance for Historical Archaeological Sites and Relics,* NSW Office of Environment and Heritage.

Independent Scientific Committee (ISC) 2004, *An assessment of the values of Kosciuszko National Park.* Chapter 8: Aquatic Values, Dr Richard Marchant.

Landcom 2004, *Managing Urban Stormwater: Soils and Construction*, volume 2D, NSW Government.

McDowell, R. (1994). Freshwater Fishes of South-eastern Australia.

National Health and Medical Research Council (NHMRC) 2011, *Australian drinking water guidelines paper 6 national water quality management strategy*. National Health and Medical Research Council, National Resource Management Ministerial Council, Commonwealth of Australia, Canberra.

Natural Resources Access Regulator (NRAR) 2018, *Guidelines for Controlled Activities on Waterfront Land*, NSW Department of Industry.

NSW Department of Environment and Climate Change (DECC) 2008, *Managing Urban Stormwater: Soils and Construction*, NSW Department of Environment and Climate Change.

- 2009, *Interim Construction Noise Guideline*, NSW Department of Environment and Climate Change.

NSW Department of Environment Climate Change and Water (DECCW) 2011, *Road Noise Policy*, NSW Department of Environment, Climate Change and Water.

NSW Department of Infrastructure, Planning and Natural Resource (DIPNR) 2005, *Floodplain Development Manual*, NSW Office of Environment and Heritage.

NSW Department of Planning and Environment (DPE) 2017 draft *Environmental Impact Assessment Guidance Series*.

NSW Department of Primary Industries - Fisheries (DPI Fisheries) 2013, *Policy and Guidelines for Fish Habitat Conservation and Management,* NSW Department of Primary Industries.

NSW Environment Protection Agency (EPA) 2014, *Waste Classification Guidelines*, NSW Environment Protection Agency.

NSW Government 2014, *NSW Renewable Energy Action Plan*, NSW Government.

NSW National Parks and Wildlife Services (NPWS) 2003, *The Bioregions of New South Wales.*

- 2006, Kosciuszko National Park Plan of Management, NSW Office of Environment and Heritage.
- 2008, *Kosciuszko National Park Fire Management Strategy 2008-2013*, NSW Office of Environment and Heritage.
- 2011, *Kosciuszko National Park Geodiversity Action Plan 2012-2017*, NSW Office of Environment and Heritage.

NSW Office of Environment and Heritage (OEH) 2010, *Aboriginal Cultural Heritage Consultation Requirements for Proponents,* NSW Office of Environment and Heritage.

- 2012, *The land and soil capability assessment scheme: second approximation,* 2nd Edition, NSW Office of Environment and Heritage.
- 2017, *The Biodiversity Assessment Method*, NSW Office of Environment and Heritage.

NSW Rural Fire Service (NSW RFS) 2006, *Planning for Bush Fire Protection*. A guide for Councils, planners, fire authorities and developers, NSW Rural Fire Service.

- 2014, *A Guide to Developing a Bush Fire Management and Evacuation Plan*, NSW Rural Fire Service.

NSW Roads and Maritime Services (RMS) 2002, *Guide to Traffic Generating Developments*, Transport for NSW.

- 2004, *Road Classification Review Information Paper and Invitation of Submissions*, Transport for NSW.

- 2010, *Traffic Control at Work Sites manual*, Transport for NSW.

Snowy Hydro 2017, *Snowy 2.0 Feasibility Study*, prepared by Snowy Hydro Limited, retrieved June 2, https://www.snowyhydro.com.au/our-scheme/snowy20/snowy-2-0-feasibility-study/.

Theden-Ringl, F 2016, *Aboriginal presence in the high country: new dates from the Namadgi Ranges in the Australian Capital Territory*. *Australian Archaeology*. 82:1, 25 - 42.

TransGrid 2018, Preliminary Environmental Assessment Snowy 2.0 Transmission Connection Project.

