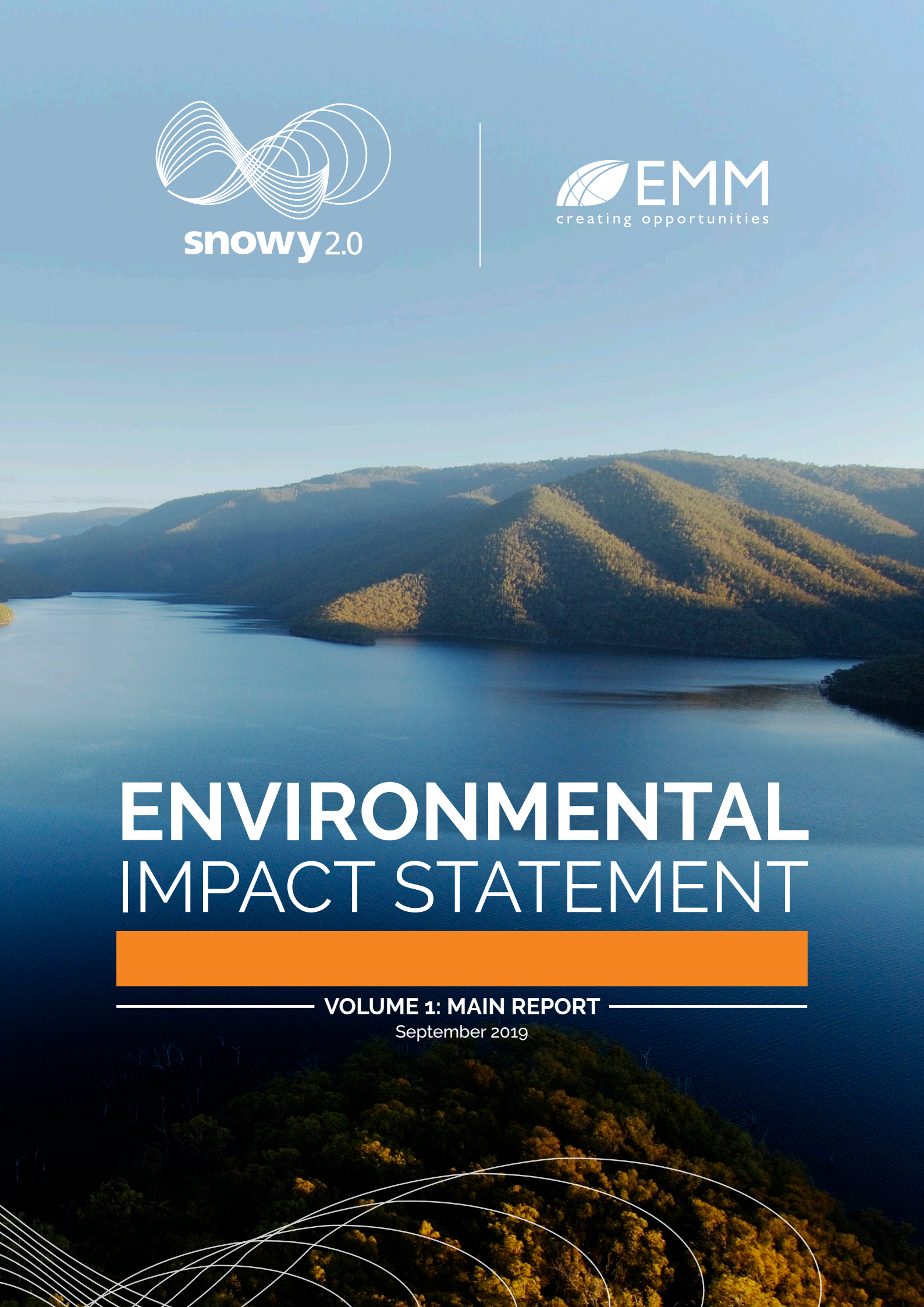

snowy 2.0

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ENVIRONMENTAL IMPACT STATEMENT

VOLUME 1: MAIN REPORT

September 2019

VOLUME 1: MAIN REPORT

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3 Strategic context
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X.2 Recreational users study
Y Economic assessment

Snowy 2.0 Main Works

Environmental Impact Statement

Report Number

J17188 RP#38

Client

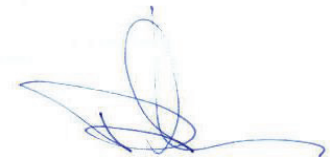
Snowy Hydro Limited

Date

13 September 2019

Version

v1 Final

Prepared by	**Approved by**
	
Alex Frolich Associate Environmental Scientist 13 September 2019	**Brett McLennan** Director 13 September 2019
	
Lawrence Wallis Senior Environmental Scientist 13 September 2019	**Duncan Peake** Director 13 September 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.

Certification

For submission of an environmental impact statement under Division 5.2 of Part 5 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

EIS prepared by

Lawrence Wallis	**Alexandra Frolich**	**Duncan Peake**	**Brett McLennan**
Bachelor of Arts	Bachelor of Science	Bachelor of Science (Hons)	Bachelor of Town Planning
Bachelor of Science	(Marine Science)		(Hons)

Address: EMM Consulting Pty Limited, Ground floor, 20 Chandos Street St Leonards NSW 2065

Applicant

Snowy Hydro Limited

Description of development

The development of an underground pumped hydro power station and ancillary infrastructure

Land to be developed

The land to be developed includes:

- Land within Kosciuszko National Park within Snowy Valleys and Snowy Monaro local government areas;
- Part of lots 11 and 13 in DP 756682; and
- Part of road corridor shown in detailed maps and plans.

Certification

I certify that the contents of this EIS have been prepared in accordance with Division 5.2 of Part 5 of the EP&A Act, Schedule 2 of the NSW *Environmental Planning and Assessment Regulation 2000* and the NSW Department of Planning, Industry and Environment Secretary's Environmental Assessment Requirements issued for the development on 31 July 2019. To the best of my knowledge, it contains all available information that is relevant to the environmental assessment of the development to which the statement relates. The information contained in this EIS is neither false nor misleading.

Lawrence Wallis
Senior Environmental Scientist
13 September 2019

Alexandra Frolich
Associate Environmental Scientist
13 September 2019

Duncan Peake
Director
13 September 2019

Brett McLennan
Director
13 September 2019

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CHAPTER 1

INTRODUCTION

1 Introduction

1.1 Overview

Snowy Hydro Limited (Snowy Hydro) owns and operates the Snowy Mountains Hydro-electric Scheme (Snowy Scheme), a large and complex water storage and diversion scheme in the Australian Alps in southern New South Wales (NSW). In March 2017 Snowy Hydro announced a plan to conduct a Feasibility Study into a possible pumped hydro-electric expansion of the existing Snowy Scheme, called 'Snowy 2.0'. The final investment decision (FID) to proceed with Snowy 2.0 was made by Snowy Hydro's Independent Board of Directors on 12 December 2018 following two years of robust market and economic modelling, extensive due diligence and planning. Shareholder approval was subsequently received from the Australian Government on 26 February 2019.

Snowy 2.0 is the largest committed renewable energy project in Australia and is critical to underpinning system security and reliability as Australia transitions to a decarbonised economy. Snowy 2.0 will increase the pumped hydro-electric capacity of the existing Snowy Scheme by linking Tantangara and Talbingo reservoirs with tunnels and a power station built in between, almost 1 km below the ground.

Snowy 2.0 will increase the generation capacity of the Snowy Scheme by almost 50%, providing an additional 2,000 megawatts (MW) generating capacity, and making approximately 350,000 megawatt hours (MWh) (175 hours of energy storage) available to the National Electricity Market (NEM). When operational, Snowy 2.0 will provide on-demand energy generation and large-scale energy storage; allowing the water to flow from Tantangara Reservoir into Talbingo Reservoir in the generating mode and pumping water out of Talbingo Reservoir (the lower reservoir) to Tantangara Reservoir (the upper reservoir) in the storage mode. This concept is shown in Figure 1.1.

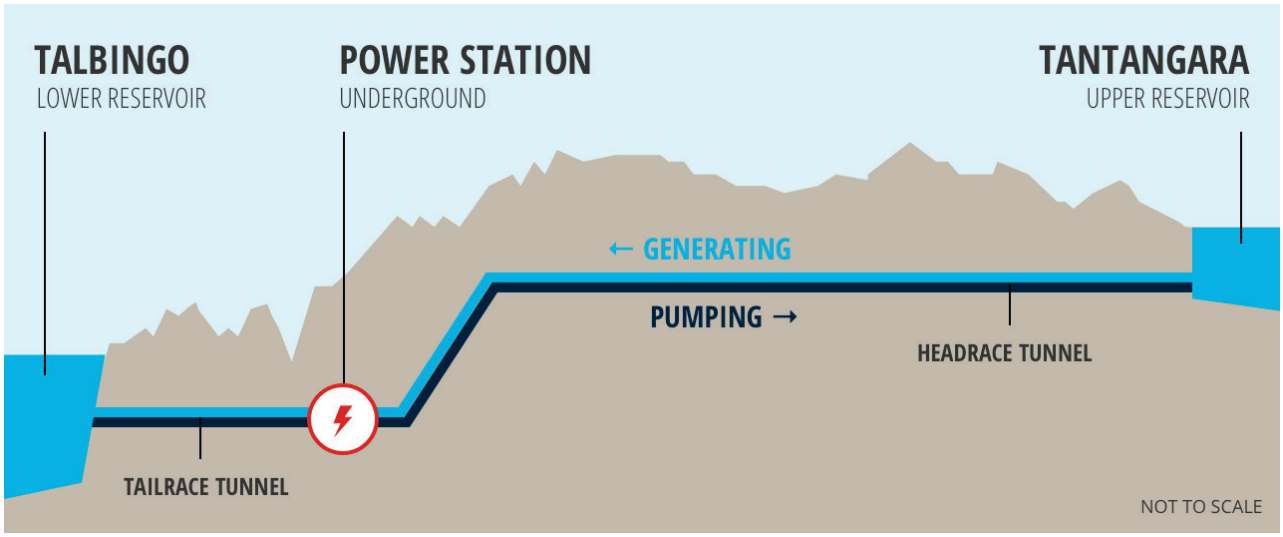


Figure 1.1 Snowy 2.0 pumped hydro concept

Snowy 2.0 will provide large-scale energy storage and quick-start electricity generation at critical times of peak demand when energy supply is constrained and at times when intermittent renewable energy output is low. Pumping water at times of low electricity demand (ie when there is excess supply) 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 precious water resources to generate electricity without impacting on downstream water users and environmental flows for the Murray-Darling Basin.

Snowy 2.0 has been declared State significant infrastructure (SSI) and critical State significant infrastructure (CSSI) in accordance with the provisions of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The declaration of Snowy 2.0 as a CSSI project acknowledges that the project is critical to the State for environmental, economic or social reasons.

Snowy 2.0 Main Works (the project) refers to the application for the construction and operation of Snowy 2.0. As a CSSI project, Snowy 2.0 Main Works is subject to Part 5, Division 5.2 of the EP&A Act which requires the preparation of an environmental impact statement (EIS) in accordance with Secretary's Environmental Assessment Requirements (SEARs) (Appendix A) and the approval of the NSW Minister for Planning and Public Spaces.

In addition to requiring approval from the NSW Minister for Planning and Public Spaces, Snowy 2.0 Main Works has been deemed a controlled action under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and requires approval from the Commonwealth Minister for the Environment. The Minister for the Environment has accredited the NSW planning process for the assessment of Snowy 2.0 Main Works. Therefore, a single EIS has been prepared to address the requirements set out by the NSW Department of Planning, Industry and Environment (DPIE) and the Commonwealth Department of the Environment and Energy (DEE).