Appendix A

Scoping worksheet

Project: Snowy 2.0 Main Works

MATTERS			IMPACTS		ASSESSMENT LEVEL	CUMULATIVE IMPACTS	COMMUNITY ISSUES	ASSESSMENT APPROACH	SCOPING REPORT	RATIONALE
Potential matters that could be affected by the project			Is the project (without mitigation) likely to cause an impact?	Are the impacts (without mitigation) likely to be significant based on the magnitude of the impacts and/or sensitivity of receivers?	What level of assessment is required to assess impacts and determine mitigation measures?	Will cumulative assessment be required?	Did the community raise any concerns about the impacts?	Indicative approach to assessment in EIS	Where was this addressed in the Scoping Report?	Rationale for ratings in the worksheet
Group	**Specific**	**Meaning of the matter for purposes of the worksheet**	**Impact?**	**Significant Impact?**	**Assessment Level**	**Cumulative Impact?**	**Concerns?**	**Category**	**Section**	
ACCESS	access to property	includes general access and disabled, pedestrian and cyclist access to public and private property (buildings, open space, recreation areas)	Yes	Likely	Detailed	No	Yes	Standard Assessment + focussed engagement	5.7	This includes consideration of access to KNP, which will potentially be closed in some areas during construction (access to KNP, Lobs Hole, Talbingo and Tantangara reservoirs). Temporary closures will impact hikers, cars and other recreation (such as boating). Changes to access of recreational areas was raised by the community during previous submissions on Exploratory Works.
	port / airport facilities	existing port/airport capacity	Yes	Unknown	Standard	Yes	No	Standard Assessment + CIA	5.7	There are no ports to be impacted. It is possible the project may require FIFO of workers from nearby airports. The number of personnel flying vs driving to site is not yet known. Similarly, workforce mobilisation by TransGrid will occur concurrently as part of the Transmission Connection Works.
	road and rail network	existing network capacity and traffic on roads/rail, intersections, major roads/rail, residential streets	Yes	Likely	Detailed	Yes	Yes	Detailed Assessment + CIA+ focussed engagement	5.7	No rail impacts anticipated. Construction will impact internal and external road networks and intersections. Some roads will be upgraded as part of Main Works, and transport of materials via Snowy Mountains Highway and the arterial road network.
	offsite parking	parking on the project site, offsite and surrounding areas during construction and/or operation	Yes	Likely	Standard	No	No	Standard Assessment	5.7	Parking will be provided primarily on site within construction areas. No removal of offsite parking is proposed.
AIR	particulate matter	fine and coarse airborne particles including dust, dirt, soot, smoke, and liquid droplets	Yes	Likely	Standard	Yes	No	Standard Assessment + CIA	5.11.1	Dust will be the key air quality impact of Main Works due civil and earthworks for surface components and transport of excavated materials. Management measures are known and routinely used.
	gases	gases that cause air pollution and potential health problems including carbon monoxide, volatile organic compounds, ozone, nitrogen dioxide and sulphur dioxide,	Yes	Unlikely			No	Scoping Report	5.11.1	Operation of plant and equipment may emit some gases but would not be significant and not expected to impact on health.
	atmospheric emissions	long-term changes in the pattern of weather, which can cause changes in oceans, land surfaces and ice sheets.	No	N/A				None (include short explanation in Scoping Report)	Scoping Worksheet	The project is not expected to result in long-term weather changes. The air quality assessment will include consideration of greenhouse gas emissions.

MATTERS			IMPACTS		ASSESSMENT LEVEL	CUMULATIVE IMPACTS	COMMUNITY ISSUES	ASSESSMENT APPROACH	SCOPING REPORT	RATIONALE
Potential matters that could be affected by the project			Is the project (without mitigation) likely to cause an impact?	Are the impacts (without mitigation) likely to be significant based on the magnitude of the impacts and/or sensitivity of receivers?	What level of assessment is required to assess impacts and determine mitigation measures?	Will cumulative assessment be required?	Did the community raise any concerns about the impacts?	Indicative approach to assessment in EIS	Where was this addressed in the Scoping Report?	Rationale for ratings in the worksheet
Group	**Specific**	**Meaning of the matter for purposes of the worksheet**	**Impact?**	**Significant Impact?**	**Assessment Level**	**Cumulative Impact?**	**Concerns?**	**Category**	**Section**	
AMENITY	noise	a person's ability to experience a reasonable level of acoustic amenity during recreational pursuits (i.e. during leisure times) and sleep	Yes	Likely	Detailed	Yes	Yes	Detailed Assessment + CIA+ focussed engagement	5.8.1	Construction activities will generate noise and vibration impacts, and are nearby recreational areas. Traffic-related noise impacts have potential to impact residences though it is noted the number of sensitive (residential) receivers proximal to the main works are minimal. Noise impacts were raised by nearby Talbingo residents during previous consultation. There is potential for overlap of construction with TransGrid's connection works, requiring cumulative impact considerations.
	vibration	damage to property likely to be caused by excessive vibrations and a person's ability to experience a reasonable level of amenity during recreational pursuits (i.e. during leisure times) and sleep	Yes	Likely	Detailed	Yes	No	Detailed Assessment + CIA	5.8.1	Tunnelling and surface works will result in vibration impacts. Consideration of these impacts on heritage items will be required. The community raised concern of vibration impacts at the Yarrangobilly Karst Caves.
	visual	the aesthetic appeal of the development area (and surrounds) from different viewing points, including privacy (being free from scrutiny or being observed in private settings, such as one's own home)	Yes	Likely	Detailed	Yes	Yes	Detailed Assessment + CIA+ focussed engagement	5.8.2	New physical elements (temporary and permanent) are being introduced into a National Park setting. A detailed assessment will be required to consider landscape values and changes to views from sensitive receivers. Visual amenity impacts have been raised during consultation with community members.
	odour	Offensive smell that, by reason of its strength, nature, duration, character or quality, or the time at which it is emitted, or any other circumstances: (i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or (ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted. (EPA)	Yes	Likely	Standard	No	No	Standard Assessment	5.11.1	The proposed project accommodation camp will feature a sewage treatment plant and therefore has the potential to generate odorous emissions to ambient air. Consideration of odour on the workforce will be considered as part of the air quality assessment.

MATTERS			IMPACTS		ASSESSMENT LEVEL	CUMULATIVE IMPACTS	COMMUNITY ISSUES	ASSESSMENT APPROACH	SCOPING REPORT	RATIONALE
Potential matters that could be affected by the project			Is the project (without mitigation) likely to cause an impact?	Are the impacts (without mitigation) likely to be significant based on the magnitude of the impacts and/or sensitivity of receivers?	What level of assessment is required to assess impacts and determine mitigation measures?	Will cumulative assessment be required?	Did the community raise any concerns about the impacts?	Indicative approach to assessment in EIS	Where was this addressed in the Scoping Report?	Rationale for ratings in the worksheet
Group	**Specific**	**Meaning of the matter for purposes of the worksheet**	**Impact?**	**Significant Impact?**	**Assessment Level**	**Cumulative Impact?**	**Concerns?**	**Category**	**Section**	
	conservation areas	lands reserved to protect and conserve significant or representative ecosystems, landforms, natural phenomena or places of cultural significance. They provide opportunities for sustainable visitation, public enjoyment, and research. Protect natural and cultural heritage values and provide recreational opportunities. Also provide for other uses including mineral exploration and mining, and petroleum exploration and production.	Yes	Likely	Detailed	Yes	Yes	Detailed Assessment + CIA+ focussed engagement	5.2	Main Works is located within KNP. KNP values include ecosystems, landforms, natural and cultural heritage and recreational values. Impacts to KNP has been raised as a community and stakeholder concern, and will require consideration of cumulative impacts with TransGrid's connection project and with those impacts already assessed as part of Exploratory Works.
BIODIVERSITY	native vegetation	vegetation (including threatened, endangered and critically endangered flora species, populations and communities) native to NSW including its value as corridors, habitat and food source	Yes	Likely	Detailed	Yes	Yes	Detailed Assessment + CIA+ focussed engagement	5.3	Main Works involve earthworks and other ground breaking activities that will necessitate the removal of native vegetation. Threatened flora species are known to occur in the project area and will require detailed assessment and consideration of avoidance and minimisation of impacts. Any impacts will need to consider cumulative activities associated with Exploratory Works and TransGrid's connection works.
	native fauna	fauna species, populations, and communities (including threatened, endangered, critically endangered) native to NSW	Yes	Likely	Detailed	Yes	Yes	Detailed Assessment + CIA+ focussed engagement	5.3	Main Works involve earthworks and other ground breaking activities that will necessitate the removal of native vegetation and potential habitat. Threatened fauna species are known to occur in the project area and will require detailed assessment and consideration of avoidance and minimisation of impacts. Any impacts will need to consider cumulative activities associated with Exploratory Works and TransGrid's connection works.
	aquatic ecology (including noxious species)	aquatic species, populations, and communities and their habitat	Yes	Likely	Detailed	Yes	Yes	Detailed Assessment + CIA+ focussed engagement	5.3	Main Works involves the connection of two existing reservoirs with different aquatic ecology that may be transferred via the power waterway tunnel, in particular redfin (aquatic pest species) is a key issue. In addition, construction of bridges over waterways, and subaqueous placement of excavated rock within the reservoir may impact aquatic ecology. These issues have been raised by the community and stakeholders during consultation, and requires consideration of work being undertaken by Exploratory Works.

MATTERS			IMPACTS		ASSESSMENT LEVEL	CUMULATIVE IMPACTS	COMMUNITY ISSUES	ASSESSMENT APPROACH	SCOPING REPORT	RATIONALE
Potential matters that could be affected by the project			Is the project (without mitigation) likely to cause an impact?	Are the impacts (without mitigation) likely to be significant based on the magnitude of the impacts and/or sensitivity of receivers?	What level of assessment is required to assess impacts and determine mitigation measures?	Will cumulative assessment be required?	Did the community raise any concerns about the impacts?	Indicative approach to assessment in EIS	Where was this addressed in the Scoping Report?	Rationale for ratings in the worksheet
Group	**Specific**	**Meaning of the matter for purposes of the worksheet**	**Impact?**	**Significant Impact?**	**Assessment Level**	**Cumulative Impact?**	**Concerns?**	**Category**	**Section**	
BUILT ENVIRONMENT	public domain	publicly accessible areas of the urban environment (including villages), rural or natural areas	Yes	Likely	Detailed	No	Yes	Standard Assessment + focussed engagement	5.9	Publicly accessible areas that may be impacted relate to natural areas of KNP and recreational uses and facilities. These impacts will be considered as part of a recreational users study proposed to be prepared for the EIS and support the social assessment.
	public infrastructure	road, rail, wharves, bridges, etc	Yes	Likely	Detailed	No	Yes	Standard Assessment + focussed engagement	5.7, 5.11	Existing public infrastructure (roads, utilities) are considered with respect to other matters (such as transport, subsidence). These impacts will be considered as part of a recreational users study proposed to be prepared for the EIS and support the social assessment.
	private property	property owned by non-governmental legal entities including businesses, corporations and individual citizens	Yes	Likely	Detailed	No	Yes	Standard Assessment + focussed engagement	4.2.2, 5.2, 5.9	Consideration of amenity impacts on private property (eg noise), and property lease and acquisition if required will be assessed in the EIS. These impacts will be considered as part of the social assessment.
CLIMATE	macroclimate	changes to climate caused by activities which affect the release and uptake of carbon dioxide	No	Unlikely			No	Scoping Report	Scoping Worksheet	Activities which affect release and uptake of carbon dioxide include vehicle and plant emissions, industrial processes (particularly electricity generation), and land clearing. Emissions from Main Works are unlikely to be significant to cause changes to climate. No issues were raised by the community relating to this matter.
	microclimate	the climate of a small area that differs from the climate of the surrounding area	No	N/A				None (include short explanation in Scoping Report)	Scoping Worksheet	There is differing climate across the wider project area relating to changes in topography, altitude and other meteorological factors. Main Works is unlikely to result in microclimates or result in changes to existing climate. No issues were raised by the community relating to this matter.