1.2 The Snowy 2.0 Main Works project

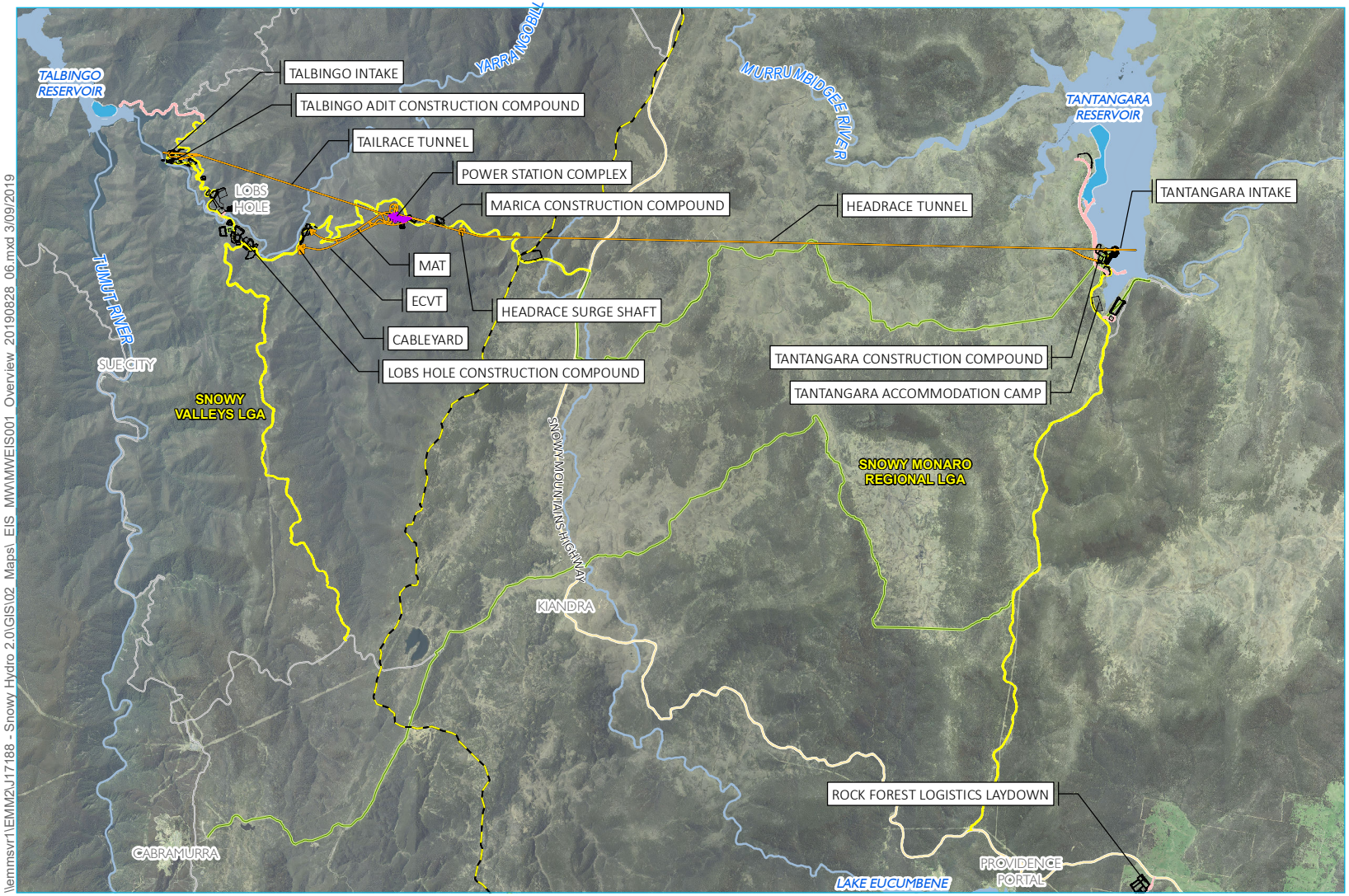
Snowy 2.0 is being developed in two stages. The Exploratory Works which have commenced, includes an exploratory tunnel and portal and other exploratory and construction activities primarily in the Lobs Hole area of Kosciuszko National Park (KNP). The Exploratory Works were approved by the former NSW Minister for Planning on 7 February 2019 as a separate project application to DPIE (SSI 9208).

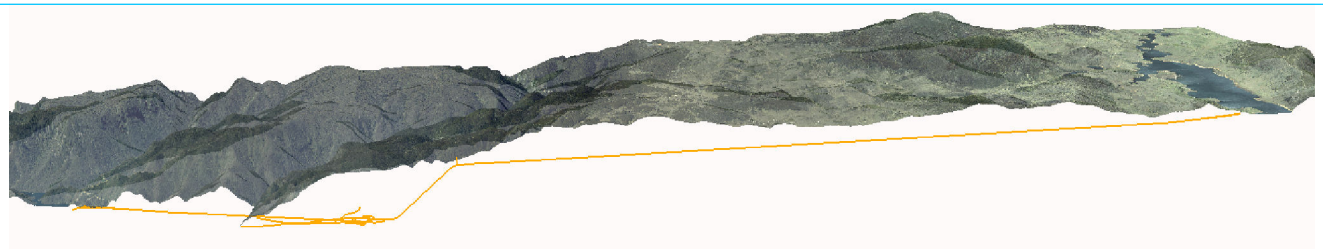
This EIS addresses the **Snowy 2.0 Main Works**. As the title suggests, this EIS covers the major construction and operational elements of Snowy 2.0. The Snowy 2.0 Main Works is shown on Figure 1.2. The project includes:

- construction of permanent infrastructure needed for the operation of Snowy 2.0, such as the underground power station and access tunnels, water intakes, power waterways, chambers and shafts, new access roads, communications cable, and power and water supply;
- establishment of sites and infrastructure needed during construction, such as temporary access roads, construction adits, construction compounds and accommodation (including water and wastewater services), management and storage of extracted rock material, and construction power supply; and
- the operation of Snowy 2.0.

The construction of the project will involve tunnelling and excavation works between Tantangara and Talbingo reservoirs to depths of up to 1 kilometre (km). Surface works will also be required at specific locations during construction. The design and construction of the project will be carried out by Future Generation Joint Venture (FGJV), the contractor appointed by Snowy Hydro. Once construction is complete, Snowy Hydro is responsible for the operation of Snowy 2.0 and its infrastructure.

A detailed description of the construction and operation of the project is provided in Chapter 2, with detailed maps and plans provide at Appendix B.





KEY

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

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

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

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

0 2.5 5 km

GDA 1994 MGA Zone 55

N

Snowy 2.0 project elements

Snowy 2.0
Environmental Impact Statement
Main Works
Figure 1.2

snowy 2.0

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1.3 Location and setting

1.3.1 Location

Snowy 2.0 Main Works is in the Australian Alps in southern NSW, about mid-way between Canberra and Albury. Snowy 2.0 Main Works is within both the Snowy Valleys and Snowy Monaro Regional local government areas (LGAs). The area in which Snowy 2.0 will be built and operated is referred to herein as the project area, as shown on Figure 1.3.

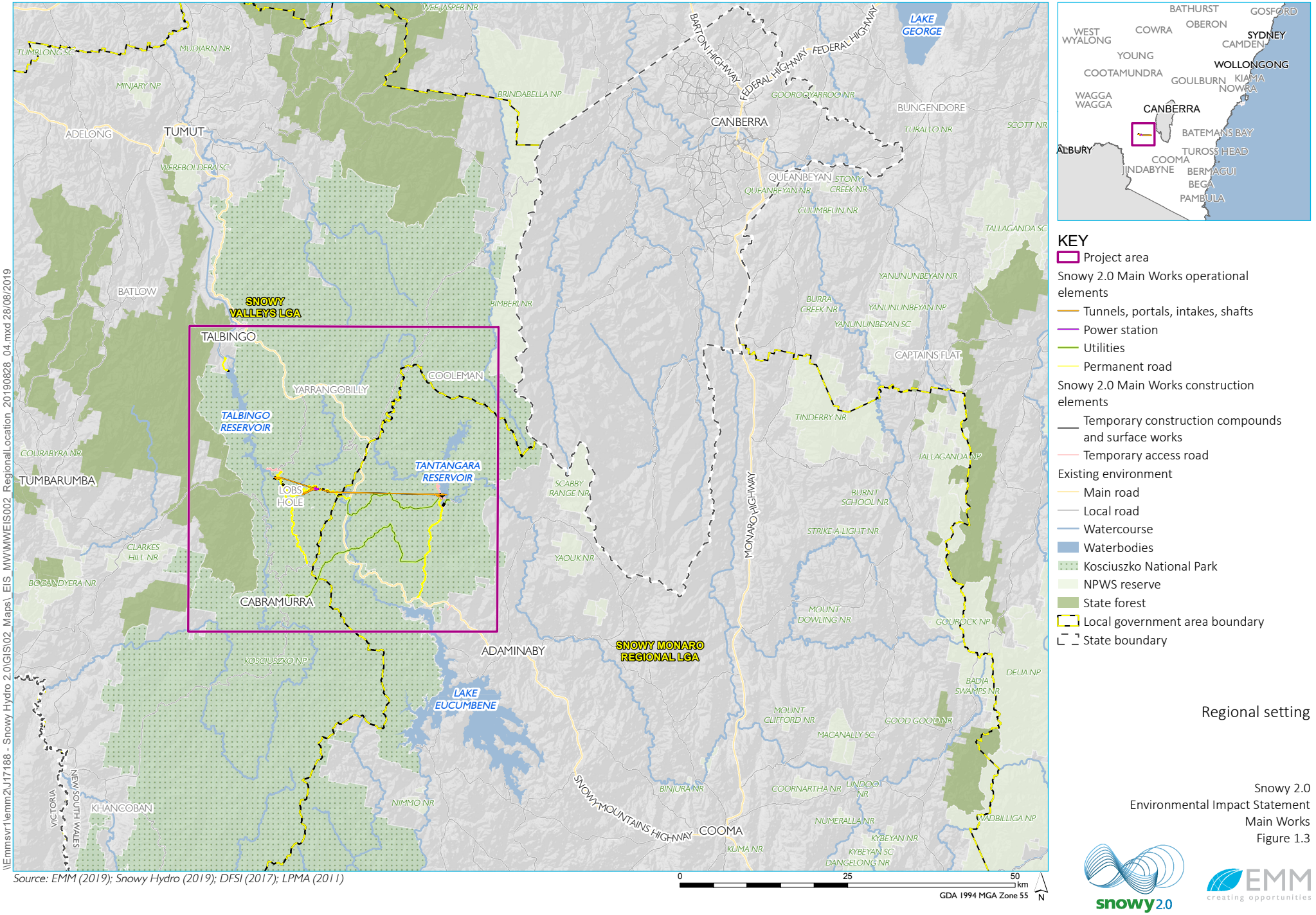
The nearest large towns to the Snowy 2.0 Main Works project area are Cooma and Tumut. Cooma is about 50 km south-east of the project area (or 70 km by road from Providence Portal), and Tumut is about 35 km north-west of the project area (or 45 km by road from Tumut 3 power station). Other nearby towns include Talbingo, Cabramurra, Adaminaby and Tumbarumba. These towns in relation to the project are shown on Figure 1.3.

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. Key locations for the project are shown on Figure 1.4 and include Talbingo Reservoir, Marica, Lobs Hole, Plateau and Tantangara Reservoir. A site outside the boundaries of KNP (referred to as Rock Forest) will also be used for logistics and staging during construction and is accessed directly from the Snowy Mountains Highway.

1.3.2 Natural and built features

Key features of the project area are shown on Figure 1.4:

- the water bodies of Talbingo and Tantangara reservoirs, covering areas of 19.4 square kilometres (km^2) and 21.2 km^2 respectively, and with gross storages of 921 and 254.1 gigalitres (GL) respectively. The reservoirs provide the water to be utilised in the proposed pumped hydro-electric scheme;
- major watercourses including the Yarrangobilly, Eucumbene and Murrumbidgee rivers and some of their tributaries (such as Nungar, Gooandra and Tantangara creeks); and
- KNP, within which the majority of project elements are located. 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').