MATTERS			IMPACTS		ASSESSMENT LEVEL	CUMULATIVE IMPACTS	COMMUNITY ISSUES	ASSESSMENT APPROACH	SCOPING REPORT	RATIONALE
Potential matters that could be affected by the project			Is the project (without mitigation) likely to cause an impact?	Are the impacts (without mitigation) likely to be significant based on the magnitude of the impacts and/or sensitivity of receivers?	What level of assessment is required to assess impacts and determine mitigation measures?	Will cumulative assessment be required?	Did the community raise any concerns about the impacts?	Indicative approach to assessment in EIS	Where was this addressed in the Scoping Report?	Rationale for ratings in the worksheet
Group	**Specific**	**Meaning of the matter for purposes of the worksheet**	**Impact?**	**Significant Impact?**	**Assessment Level**	**Cumulative Impact?**	**Concerns?**	**Category**	**Section**	
ECONOMIC	natural resource use	availability and access to natural resources for economic use, including minerals, water, forestry, soils, etc	Yes	Likely	Standard	No	No	Standard Assessment	5.10	Consultation provided positive feedback on natural resource use (renewable energy).
	livelihood	a person's ability to continue to make a living	Yes	Likely	Standard	No	Yes	Standard Assessment + focussed engagement	5.10	The land is not used for agricultural or other livelihood however consultation raised concern over local employment impacts / business and the Talbingo township. Rock Forest will be used under agreed lease with the landowner.
	opportunity cost	changes in opportunities or values when one alternative is chosen	Yes	Likely	Standard	No	Yes	Standard Assessment + focussed engagement	5.10	Alternatives (such as workforce) may influence social and economic impacts. Consultation raised concern over local employment impacts / business and the Talbingo township.
	regional economic benefits	economic benefits to the wider region	Yes	Likely	Detailed	Yes	Yes	Detailed Assessment + CIA+ focussed engagement	5.10	The project has wider regional economic costs and benefits. A regional economic analysis is proposed to understand the impacts and benefits from the project, including consideration of Exploratory Works and TransGrid's connection works projects.
HERITAGE	natural	landscape features of heritage value (e.g. national parks, World Heritage Areas, National Heritage Sites)	Yes	Likely	Detailed	Yes	Yes	Detailed Assessment + CIA+ focussed engagement	5.2	Main Works is within the KNP, a national park recognised for its natural values. It also contains Aboriginal cultural and historic heritage sites. Heritage was raised during consultation with the community. A detailed assessment including field survey is required, and consideration of cumulative impacts with Exploratory Works and TransGrid's connection works.
	historic	the legacy of physical artefacts and intangible attributes of a group or society that are inherited from past generations, maintained in the present and bestowed for the benefit of future generations (UNESCO)	Yes	Likely	Detailed	Yes	Yes	Detailed Assessment + CIA+ focussed engagement	5.4	Main Works is within the KNP, a national park recognised for its natural values. It also contains Aboriginal cultural and historic heritage sites. Heritage was raised during consultation with the community. A detailed assessment including field survey is required, and consideration of cumulative impacts with Exploratory Works and TransGrid's connection works.
	Aboriginal cultural	places and items that are of significance to Aboriginal people because of their traditions, observances, lore, customs, beliefs and history (OEH)	Yes	Likely	Detailed	Yes	Yes	Detailed Assessment + CIA+ focussed engagement	5.4	Main Works is within the KNP, a national park recognised for its natural values. It also contains Aboriginal cultural and historic heritage sites. Heritage was raised during consultation with the community. A detailed assessment including field survey is required, and consideration of cumulative impacts with Exploratory Works and TransGrid's connection works.
LAND	stability / structure	physical properties of soils (including water beds), structure and aggregate properties, and sub-soil rock formation	Yes	Likely	Standard	No	Yes	Standard Assessment + focussed engagement	5.5	Preliminary soil survey has been undertaken in limited areas and provides some understanding of soil properties. Further assessment is needed to qualify concerns of erosion within national park and impacts to landforms, which was raised during consultation.

MATTERS			IMPACTS		ASSESSMENT LEVEL	CUMULATIVE IMPACTS	COMMUNITY ISSUES	ASSESSMENT APPROACH	SCOPING REPORT	RATIONALE
Potential matters that could be affected by the project			Is the project (without mitigation) likely to cause an impact?	Are the impacts (without mitigation) likely to be significant based on the magnitude of the impacts and/or sensitivity of receivers?	What level of assessment is required to assess impacts and determine mitigation measures?	Will cumulative assessment be required?	Did the community raise any concerns about the impacts?	Indicative approach to assessment in EIS	Where was this addressed in the Scoping Report?	Rationale for ratings in the worksheet
Group	**Specific**	**Meaning of the matter for purposes of the worksheet**	**Impact?**	**Significant Impact?**	**Assessment Level**	**Cumulative Impact?**	**Concerns?**	**Category**	**Section**	
	soil chemistry	chemical characteristics of soil, affected by mineral composition, organic matter and environmental factors	Yes	Likely	Detailed	No	Yes	Standard Assessment + focussed engagement	5.5	Preliminary soil survey has been undertaken in limited areas and provides some understanding of soil properties. Further assessment is needed to qualify concerns of erosion within national park and impacts to landforms, which was raised during consultation.
	land capability	ability of land to accept a type and intensity of use permanently, or for specified periods under specific management, without permanent damage.	Yes	Likely	Standard	No	Yes	Standard Assessment + focussed engagement	5.5	Main Works will introduce new elements into the landscape and require some temporary and permanent changes in land use (eg. new access roads, portals, substation). The community has raised concern on the effectiveness of rehabilitation.
	topography	shape, slope, elevation and aspect of the land	Yes	Likely	Standard	No	No	Standard Assessment	5.5	Main Works will introduce new elements into the landscape and require some cut and fill of the land to accommodate construction areas.
RISKS	effects of climate change	increase in the effects of climate change (e.g. storm surge, changed flooding regimes, extreme weather patterns, increased temperatures) which may impact upon a project	Yes	Unknown	Standard	No	Yes	Standard Assessment + focussed engagement	5.11.3	Main Works is located in an alpine region. Alpine regions may experience effects of climate change in the future, including change in temperatures and weather patterns. Limited information is available at this stage and as such risks to Main Works will be considered during the EIS. Impacts of increased flooding was raised during community consultation.
	coastal hazards	physical phenomena that expose a coastal area to risk of property damage, loss of life or environmental degradation	No	N/A				None (include short explanation in Scoping Report)	Scoping Worksheet	Main Works is not located in a coastal area. No coastal hazards require consideration.
	effects of flood waters	natural or man made flooding that might affect the project	Yes	Likely	Detailed	No	Yes	Standard Assessment + focussed engagement	5.6	Main Works is located adjacent to a number of watercourses and waterbodies. Flood modelling will be needed to demonstrate the extent of likely flood waters during certain events. Impacts of increased flooding was raised during community consultation.
	bushfire	potential for bushfire to impact on the project	Yes	Likely	Standard	Yes	No	Standard Assessment + CIA	5.11.3	Main Works is introducing new accommodation into vegetated areas. Consideration of appropriate bushfire protection will be needed. Consideration of the cumulative impact of bushfire risk from TransGrid's connection works will also be required.
	effects of subsidence	excavation of the earth beneath (e.g. from mining or tunnelling)	Yes	Likely	Detailed	No	No	Standard Assessment	5.11.3	Main Works involves tunnelling activities to connect the two reservoirs. While not anticipated there is potential for subsidence and settlement result from tunnelling and the associated drawdown of groundwater.
	steep slopes	land which generally has a slope greater than 18 degrees from the horizontal	Yes	Likely	Standard	No	No	Standard Assessment	5.11.3	Main Works is located within an alpine region of varying slopes. Consideration of topography and risks to land stability has been undertaken as part of the design to ensure proposed elements are not located within high risk areas.