KEY

- Project area

Snowy 2.0 Main Works operational elements

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

Snowy 2.0 Main Works construction 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
- Local government area boundary
- State boundary

\\Emmsvr1\emm2\J177188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\MWEIS002 RegionalLocation 20190828 04.mxd 28/08/2019

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

Regional setting

Snowy 2.0
Environmental Impact Statement
Main Works
Figure 1.3

snowy 2.0

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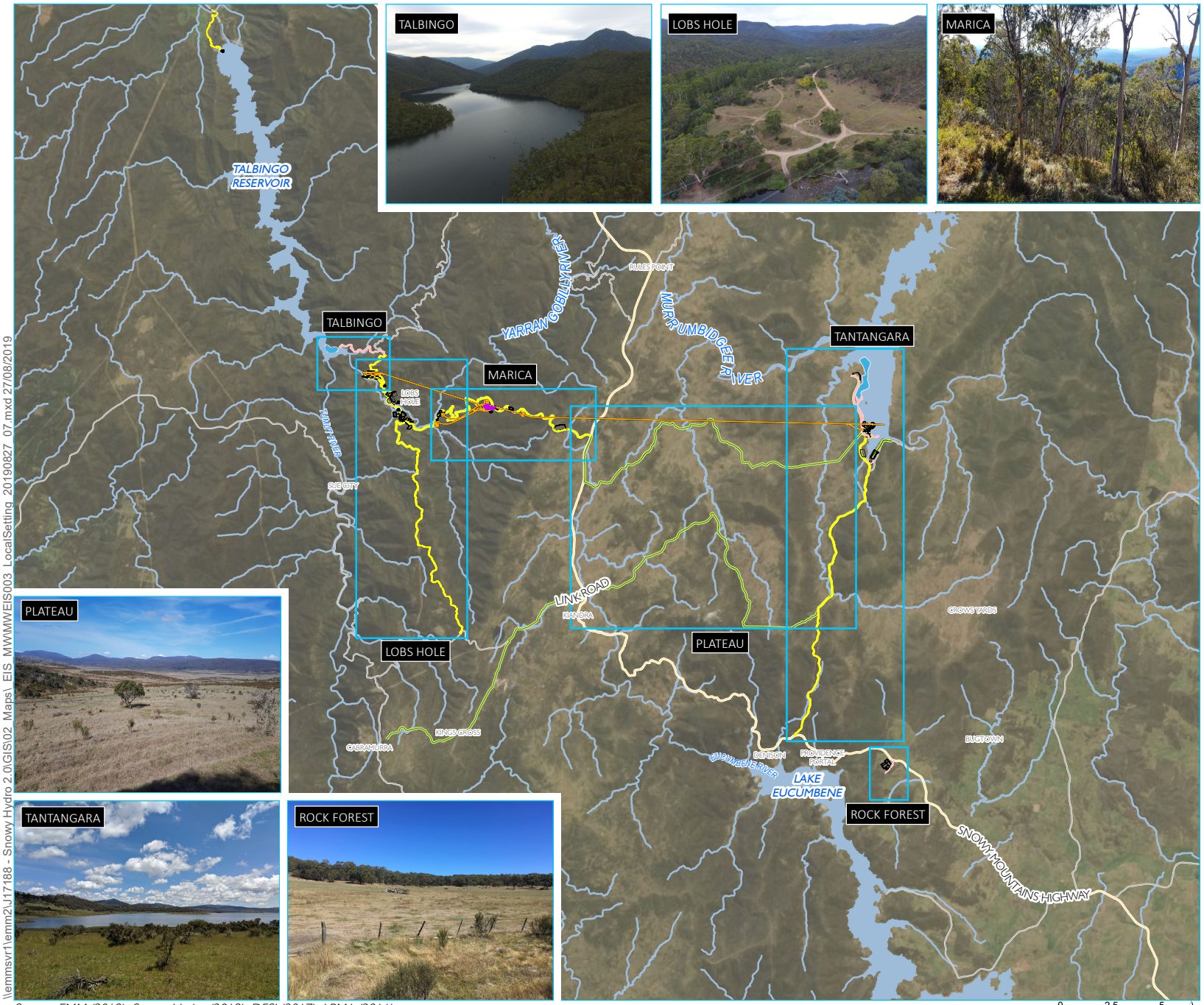

KEY

- Project precinct

Existing environment

- Main road
- Local road
- Watercourse
- Waterbodies

Snowy 2.0 Main Works operational elements

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

Snowy 2.0 Main Works construction elements

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

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

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Local setting

Snowy 2.0
Environmental Impact Statement
Main Works
Figure 1.4

snowy 2.0

EMM
creating opportunities

1.4 History and background of the project

1.4.1 The existing Snowy Scheme

i History of development

The Snowy Scheme was 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. The Snowy Scheme is the largest engineering project ever undertaken in Australia and is one of the largest and most complex hydro-electric schemes in the world. It took about 100,000 workers around 25 years to build and resulted in many new towns being established. Its construction is seen by many as a defining point in Australia's history, and an important symbol of Australia's identity as an independent, multicultural and resourceful country (Australian Government 2016). A timeline of the development of the Snowy Scheme is provided in Figure 1.5.

ii How the Snowy Scheme works

Precipitation in the form of snow and rain falls in the catchment area of the Snowy Scheme. A catchment area is any part of the land where water drains to its lowest part. Water from melting snow and rain is collected and stored behind dams in lakes and reservoirs and then diverted through tunnels and pipelines down to power stations hundreds of metres below.

Water is used to drive turbines, turning kinetic energy into mechanical energy. These turbines drive shafts that operate generators. Transformers boost generated voltage to a level that can be economically transmitted over long distances by transmission lines to the towns and cities of eastern mainland Australia. The Snowy Scheme can generate large amounts (around 4,100 MW) of peak-load electricity to meet the daily fluctuating demands for power in the NEM.

Once the water has passed through the turbines in the power stations, it is released into the Murray River and Murrumbidgee River catchments to be used to irrigate farms in the Murray, Murrumbidgee Irrigation Area and Coleambally regions, and for environmental flows. A water licence (known as the Snowy Water Licence) determines the flows and releases to these catchments. Snowy Hydro must deliver the required amount of water to storage outlined in the licence, for flows to be released by the Murray Darling Basin Authority and WaterNSW. This long-term water regulation is designed to counteract the effects of severe drought sequences and raise productivity in the Murray Darling Basin.

iii Snowy Scheme assets

The Snowy Scheme today (shown on Figure 1.6) includes 16 major dams, nine power stations (33 hydro-electric turbines), one pumping station, and 145 km of interconnected tunnels and pipelines and 80 km of aqueducts. It consists of two major developments: the northern Snowy-Tumut Development and the southern Snowy-Murray Development.

1949 – The Snowy Mountains Hydro-electric Authority was established

1949

1951 – Enlgish classes in Cooma

1951

1955 – T1 power station construction

1955

7 July 1949 –
The Commonwealth Parliament passed the *Snowy-Mountains Hydro-electric Power Act 1949* which established the Snowy Mountains Hydro-electric Authority, the construction body for the Snowy Scheme.

1949

17 October 1949 –
Construction started on the Snowy Scheme.

1949

November 1951 –
Construction of the Snowy Scheme's first power station at Guthega started.

1951

1954 –
Cabramurra township was established as part of the Snowy Scheme.

1954

May 1955 –
Construction of Tumut 1 power station commenced.

1955

May 1956 –
Construction of Eucumbene Dam commenced.

1956

1956-1957 –
The township of Adaminaby is relocated to make way for the rising waters of Lake Eucumbene.

1956-1957

1958 –
Eucumbene Dam construction is completed. It is nine times the size of Sydney Harbour and the central dam of the Snowy Scheme.

1958

1958 - 1960
Tantangara Reservoir construction

1958-1960

December 1962 –
Construction of Murray 1 power station commenced.

1962

19 December 1964 –
The township of New Jindabyne was opened after being relocated to make way for Lake Jindabyne.

1964

1966 –
Construction of Murray 2 power station, Jindabyne pumping station and Blowering power station commenced.

1966

1968 - 1971
Construction of Talbingo Reservoir

1968-1971

21 October 1972 –
Official opening of the Tumut 3 project marking completion of the works on the Snowy Scheme.

1972

August 1974 –
The Snowy Scheme became fully operational. Tumut 3 is the largest power station within the Snowy Scheme.

1974

January 1997 –
Snowy Hydro Trading Pty Ltd established as a company to trade electricity from the Snowy Scheme.

1997

13 December 1998 –
The National Electricity Market commenced creating the Australian wholesale electricity market connecting the states of QLD, NSW, VIC and SA.

1998

June 2002 –
Snowy Mountains Hydro-electric Authority and Snowy Hydro Trading Pty Ltd were corporatised to become Snowy Hydro Limited with the Commonwealth, NSW and VIC governments becoming the shareholders of the new company.

2002

June 2010 –
Jounama Small Hydro power station opened.

2010

2012 –
A major milestone of the Snowy Scheme's modernisation was accomplished with the completion of the Tumut 3 upgrade.

2012

March 2017 –
Snowy 2.0 feasibility study was announced by Snowy Hydro.

2017

1955 - 1958 – Eucumbene -Tumut tunnel

1955 - 1958

1958 - 1960 – Tantangara Reservoir construction

1958 - 1960

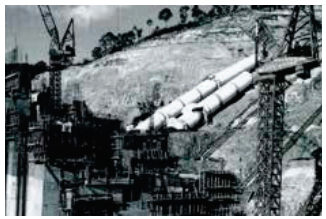
1966 – Murray 2 power station

1966

1968 - 1971 – Construction of Talbingo Reservoir

1968 - 1971

1974 – T3 power station under construction (opened 1974)



1974

2012 – T3, the largest power station in the Snowy Scheme today

2012

snowy2.0 EMM creating opportunities

Timeline for the Snowy Scheme

Snowy 2.0
Environmental Impact Statement
Main Works
Figure 1.5

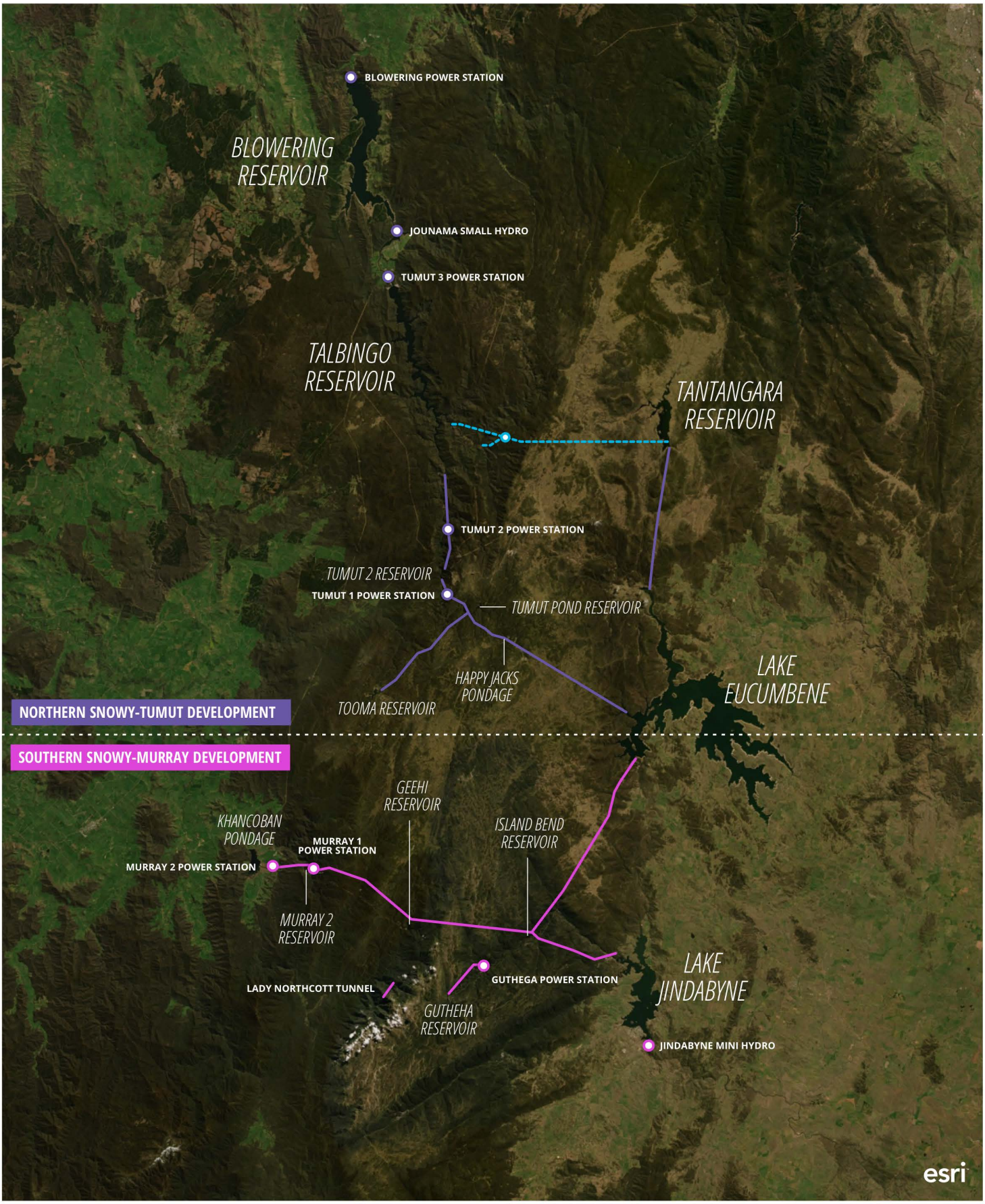


Figure 1.6 **Existing Snowy Mountains Scheme**

LOCATIONS ARE APPROXIMATE ONLY

- Power Station in Snowy-Tumut development
- Tunnel in Snowy-Tumut development
- Power Station in Snowy-Murray development
- Tunnel in Snowy-Murray development
- Proposed Power Station in Snowy 2.0
- Proposed tunnel for Snowy 2.0

snowy 2.0

EMM creating opportunities

iv Coexisting with Kosciuszko National Park

The Snowy Scheme operates within a catchment of around 5,100 km^2, most of which is within the KNP. KNP straddles the Great Dividing Range and contains most of Australia's snow and alpine areas. The purpose of the Snowy Scheme was to collect water from these alpine areas and send it to farms and communities in the west. There has been close to 65 years of continuous operation since construction, with sustained water and environmental management allowing the Snowy Scheme's assets to operate within the natural and recreational areas of KNP. The infrastructure of the Snowy Scheme forms part of the tourist attraction to KNP, with many of the Scheme's reservoirs used for recreation as well as the Snowy Hydro operated tourism visitor centres. KNP is discussed further in Chapter 3.

The NSW *Snowy Hydro Corporatisation Act 1997* (SHC Act) provides the legal framework for the Snowy Scheme to operate within the KNP. 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 former NSW Minister for Environment in 2002 and has a term of 75 years.

The SHC Act was amended in 2018 and now also entitles Snowy Hydro to the grant of a lease, licence, easement or right of way over KNP, for the purposes of Snowy 2.0. If planning approval is received, Snowy Hydro will be granted a series of licenses and leases by the former NSW Minister for the Environment to enable the construction and operation of Snowy 2.0.

1.4.2 The Snowy 2.0 vision

According to Dunn (SMA 1991), 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 to 1986.

Snowy 2.0 involves linking Tantangara and Talbingo reservoirs. This tunnel link can be seen on a number of historical plans for the Snowy Scheme but was not built at the time due to economic feasibility. At the time cheap coal fired generation was becoming readily available, and at that time, was not limited by potential concerns over greenhouse emissions and climate change.

Snowy 2.0 adopts the vision of connecting Tantangara and Talbingo reservoirs to generate power through a new power station, similar to what was previously envisaged for the original Snowy Scheme. An advantage however of the current vision, Snowy 2.0, is the ability to pump water back to Tantangara Reservoir to be stored for future reuse (ie a closed system) for dispatchable energy generation. The ability for the water to be reused in this way contributes to the strong economic business case of Snowy 2.0. As previously stated, Snowy 2.0 will increase the generation capacity of the Snowy Scheme by almost 50%, providing an additional 2,000 MW generating capacity, and making approximately 350,000 MWh available to the NEM.

1.4.3 Developing the Snowy 2.0 concept

Since the project was announced in March 2017 Snowy Hydro has undertaken a comprehensive program of project planning, energy market and economic modelling and design development. The project planning and development milestones are provided in Figure 1.7.

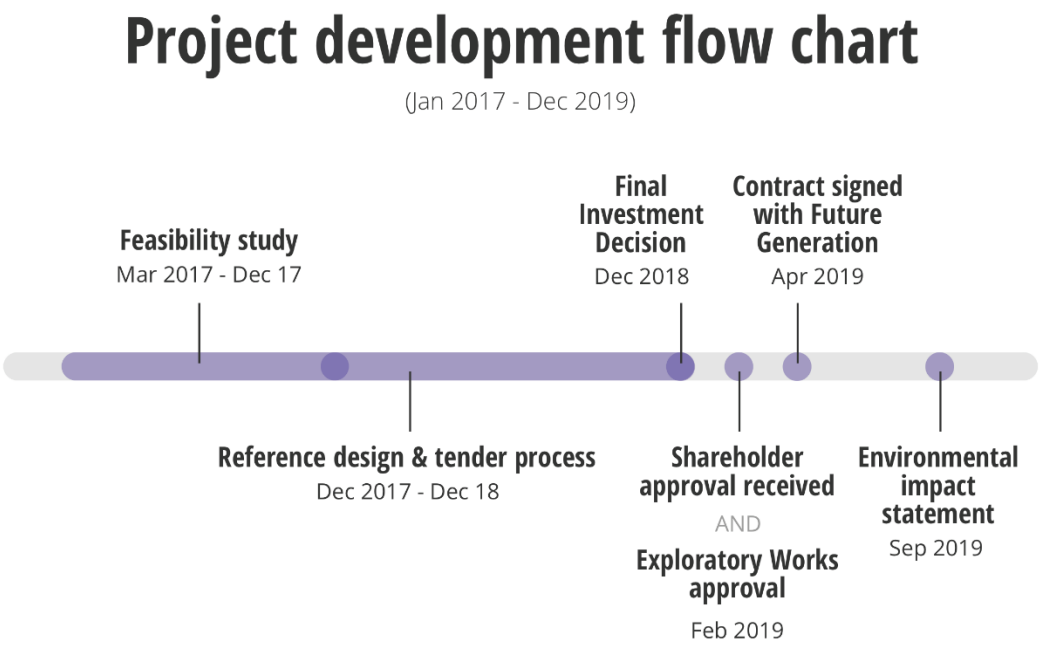


Figure 1.7 Project development flow chart

The first key step of Snowy 2.0 project development was the Feasibility Study which developed the preliminary business case, design, cost estimate, schedule and execution plan. The Feasibility Study, released in December 2017, confirmed that Snowy 2.0 is economic, technically feasible and financeable. The Feasibility Study is available on Snowy Hydro's website.

The next phase of project development was the planning required for the FID. This involved comprehensive and careful planning and assessment of all aspects of the project including: health and safety, the commercial business case, reference design, project execution, consolidated business operability, schedule, cost and contingency, market modelling, revenue sources and portfolio modelling, drivers of revenue, project valuation, scenario analysis, site and ground conditions, environment, project controls, transmission, hydrology, operations readiness, approvals, legal, governance and stakeholder engagement.

The FID was made by Snowy Hydro's Independent Board of Directors on 12 December 2018 with a decision to proceed based on the outcomes of the project planning. The FID documentation (some 1,000 pages) is available on Snowy Hydro's website. Since the FID, a contractor (FGJV) for the detailed design and construction of the project has been appointed by Snowy Hydro, following shareholder approval for Snowy 2.0 from the Australian Government and following approval and commencement of Exploratory Works.

Throughout the project development, comprehensive environmental impact assessment has been carried out by leading experts and identified environmental values of the project area have been considered through careful planning and design. This has involved extensive field surveys to better understand the baseline conditions of the project area as well as environmental specialists working closely with the project design team to avoid, minimise, mitigate and offset environmental impacts.

i Options and alternatives considered

The Snowy 2.0 Main Works has a number of significant and unique benefits that justify its selection over alternative projects to meet the urgent requirements of the NEM for large-scale capability to underpin a stable and secure decarbonisation at lowest cost.

As described more fully in Chapter 3, the NEM is undergoing a paradigm transformation that has been brought about by rapidly decreasing costs of wind and solar (known as variable renewable energy or VRE), significant shifts in energy efficiency, coal power station retirements, increasing coal and gas costs and Australia's participation in global commitments to reduce carbon emissions (ie Paris Agreement).

The NEM urgently needs more on-demand energy and large-scale storage to ensure Australia's secure and stable transition to renewables at lowest cost to consumers.

Independently to Snowy Hydro, the requirement for large-scale storage was identified as a policy priority by the then Prime Minister in an address to the National Press Club on 1 February 2017[1]. This has been subsequently confirmed by multiple independent bodies, including the Finkel Review in June 2017[2] and the Integrated System Plan (ISP) prepared by the Australian Energy Market Operator (AEMO) in December 2018[3]. It was most recently affirmed by the ISP Insights document published by AEMO in July 2019[4]. The ISP Insights paper confirms that the NEM requires large-scale storage more quickly (by the mid-2020s) and at a greater scale (up to 15 GW of capacity by the early 2040s) than anticipated when Snowy Hydro commenced its Feasibility Study into Snowy 2.0 in March 2017.

The Finkel Review confirmed that the only viable commercial technology to provide large grid-scale storage is pumped hydro-electric storage. The pumped hydro-electric energy storage technology used in Snowy 2.0 would have high full cycle energy efficiency, a long lifespan and significant storage capacity. These benefits are considered to justify the use of pumped hydro energy storage to complement other smaller scale energy storage technologies, such as batteries, which also have a valuable role in the NEM.

As set out in Chapter 3, the independent Marsden Jacob Associates (MJA) study shows that without Snowy 2.0, the market needs would be met by a mix of gas generation and batteries, which would be an order of magnitude more expensive, and would not provide the same benefits as pumped hydro-electric storage.

Other opportunities have been identified in NSW and throughout Australia for hydro-electric storage, notably the atlas of pumped hydro-electric storage released in 2017 (Blakers et al. 2017), however the lead time and planning for such projects is extremely complex. Given the scale of storage that will be required in the NEM, a number of these opportunities are likely to play a role in the future.

Snowy 2.0 Main Works has the following benefits when compared to alternatives in meeting the immediate requirements of the NEM:

- it uses two existing reservoirs (Tantangara and Talbingo) and accordingly does not require inundation of a new area, which is a key environmental impact associated with typical hydro-electric projects;
- the scale of these existing storages, and in particular Tantangara Reservoir, means Snowy 2.0 can provide up to 350,000 MWh of storage, which is significant storage capacity when compared to any alternative;

1 https://www.energy.gov.au/sites/default/files/independent-review-future-nem-blueprint-for-the-future-2017.pdf

2 https://www.energy.gov.au/government-priorities/energy-markets/independent-review-future-security-national-electricity-market

3 https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Integrated-System-Plan

4 https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/ISP/2019/ISP-Insights---Building-power-system-resilience-with-pumped-hydro-energy-storage.pdf

- section 37A of the SHC Act, which was introduced by the *Snowy Hydro Corporatisation Amendment (Snowy 2.0) Act 2018*, entitles Snowy Hydro to the grant of a lease for the purpose of the Snowy 2.0 Main Works. Notably, the pumped hydro-electric storage atlas (Blakers et al. 2017) notes that 'There has been no investigation of land tenure [in respect of the sites]...and no discussions with landowners and managers. Nothing in this list of potential site locations implies any rights for development of these locations';

- it has been developed to a point that, subject to this approval, it can be delivered by the mid-2020s when storage is required;

- it is between the two largest load centres in the NEM (in NSW and Victoria) and also in proximate to major renewable energy zones in southwestern NSW and northwestern Victoria;

- it will be integrated into the operations of the existing Scheme. Once complete, Snowy 2.0 will be one of nine large generators within the existing Snowy Scheme that operate within an integrated portfolio under the control of Snowy Hydro. Snowy Hydro is uniquely positioned to deliver and operate a project of this magnitude; and

- the Snowy Scheme itself was deliberately in the Australian Alps to capture snow melt, and utilise the existing topography of the landscape. Only by being integrated within the Snowy Scheme can the Snowy 2.0 Main Works leverage these existing capabilities to meet the needs of the NEM, and also provide additional drought proofing for the existing Snowy Scheme.

A comprehensive assessment of options for the augmentation of the Snowy Scheme was documented in the Snowy Mountains Scheme Augmentation Ranking Study (SMA 1991). This involved consideration of 10 conventional hydro power alternatives and four pumped storage alternatives. The options considered are provided in Figure 1.8. This study included consideration of a pumped hydro connection between reservoirs similar to the Snowy 2.0 alignment, called the Yarrangobilly Pumped Storage Scheme. This option was found to be the lowest cost alternative for large scale pumped hydro energy storage of 18 GWh for 10 day capability. This option was not considered economic at the time largely due to the comparative cost of gas turbines. The Yarrangobilly Pumped Storage Scheme was investigated further in 2017 in the Snowy 2.0 Feasibility Study as it was identified that the economic viability of large scale pumped hydro energy storage had improved. It is this scheme which has been developed into Snowy 2.0.