MATTERS			IMPACTS		ASSESSMENT LEVEL	CUMULATIVE IMPACTS	COMMUNITY ISSUES	ASSESSMENT APPROACH	SCOPING REPORT	RATIONALE
Potential matters that could be affected by the project			Is the project (without mitigation) likely to cause an impact?	Are the impacts (without mitigation) likely to be significant based on the magnitude of the impacts and/or sensitivity of receivers?	What level of assessment is required to assess impacts and determine mitigation measures?	Will cumulative assessment be required?	Did the community raise any concerns about the impacts?	Indicative approach to assessment in EIS	Where was this addressed in the Scoping Report?	Rationale for ratings in the worksheet
Group	**Specific**	**Meaning of the matter for purposes of the worksheet**	**Impact?**	**Significant Impact?**	**Assessment Level**	**Cumulative Impact?**	**Concerns?**	**Category**	**Section**	
SOCIAL	health	the physical and mental wellbeing of the public	Yes	Unlikely			No	Scoping Report	Scoping Worksheet	Main Works is located within KNP and generally away from residences and built up areas. However, the works will impact recreational uses and have amenity impacts on some townships as a result of transport and access. These impacts are not considered to impact the physical and mental wellbeing of the public. However, relevant social impacts will be considered as part of the social assessment in the EIS.
	safety	the security of the community environment including roads, footpaths, stairways, cycleways, exposure to hazards or hazardous materials (not including air quality), crime	Yes	Likely	Standard	No	Yes	Standard Assessment + focussed engagement	5.9	During construction there will be temporary access closures or restrictions within KNP to prevent public access and to ensure public safety. Exposure of the public to hazardous materials is therefore not expected but will be considered with respect to potential workforce exposure. Public safety was raised as an issue during community consultation activities.
	community services / facilities	availability and access to education, healthcare, open space and recreation facilities for the affected community	Yes	Likely	Detailed	Yes	Yes	Detailed Assessment + CIA+ focussed engagement	5.9	The influx of workers may put pressure on existing community services if they do not have sufficient capacity. The ability for these services to cope with an increased workforce will need to be assessed. The community raised concern on local hospital services capacity during consultation activities. As TransGrid's connection works will be under construction concurrently, consideration of cumulative impacts is also required.
	housing availability	availability and access to a variety of housing types, sizes and costs	Yes	Likely	Detailed	Yes	Yes	Detailed Assessment + CIA+ focussed engagement	5.9	Main Works proposes to provide accommodation for its workers onsite. However, some workers may choose to relocate or stay in the local area. Previous assessment demonstrated adequate availability of housing but would now require consideration of cumulative impact with TransGrid's connection works. Local housing was raised during community consultation.
	social cohesion	the willingness and ability of members of a society to cooperate with each other in order to survive and prosper	No	Unlikely			No	Scoping Report	Scoping Worksheet	Main Works is located within KNP and generally away from residences and built up areas. Local community services are expected to be utilised by the workforce. However, construction and operation of the project is not likely to impact social cohesion.
WATER	hydrological flows (incl. Flooding and geomorphology)	natural movement of water across the landscape or under the ground, including seasonal wetting and drying regimes, tidal movement and flooding, groundwater losses and inflows	Yes	Likely	Detailed	No	Yes	Standard Assessment + focussed engagement	5.6	There are several watercourses in the project area for Main Works that are typical of alpine rivers and streams. Process water may be discharged to surrounding waters and therefore consideration of flooding and geomorphological impacts is needed. Impacts of increased flooding was raised during community consultation.

MATTERS			IMPACTS		ASSESSMENT LEVEL	CUMULATIVE IMPACTS	COMMUNITY ISSUES	ASSESSMENT APPROACH	SCOPING REPORT	RATIONALE
Potential matters that could be affected by the project			Is the project (without mitigation) likely to cause an impact?	Are the impacts (without mitigation) likely to be significant based on the magnitude of the impacts and/or sensitivity of receivers?	What level of assessment is required to assess impacts and determine mitigation measures?	Will cumulative assessment be required?	Did the community raise any concerns about the impacts?	Indicative approach to assessment in EIS	Where was this addressed in the Scoping Report?	Rationale for ratings in the worksheet
Group	Specific	Meaning of the matter for purposes of the worksheet	Impact?	Significant Impact?	Assessment Level	Cumulative Impact?	Concerns?	Category	Section	
	surface water quality	physical, chemical, biological and aesthetic (appearance and smell) characteristics of water which provide a healthy environment which supports a rich and varied community of organisms and protects public health.	Yes	Likely	Detailed	Yes	Yes	Detailed Assessment + CIA+ focussed engagement	5.6	Surface water in the project area include rivers and streams as well as Talbingo and Tantangara Reservoirs. Main Works has the potential to impact on surface water as a result of construction activities as well as process water discharge and the subaqueous placement of excavated materials within the reservoirs. The impacts and mitigation will be project-specific and require targeted assessment and management. Impacts to water quality was a key issue raised by the community and stakeholders.
	ground water quality	the state of water that is located beneath Earth's surface (i.e. in cracks in subsurface rocks and in between soil particles)	Yes	Likely	Detailed	Yes	Yes	Detailed Assessment + CIA+ focussed engagement	5.6	Tunnelling activities will result in groundwater drawdown, the extent of which requires assessment. There is potential for groundwater to be used in construction activities and will become process water requiring discharge. The impacts and mitigation will be project-specific and require targeted assessment and management. Impacts to water quality was a key issue raised by the community and stakeholders.
	water availability	the quantity of water (surface and groundwater) available for existing natural or regulated use	Yes	Likely	Detailed	No	No	Standard Assessment	5.6	Water quantities within the existing reservoirs is expected to fluctuate with natural weather events as it currently does now. No change to the existing environmental releases by the reservoirs is proposed by Snowy Hydro. As above, there will be some change to groundwater and further assessment will be carried out as part of the EIS.

Appendix B

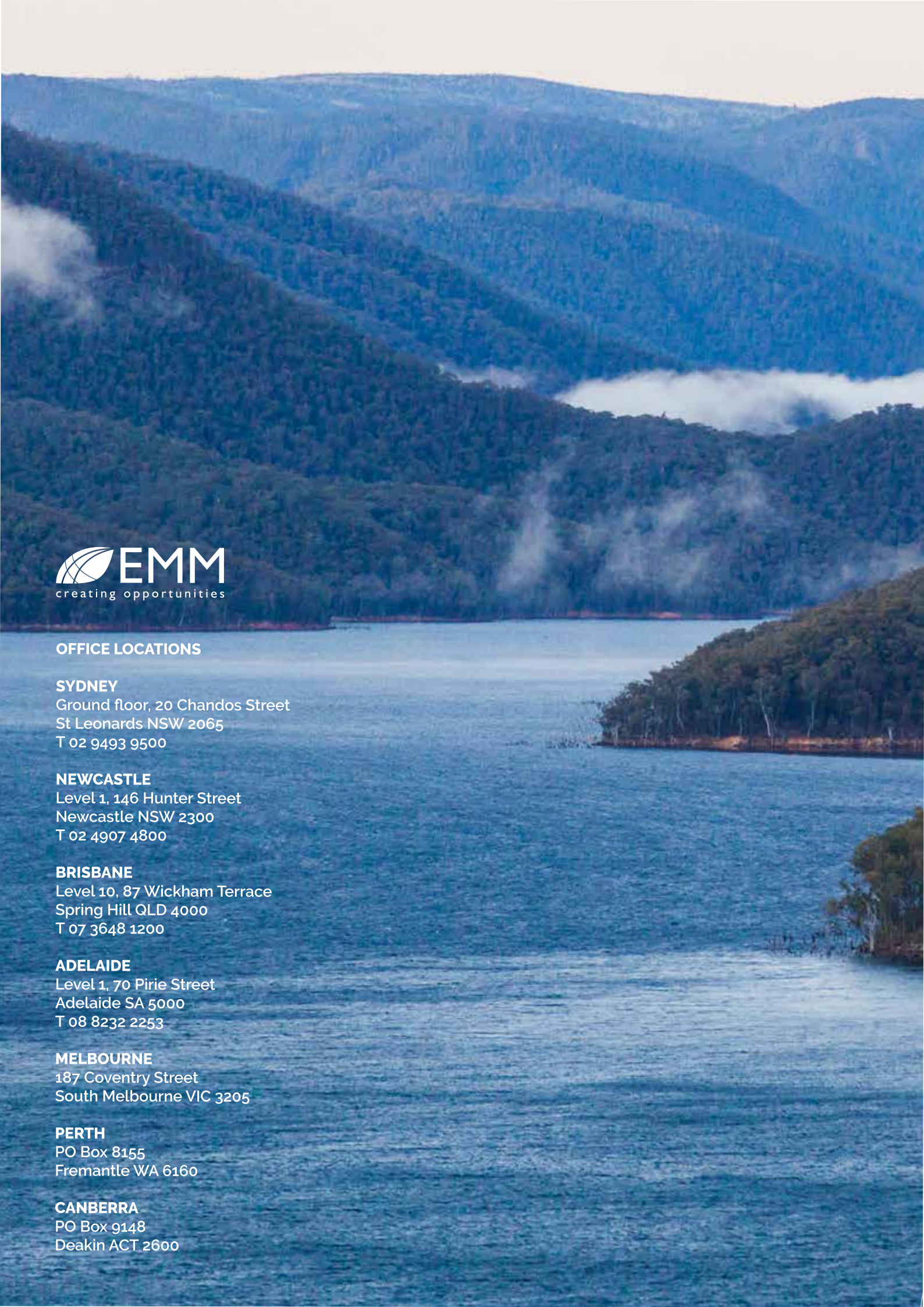
MNES Table

B.1 MNES Table

Matters of NES	Matters within the Study Area
World Heritage Properties	There are no World Heritage properties within the area.
National Heritage Places	Natural – Australian Alps National Parks and Reserves Historic – Snowy Mountains Scheme
Wetlands of International Importance	There are no Wetlands of International Importance within the area, however the Ginini flats wetland complex is within 10 km.
Commonwealth listed threatened ecological communities	One community known to occur within area: • Alpine Sphagnum Bogs and Associated Fens Three communities may or are likely to occur within area: • Grey Box (*Eucalyptus macrocarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia • Natural Temperate Grassland of the South Eastern Highlands • White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland
Commonwealth listed threatened species	Seven bird species may or are likely to occur within the area: • Regent Honeyeater (*Anthochaera phrygia*) • Australasian Bittern (*Botaurus poiciloptilus*) • Curlew Sandpiper (*Calidris ferruginea*) • Painted Honeyeater (*Grantiella picta*) • Swift Parrot (*Lathamus discolor*) • Eastern Curlew, Far Eastern Curlew (*Numenius madagascariensis*) • Australian Painted-snipe, Australian Painted Snipe (*Rostratula australis*) One fish species known to occur within the area: • Macquarie Perch (*Macquaria australasica*) Three fish species may occur within the area: • Flathead Galaxias, Beaked Minnow, Flat-headed Galaxias, Flat-headed Jollytail, Flat-headed Minnow (*Galaxias rostratus*) • Trout Cod (*Maccullochella macquariensis*) • Murray Cod (*Maccullochela peelii*) Four frog species known to occur within the area: • Booroolong Frog (*Litoria booroolongensis*) • Alpine Tree Frog, Verreaux's Alpine Tree Frog (*Litoria verreauxii alpina*) • Southern Corroboree Frog (*Pseudophryne corroboree*) • Northern Corroboree Frog (*Pseudophryne pengilleyi*) Three frog species may or are likely to occur within the area: • Yellow-spotted Tree Frog, Yellow-spotted Bell Frog (*Litoria castanea*) • Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog (*Litoria raniformis*) • Spotted Tree Frog (*Litoria spenceri*) One insect species may occur within the area: • Golden Sun Moth (*Synemon plana*)