When compared to the other four pumped hydro alternatives in the Ranking Study, the Yarrangobilly Pumped Storage Scheme (ie Snowy 2.0) was clearly superior to the others because:

- The proposed Wandilla and Jagumba Pumped Hydro Schemes would require the construction of new storages; and

- None of the other three options provide the same high head potential linked to the high storage capacity of Snowy 2.0. A detailed comparison of the four schemes is set out in Table 1.1.

Table 1.1 Ranking Study (SMA 1991) options

Scheme option	New storages required	Potential storage	Potential head	Tunnelling required
Yarrangobilly	No	238 GL	680 m	~27 km
Wandilla	Yes	6.3 GL	270 m	~1.5 km pressure pipeline
Jagumba	Yes	25.5 GL	680 m	~10 km
Upper Tumut	No	52 GL	610 m	~24 km

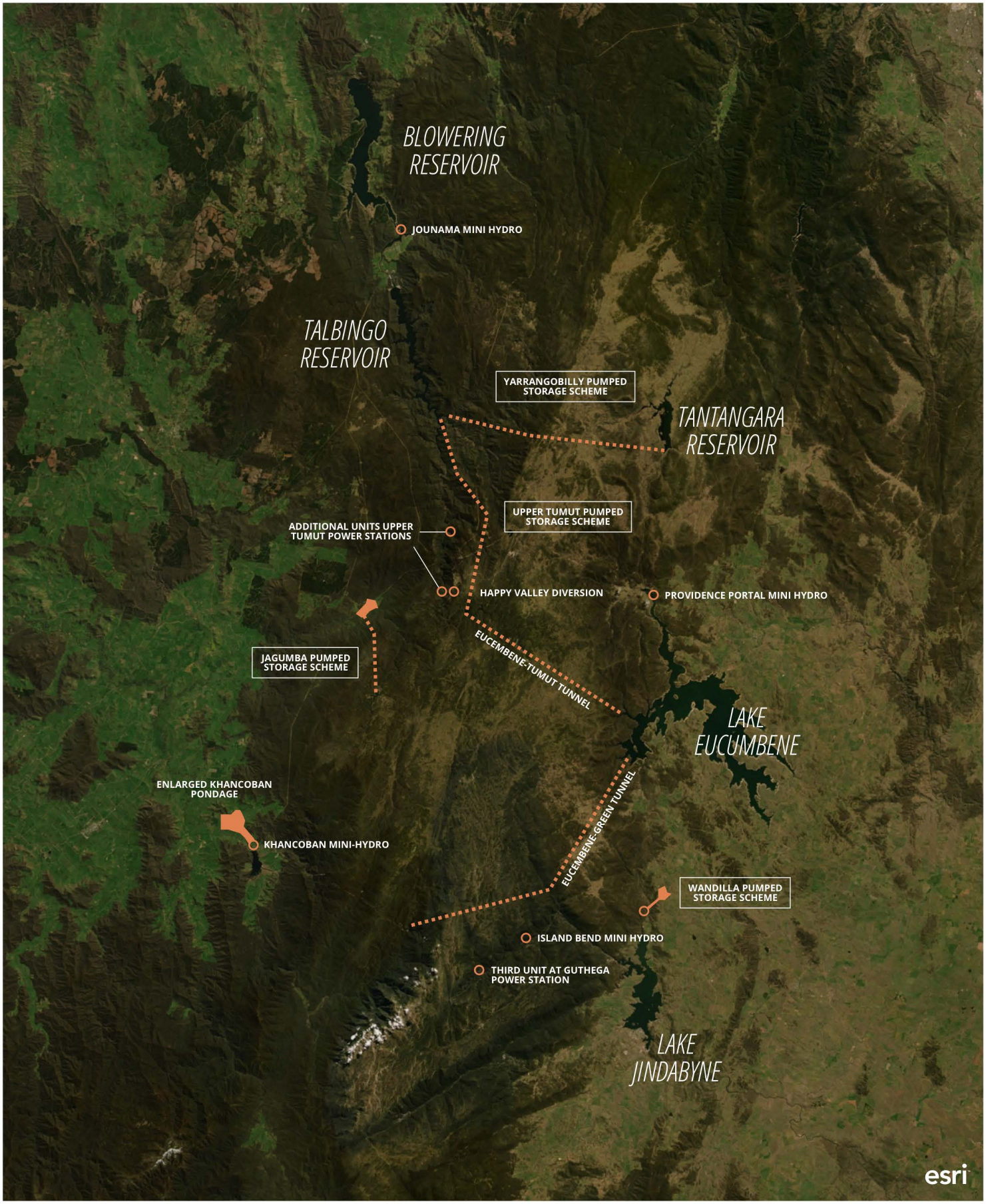
In light of the unique nature of the opportunity offered by the Snowy 2.0 Main Works, Snowy Hydro embarked on a Feasibility Study of the development in March 2017. The progress of that Feasibility Study, and the options within the Snowy 2.0 development are described more fully in Appendix C.

The alternatives within the project have been considered and further developed following the appointment of FGJV. The alternatives considered have arisen with the aim of optimising the former reference design with reference to constructability, environmental, social and economic factors. A detailed description of the options and alternatives considered throughout the design and assessment process for Snowy2.0 is provided at Appendix C. The key aspects of Snowy 2.0 Main Works that have been subject to consideration of options and alternatives are:

- underground infrastructure, primarily the location of the underground power station and the connecting power waterway and access tunnels;
- management options and alternatives for excavated rock, including consideration of alternative placement areas and methods;
- location and extent of surface works, which was subject to an iterative design and environmental assessment process to minimise impacts; and
- design and management measures to be incorporated into the project to minimise environmental impacts.

ii Design development, consultation and environmental assessment

Snowy 2.0 Main Works has been developed with underpinning principles to avoid and minimise environmental impacts where possible. These principles were implemented through an iterative design integration and assessment approach (DIAA), supported by consultation with relevant technical advisors, government agencies and other stakeholders. The NSW National Parks and Wildlife Service (NPWS), as land manager of KNP, was consulted throughout design development and as part of the preparation of this EIS.



Satellite image © Esri, CGIAR | Vicmap, Esri, HERE, Garmin, METI/NASA, USGS | Earthstar Geographics

Figure 1.8 **Snowy Scheme augmentation options**

LOCATIONS ARE APPROXIMATE ONLY

- Proposed Power Station
- Proposed Tunnel
- Proposed Storage

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1.5 Related projects

There are three other projects related to Snowy 2.0 Main Works, they are:

- Snowy 2.0 Exploratory Works (SSI - 9208) – a Snowy Hydro project with the former NSW Minister for Planning's approval;
- Snowy 2.0 Transmission Connect Project (SSI - 9717) – a project proposed by TransGrid; and
- Snowy 2.0 Proposed Segment Factory (SSI - 10034) – a project proposed by Snowy Hydro.

Snowy 2.0 Exploratory Works involves the construction of an exploratory tunnel and associated geotechnical investigation activities to inform the final design of Snowy 2.0. Snowy 2.0 Exploratory Works was approved by the former NSW Minister for Planning on 7 February 2019 and works commenced in March 2019. Staged submission and separate approval is appropriate for a project of this magnitude, due to its complexity and funding and procurement processes. Submission of the application and subsequent approval of Exploratory Works ahead of Main Works was critical as it will obtain detailed geological data about the rock types, conditions, ground temperature and stress conditions to inform the detailed design of the underground power station cavern.

While the upgrade works to the wider shared transmission network and connection between Snowy 2.0 and the network form part of the CSSI declaration for Snowy 2.0, they do not form part of Snowy Hydro's application. The Transmission Connection Project, while connecting Snowy 2.0 to the NEM, is part of a broader priority transmission project that will benefit the whole of the NEM as it decarbonises. TransGrid is the proponent for the transmission connection which will be subject to separate application and approval processes. However, cumulative impacts have been considered in this EIS where relevant.

A proposed segment factory at the industrial area of Polo Flat in Cooma is a development that is ancillary to Snowy 2.0 Exploratory Works and Main Works but subject to a separate approval process. This project will provide the concrete segments needed to line the tunnels of Snowy 2.0.

1.6 Purpose of this document

This EIS has been prepared by EMM Consulting Pty Limited (EMM) on behalf of Snowy Hydro to support the CSSI application for approval of Snowy 2.0 Main Works under Part 5, Division 5.2 of the EP&A Act. It has been prepared to the form and contents requirements set out in clauses 6 and 7 of Schedule 2 of the *NSW Environmental Planning and Assessment Regulation 2000* (EP&A Regulation). It has also been prepared with consideration of *Preparing an Environmental Impact Statement Guideline (Draft)* (DPE 2017).

This EIS has also been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) issued by DPIE on 31 July 2019. The SEARs and where they have been addressed in this EIS are provided in Appendix A. The EIS is supported with input from technical specialists. The EIS study team is provided at the end of this report.

CHAPTER 2

DESCRIPTION OF THE PROJECT

2 Description of the Project

2.1 Introduction

This chapter explains how Snowy 2.0 Main Works will be built over the proposed six year construction period, and how the core elements will be operated and fully integrated into the existing Snowy Scheme. The proposed phases of Snowy 2.0 Main Works comprise construction and operation. The structure of the chapter is therefore as follows:

- Section 2.1 – provides an overview of Snowy 2.0 and how it will function, including an introduction to the principles that enable Snowy 2.0 to be built and to function, the guiding design principles and overview of the construction areas, project elements and access arrangements and the sequencing of the works;
- Section 2.2– provides information relating to the construction of Snowy 2.0 Main Works;
    - Section 2.2.1 – summarises the sequencing of construction activities and outlines the typical methods to be used during construction of Snowy 2.0 Main Works;
    - Section 2.3.2 – describes the construction of permanent infrastructure, mostly underground;
    - Section 2.3.3 – describes the supporting temporary construction sites and infrastructure needed to build permanent elements of Snowy 2.0 Main Works;
    - Section 2.3.4 – describes the temporary and permanent access road requirements;
    - Section 2.3.5 – describes how excavated rock will be managed during construction, including the handling, stockpiling, transport, and placement of rock;
    - Section 2.3.6 – describes how the project area will be accessed during construction, including primary haulage and delivery routes;
    - Section 2.3.7 – describes the construction work requirements, including the workforce and hours of construction;
    - Section 2.3.8 – describes progressive rehabilitation measures to be implemented during construction, and rehabilitation objectives at completion of construction works;
- Section 2.4 – describes the operating regime and maintenance required during the operational phase of Snowy 2.0 Main Works; and
- Section 2.5 – provides a summary of the interactions between Snowy 2.0 Main Works and KNP.

The works described in this chapter form the basis of the environmental impact assessment undertaken.

2.2 Overview of Snowy 2.0 Main Works

2.2.1 Principles of Snowy 2.0

Snowy 2.0 will link the existing Tantangara and Talbingo reservoirs within the existing Snowy Scheme through a series of new underground tunnels and a hydro-electric power station, to be constructed within an underground cavern. Most of the project's facilities will be underground which minimises the project's long-term footprint and impact on the surface.

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 that will be available on-demand as quick-start electricity generation at critical times of peak demand including times when intermittent renewable energy output or thermal generation is low. To do this, Snowy 2.0 effectively has two operating modes; energy generating mode and pumping mode (for large-scale energy storage). These are shown and explained in Figure 2.1.

Operating in either generating mode or pumping mode will be facilitated by the Snowy Mountains Control Centre (SMCC) in Snowy Hydro's headquarters at Cooma, via the communication networks between Cooma and Snowy 2.0. Decisions concerning the operational mode, flow rates and flow duration will 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. As with the current Snowy Hydro generating assets Snowy 2.0 will be remotely operated, so there will be no permanent staff on-site except as required for inspection and maintenance activities. Access to the permanent infrastructure will be provided by upgraded and/or new roads established during the course of construction of Snowy 2.0 Exploratory Works and Main Works.

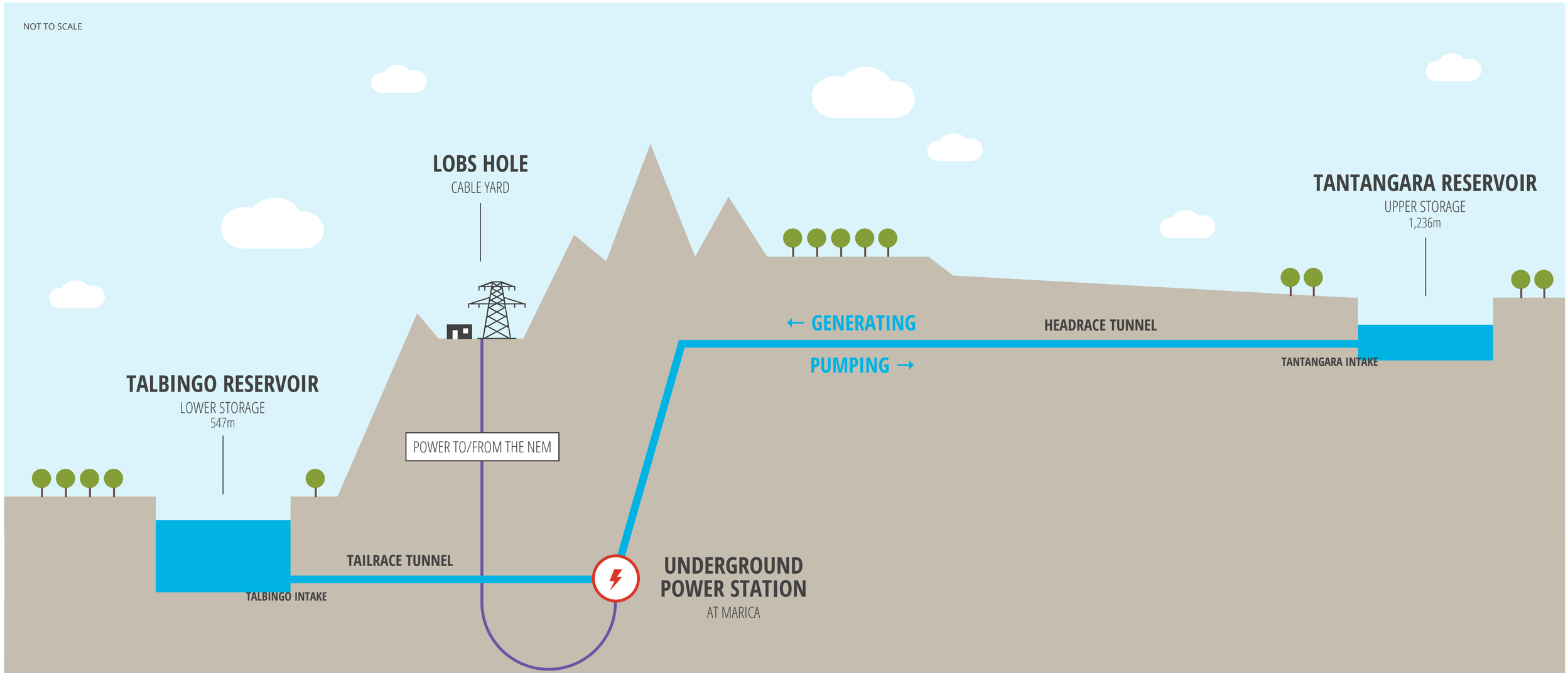
2.2.2 Guiding design principles and approach

Given the complexities of Snowy 2.0 Main Works, its scale and schedule, an iterative and risk-based design and assessment process was adopted in identifying and assessing potential environmental impacts (the DIAA process, as shown in Figure 2.2). This process was undertaken to develop the design and construction methods with the guiding principles of avoiding and minimising environmental impacts where possible and engaging with key stakeholders throughout the process. This EIS has been prepared with consideration of impacts commensurate with the levels of risk identified through the DIAA process.

The challenges for the design team included the need to develop solutions that balance the need for ensuring a safe working environment for the construction of Snowy 2.0 Main Works, including the safe movement of plant, equipment, materials and personnel across the sites, with the need to preserve and protect the values of the KNP and the environmental constraints of the location. Throughout the design process, the objective was to identify and avoid sensitive locations, to minimise the construction footprint and maintain as much of the existing natural environment as is reasonable and feasible.

As previously stated, Snowy Hydro has appointed a contractor for the design and construction of Snowy 2.0. The EIS is based on the design provided by the contractor during the tender process, noting that a detailed design process is now underway.

While project components are generally fixed, there may be some refinements to the physical layout or design of certain components of the project following further investigation and design. Consistent with the DIAA process, the objective for the detailed design process is to optimise the design to meet construction requirements while continuing to minimise environmental impacts.



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 that will be available as quick-start electricity generation at critical times of peak demand.

IN GENERATING MODE:

- The intake structure at Tantangara Reservoir allows water to flow into the headrace tunnel
- Water falls via gravity into the surge tank (the surge tank valves/gate are opened)
- Water flows through pressure tunnels and to the turbines in the machine hall, spinning the turbines and generators to create electricity
- Transformers located in the transformer hall of the underground power station convert the electricity to a higher-voltage current, and is then transmitted via cables to supply the NEM
- Water continues through the tailrace tunnel and is released into Talbingo Reservoir via the Talbingo gate shaft and intake structure

IN PUMPING MODE:

- Energy is sourced from the NEM which is transmitted into the Power station via the same electrical infrastructure used in generating mode
- Water from Talbingo Reservoir is drawn through the Talbingo intake and the tailrace tunnel toward the turbines
- The turbines in the machine hall, spinning in the reverse direction (as pumps), push the water up the inclined tunnel and through the headrace tunnel to Tantangara Reservoir where it can be stored and used again for energy generation when needed

snowy 2.0

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Figure 2.1 **Principles of Snowy 2.0 Main Works**

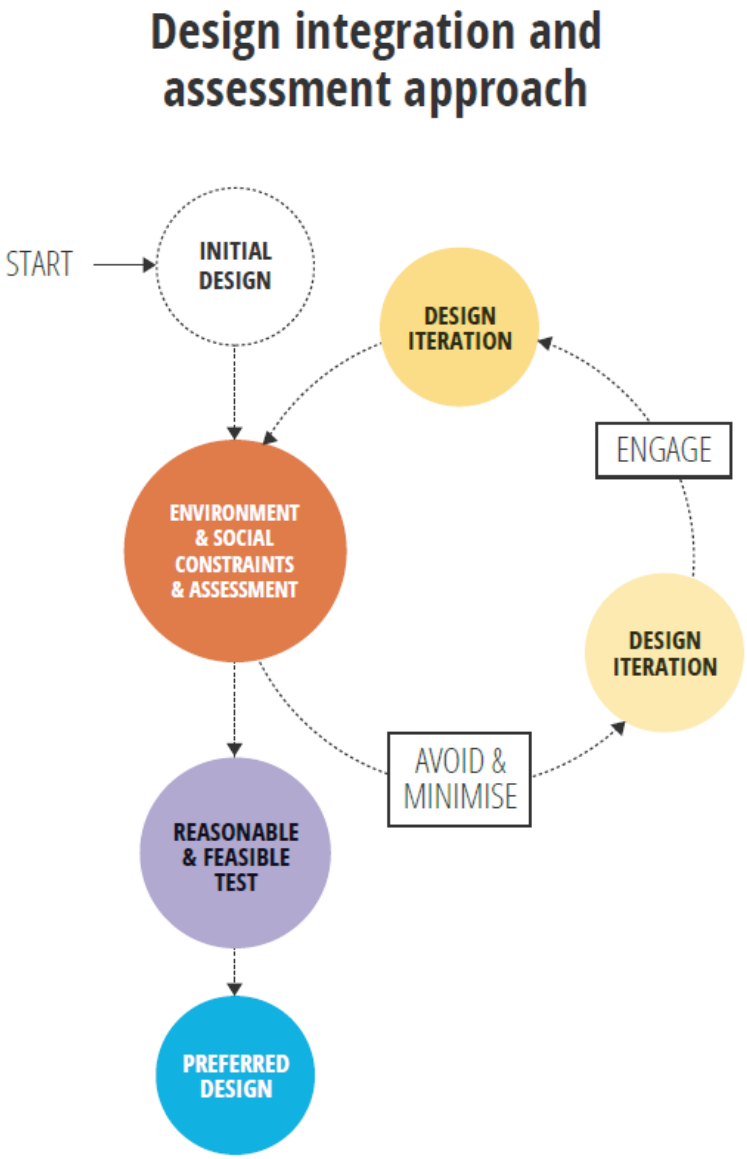


Figure 2.2 **Design integration and assessment approach**

2.2.3 Snowy 2.0 Main Works

The development of Snowy 2.0 within KNP will result in the creation of permanent infrastructure, mostly underground which is required to operate the project. The design of these infrastructure elements has been integrated into the KNP with careful consideration of its values, as well as maintaining public access to the KNP during construction where safe to do so, and in the long-term once construction has finished.

The following key design elements are proposed as part of Snowy 2.0 Main Works as they 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;
- fish control structures in proximity to Tantangara Reservoir wall;
- new and upgraded roads to allow ongoing access and maintenance; and
- power, water and communication infrastructure, including:
    - a cable yard to facilitate connection between the NEM electricity transmission network and Snowy 2.0;
    - permanent auxiliary power connection;
    - permanent communication cables; and
    - permanent water supply to the underground power station.

Figure 2.3 shows the permanent infrastructure proposed to be built within the KNP as part of Snowy 2.0 Main Works, and Table 2.1 to Table 2.6 provides a summary of the proposed project elements needed to establish this infrastructure.

To build the permanent infrastructure required for Snowy 2.0, several construction elements are needed. The construction elements proposed as part of Snowy 2.0 Main Works include:

- construction compounds, portals, stockpile areas, yards, maintenance and laydown areas to provide areas for plant and equipment, and storage of construction materials, at Talbingo Reservoir, Lobs Hole, Marica, and Tantangara Reservoir;
- access tunnels and adits to support main tunnelling activities and construction of the underground power station complex;
- a construction logistics site at Rock Forest;
- site-based accommodation camps to house the temporary workforce at Lobs Hole, Marica and Tantangara Reservoir;
- road establishment and other access improvements and upgrades to allow access to construction sites;

- management of excavated rock from tunnelling and excavation activities, including:
  - permanent storage of excavated rock within Talbingo and Tantangara reservoirs;
  - temporary and/or permanent on-land storage within the KNP and temporary and/or permanent storage outside of KNP;
- temporary water supply for water required by construction activities;
- temporary water and wastewater treatment facilities where needed to manage the above sites and construction activities;
- continued use of the Lobs Hole substation for construction power if required (note that this component is subject to a modification to the current Exploratory Works for Snowy 2.0 approval; requesting its construction and operation for the Exploratory Works phase of Snowy 2.0); and
- continued access to Talbingo Reservoir by barge (established during Exploratory Works for Snowy 2.0) and establishment of barge access at Tantangara Reservoir for construction of the intake.

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.