Matters of NES	Matters within the Study Area
	Five mammal species known to occur in the area: • Mountain pygmy-possum (*Burramys parvus*) • Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (*Dasyurus maculatus maculatus*) • Broad-toothed Rat, Tooarrana (*Mastacomys fuscus mordicus*) • Greater Glider (*Petauroides volans*) • Smoky Mouse, Konoom (*Pseudomys fumeus*) Three mammal species may or are likely to occur within the area: • Corben's Long-eared Bat, South-eastern Long-eared Bat (*Nyctophilus corbeni*) • Koala (*Phascolarctos cinereus*) • Grey-headed flying fox (*Pteropus poliocephalus*) Nine plant species known to occur within the area: • Mauve Burr-daisy (*Calotis glandulosa*) • Hoary Sunray, Grassland Paper-daisy (*Leucochrysum albicans var. tricolor*) • Bago Leek-orchid (*Prasophyllum bagoense*) • Brandy Marys Leek-orchid (*Prasophyllum innubum*) • Kelton's Leek-orchid (*Prasophyllum keltonii*) • Blue-tongued Orchid, Kiandra Greenhood (*Pterostylis oreophila*) • Monaro Golden Daisy (*Rutidosis leiolepis*) • Austral Toadflax, Toadflax (*Thesium australe*) • Swamp Everlasting, Swamp Paper Daisy (*Xerochrysum palustre*) Seven plant species may or are likely to occur within the area: • River Swamp Wallaby-grass, Floating Swamp Wallaby-grass (*Amphibromus fluitans*) • Curtis' Colobanth (*Colobanthus curtisiae*) • Black Gum (*Eucalyptus aggregata*) • East Lynne Midge-orchid (*Genoplesium vernale*) • Clover Glycine, Purple Clover (*Glycine latrobeana*) • Omeo Stork's-bill (*Pelargonium sp. Striatellum*) • Tarengo Leek Orchid (*Prasophyllum petilum*) Five reptile species may or are likely to occur within the area: • Pink-tailed Worm-lizard, Pink-tailed Legless Lizard (*Aprasia parapulchella*) • Alpine She-oak Skink (*Cyclodomorphus praealtus*) • Striped Legless Lizard *(Delma impar*) • Guthega Skink (*Liopholis guthega*) • Grassland Earless Dragon (*Tympanocryptis pinguicolla*)

Matters of NES	Matters within the Study Area
Commonwealth listed Migratory Species	One migratory marine bird likely to occur within the area: • Fork-tailed Swift (*Apus pacificus*) Three migratory terrestrial species known to occur within the area: • White-throated Needletail (*Hirundapus caudacutus*) • Satin Flycatcher (*Myiagra cyanoleuca*) • Rufous Fantail (*Rhipidura rufifrons*) Two migratory terrestrial species may or are likely to occur within the area: • Black-faced Monarch (*Monarcha melanopsis*) • Yellow Wagtail (*Motacilla flava*) Seven migratory wetland species may occur within the area: • Common Sandpiper (*Actitis hypoleucos*) • Sharp-tailed Sandpiper (*Calidris acuminata*) • Curlew Sandpiper (*Calidris ferruginea*) • Pectoral Sandpiper (*Calidris melanotos*) • Latham's Snipe, Japanese Snipe (*Gallinago hardwickii*) • Eastern Curlew, Far Eastern Curlew (*Numenius madagascariensis*) • Osprey (*Pandion haliaetus*)
Nuclear Action	The project would not result in any nuclear action nor would any nuclear activity need to be undertaken.
Commonwealth Marine Areas	There are no Commonwealth marine areas within the area.



EMM
creating opportunities

OFFICE LOCATIONS

SYDNEY
Ground floor, 20 Chandos Street
St Leonards NSW 2065
T 02 9493 9500

NEWCASTLE
Level 1, 146 Hunter Street
Newcastle NSW 2300
T 02 4907 4800

BRISBANE
Level 10, 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3648 1200

ADELAIDE
Level 1, 70 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE
187 Coventry Street
South Melbourne VIC 3205

PERTH
PO Box 8155
Fremantle WA 6160

CANBERRA
PO Box 9148
Deakin ACT 2600