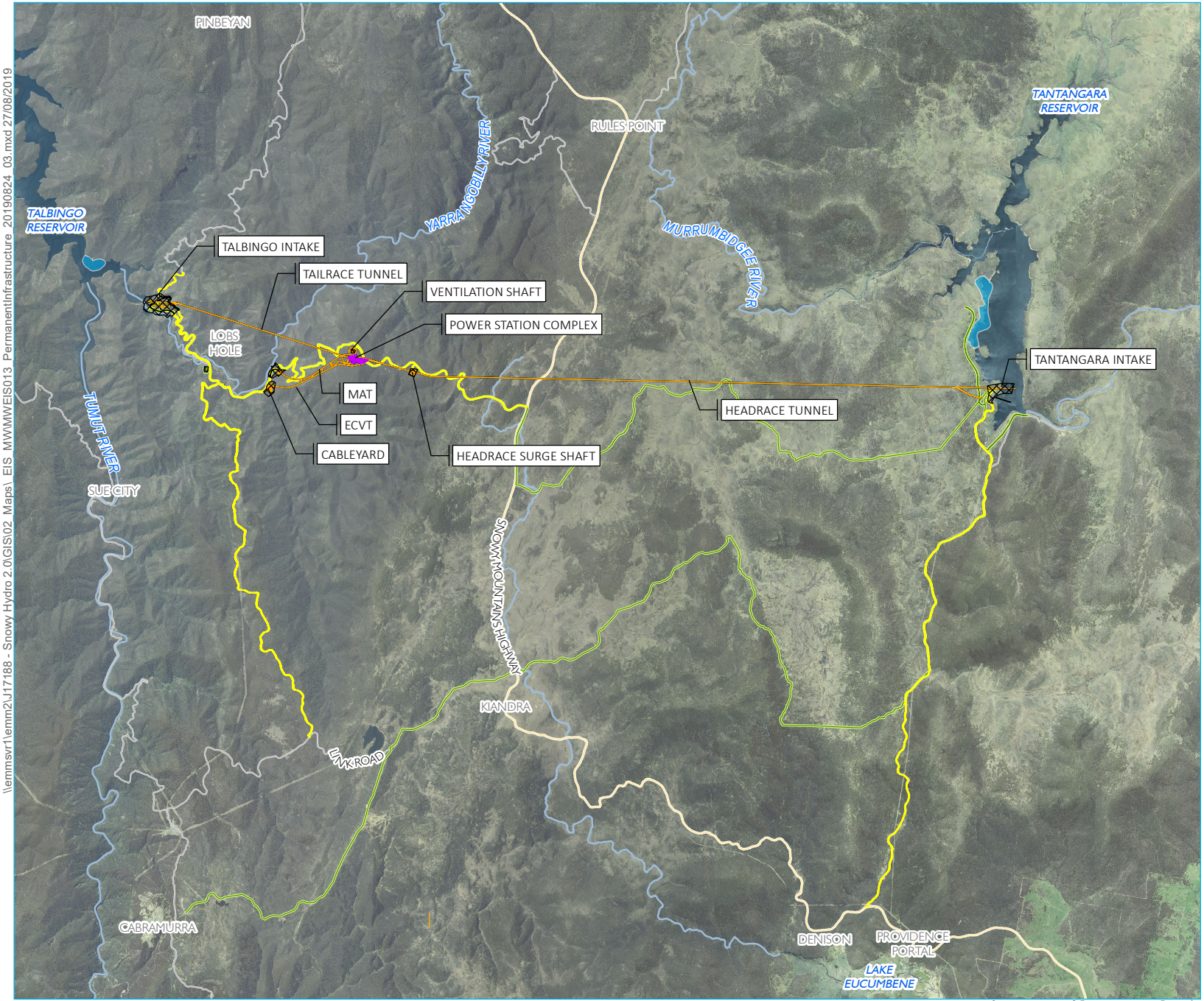
i Methods

The construction of Snowy 2.0 Main Works requires multiple techniques and methods to achieve safe, efficient and cost-effective delivery. Construction primarily involves temporary surface disturbance works through the creation of construction areas to build infrastructure as well as sites where deep excavation works (primarily utilising tunnel boring machines (TBMs)) can launch from.

The excavation of the underground tunnels and caverns (which will form the power station complex) represent most of the civil construction activities required. Two primary methods of excavation will be used for the underground works: TBM and drill and blast. Figure 2.4 shows the likely locations of where these two primary methods will be used.

Broadly, drill and blast will be initially used to excavate access adits to allow for excavation of the headrace and tailrace tunnels through use of TBM. Drill and blast will also be used for the initial section of the main access tunnel (MAT, approved under Snowy 2.0 Exploratory Works) and emergency egress, cabling and ventilation tunnel (ECVT) until there is competent rock to launch the TBMs to undertake the remainder of the excavation. Drill and blast will be used to excavate the underground caverns and attached small waterway tunnels as well as permanent access and construction adits around the power station complex, as well as to excavate some areas at the surface such as intakes and access roads.

Other methods of excavation proposed during construction include, but are not limited to, open cut (intake construction, road works), and raise bore and blind sink (to excavate shafts and chambers). Further detailed information on construction method is provided in Appendix D.



\\emmsvr1\emm2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MWMWEIS013 PermanentInfrastructure 20190824 03.mxd 27/08/2019

KEY

- Operational footprint

Existing environment

- Main road
- Local road
- Watercourse

Snowy 2.0 Main Works operational elements

- Tunnels, portals, intakes, shafts
- Power station
- Utilities
- Permanent road
- Indicative rock emplacement area

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

0 2.5 5 km

GDA 1994 MGA Zone 55

N

Snowy 2.0 Main Works - permanent infrastructure

Snowy 2.0
Environmental Impact Statement
Main Works
Figure 2.3

snowy 2.0

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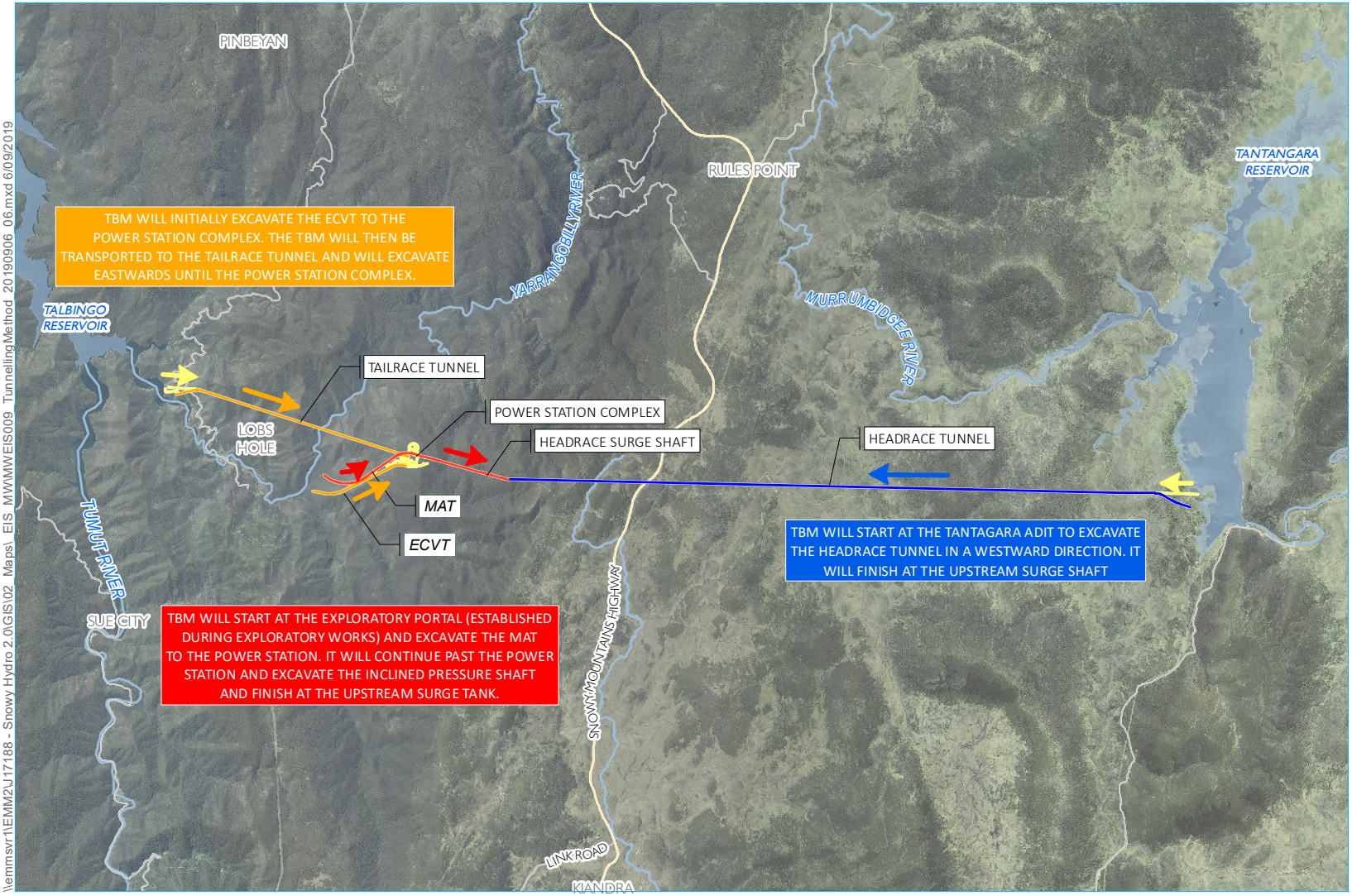


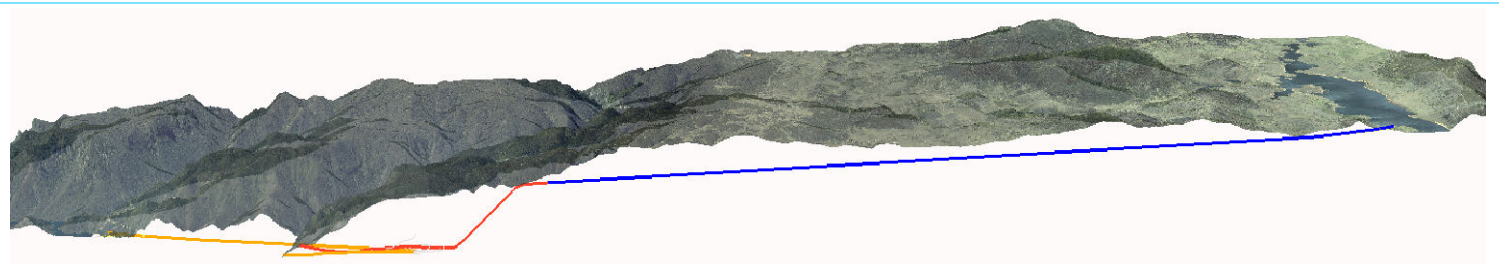
KEY

Tunnelling method

- Drill and blast
- TBM 1
- TBM 2
- TBM 3
- Tunnelling direction

Existing environment

- Main road
- Local road
- Watercourse
- Waterbodies



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

0 2.5 5 km

GDA 1994 MGA Zone 55

N

Primary excavation methods – drill and blast and tunnel boring machine

Snowy 2.0
Environmental Impact Statement
Main Works
Figure 2.4

snowy 2.0

EMM creating opportunities

ii Construction areas

Due to the remoteness of the project area for Snowy 2.0 Main Works, construction sites are generally needed to:

- provide facilities such as concrete batching plants (CBPs), mixing plants and on-site manufacturing;
- store machinery, equipment and materials to be used in construction;
- stockpile material such as aggregate to be used in construction, or stockpile material extracted from tunnelling and road works;
- maintain construction plant and equipment;
- provide access to underground construction sites; and
- provide onsite accommodation for the construction workforce.

For the purposes of this chapter the project area is described by 'construction areas' as shown on Figure 1.4 to account for the nature of the proposed activities and the varying local environmental, amenity and recreational conditions. These geographic areas are:

- Talbingo Reservoir - at an FSL of about 546 m AHD, Talbingo Reservoir will be the lower reservoir for Snowy 2.0 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 as well as an emplacement area for excavated rock and surplus cut materials;
- Lobs Hole - the area 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 Snowy 2.0 Exploratory Works tunnel, which will be refitted to become the MAT, as well as the location of the ECVT, portal, associated services and accommodation camp;
- Marica - the area will be used primarily for construction purposes including construction of vertical shafts to the underground power station (ventilation shaft) and headrace tunnel (surge shaft), and a small accommodation camp;
- Plateau – the area (predominantly within an existing track) will be used for construction and operation of buried communications and power supply cables to operational infrastructure between Talbingo and Tantangara reservoirs. At depth, the headrace tunnel will be excavated across the plateau;
- Tantangara Reservoir- at a full supply level (FSL) of about 1,229 metres (m) to Australian Height Datum (AHD), Tantangara Reservoir will be the upper reservoir for Snowy 2.0 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 as well as an emplacement area for excavated rock and surplus cut materials; and
- Rock Forest – the area comprises private property under lease to Snowy Hydro for use as a logistics site during construction.

Supporting infrastructure will include establishing or upgrading access tracks and roads and electricity connections to construction sites. Each construction site needed for Snowy 2.0 Main Works is shown on Figure 2.6 to Figure 2.11, and further described in Table 2.1 to Table 2.6. These tables provide a summary of the project elements to be built, their purpose, how they are to be built and the access arrangements in the short term (during construction) and long term at completion of construction (during operation).

iii Disturbance footprint

For the purposes of predicting environmental impacts of the project, a disturbance footprint has been defined. The disturbance footprint encompasses the extent of physical disturbance likely to be required to accommodate construction activities and infrastructure needed to build Snowy 2.0 Main Works, based on preliminary designs provided by FGJV. The maximum disturbance area is about 1,680 hectares (ha) which is approximately 0.25% of the KNP. As detailed design progresses, there may be some elements within the boundaries of the disturbance footprint that need to be relocated or optimised. For this purpose, the disturbance footprint described within this EIS may be broader than what will ultimately be impacted.

Progressively and at the end of construction, most of the disturbance footprint will be rehabilitated and returned to its previous use. The exception to this are areas required for permanent operation of Snowy 2.0 which would be retained (referred to as the operational footprint).

iv Timing

Snowy 2.0 Main Works will involve phases of works associated with its construction ensuring an efficient sequencing into operation where it will underpin the secure and reliable decarbonisation of the NEM at lowest cost to consumers. This is shown indicatively in Figure 2.5.

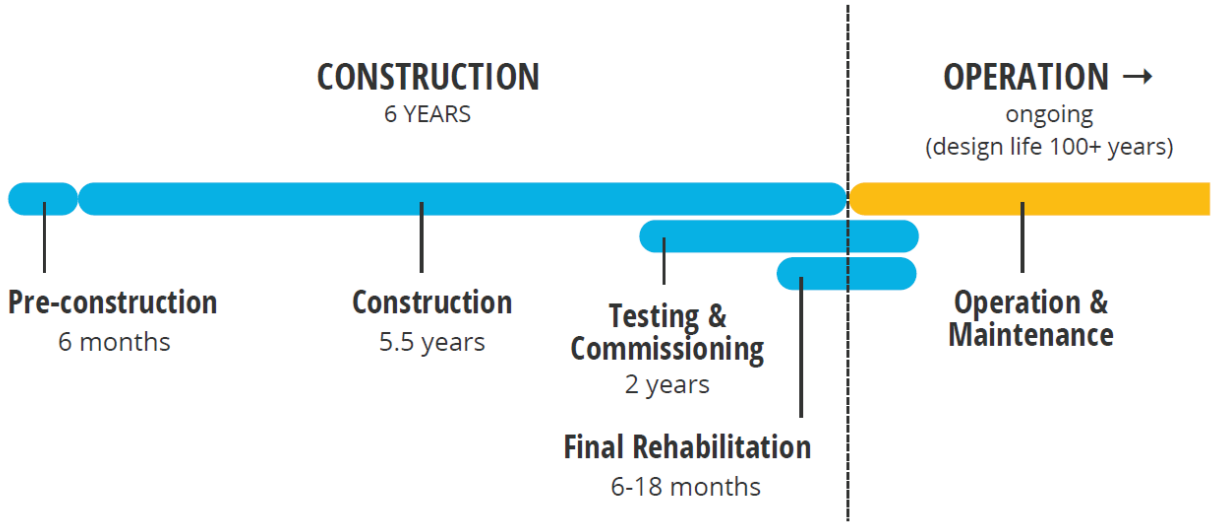


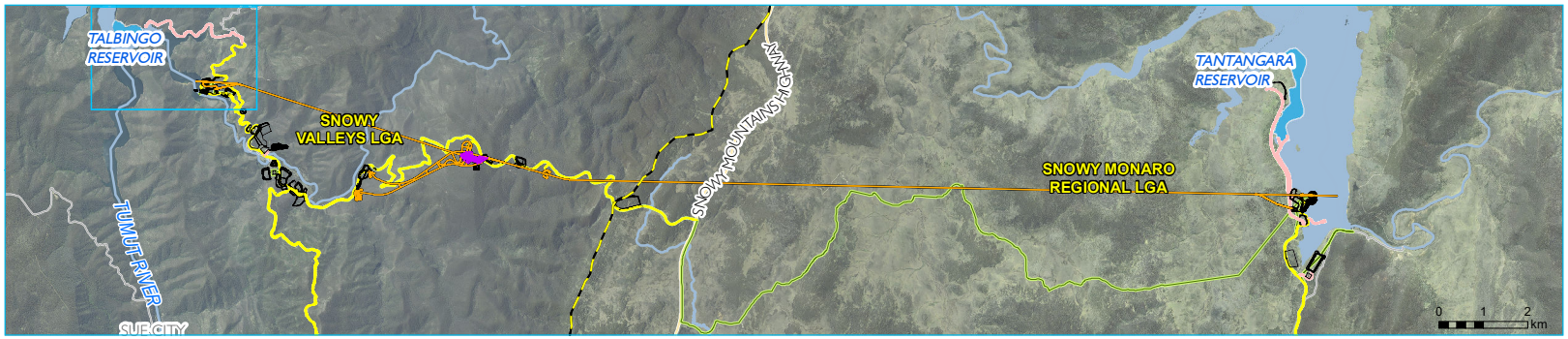
Figure 2.5 Snowy 2.0 Main Works timing and sequencing

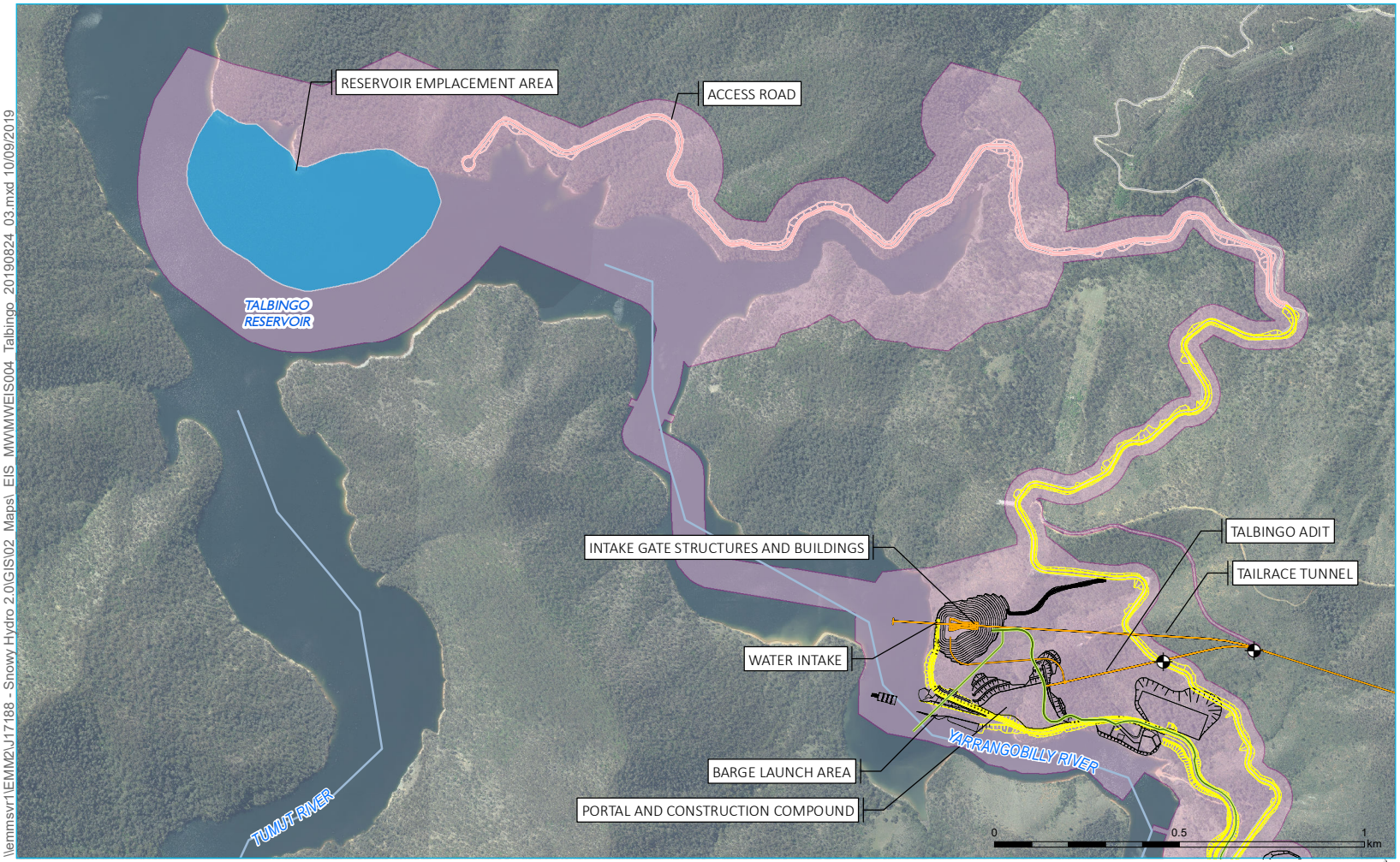
Table 2.1 Talbingo Reservoir – project elements, purpose and description

		Temporary use during construction		Permanent/long-term use during operation	
Element	**Purpose**	**Method summary**	**Rehabilitated to previous use**	**Long-term use**	**Public access**
Portal and construction compound	Portal and tunnelling associated construction area for TBM launch/support and for removal of excavated material from the tailrace tunnel.	Primary method of drill and blast to create working areas for portals and tunnel access. Construction compounds will require level areas to be created and excess material will be stockpiled and reused where possible.	✓	Construction compound area will be rehabilitated except for hardstand areas remaining at the portal to enable SHL access for maintenance and long-term operations.	SHL access only
Reservoir emplacement areas	Cost-effective and safe management of excess construction materials.	Disposal of excavated material with mobile plant and equipment. Material and armouring will be placed from the edge of the reservoir up to 1 m above FSL to allow for rehabilitation.	✓	Material will be permanent from the shore out into the reservoir down to its bed, however surface water activities on the reservoir will return to pre-construction status. Appropriate signage/navigation hazard warnings will be in place identifying the subaqueous landform.	✓
Access roads and ancillary facilities for emplacement activities	Roads will provide access to the reservoir emplacement area and ancillary facilities.	Roads will be a combination of upgraded existing access roads and new access roads. A new access road will be required to the Talbingo intake structure and to the rock emplacement area.	✓	Existing access roads upgraded to facilitate these activities will be retained permanently. The new access road to Talbingo intake structure will be retained permanently. All other construction only roads will be rehabilitated.	✓
Intake structure	To draw water from the reservoir into the tunnels, and to release water from the tunnels to the reservoir – in pumping and generation modes respectively.	Primary construction method will be drill and blast from shore-based plant and equipment, as well as conventional excavation using earthmoving equipment.	Permanent infrastructure	Cast in-situ concrete structure retained within the reservoir. While the extent is yet to be determined, public access around the intake will need to be restricted for safety reasons.	SHL access only
Intake gate structures (underground) and buildings (at surface)	To isolate the tunnels from the reservoir for maintenance and if required during operation.	Primary construction method will be drill and blast from shore-based plant and equipment. The connection between the intake and reservoir (rock plug) will be removed via water-based equipment, with some underwater blasting and/or dredging, launched from the barge launch area.	Permanent infrastructure	Gate structures within the intake, immediately east of the trashracks and diffuser structure. Access will be restricted to Snowy Hydro.	SHL access only

Table 2.1 Talbingo Reservoir – project elements, purpose and description

		Temporary use during construction		Permanent/long-term use during operation	
Element	**Purpose**	**Method summary**	**Rehabilitated to previous use**	**Long-term use**	**Public access**
Tailrace tunnel	During generation mode: to transfer water from the underground power station to Talbingo Reservoir. During pumping mode: to transfer water from Talbingo Reservoir to the underground power station.	Constructed from the Talbingo adit via a TBM heading east towards the power station complex. Excavated material will be transported from the tunnel to Lobs Hole for management or directly to the permanent placement location. The majority of the tunnel will be line with precast concrete segments.	**N/A** (underground)	Underground and restricted access for Snowy Hydro via the underground power station and Talbingo intake structure for maintenance. The tunnel will be inaccessible to the public.	SHL access only
Talbingo adit	The adit provides access for the TBM to excavate the tailrace tunnel.	Initial excavation will be by drill and blast (from the Talbingo adit to the intake), with the remainder of the tunnel excavation by TBM. The TBM will excavate eastwards to the tailrace surge shaft. This TBM will be the same TBM used for the ECVT tunnel.	✓	The adit will be sealed once excavation of the tailrace tunnel is complete. Rehabilitated land returned to NPWS.	✓
Tailrace surge tank	An underground shaft structure off the tailrace tunnel west of the power station complex at the start of the tailrace tunnel. The shaft will absorb the rise in pressure through the tailrace tunnel during load change conditions in operation.	It will likely be excavated with a blind sink method. Raise boring construction will be utilised initially, with some components constructed by conventional drill and blast practises. Excavated material will be transported from the tunnel to Lobs Hole for management.	**N/A** (underground)	Underground and restricted access for Snowy Hydro via the underground power station and Talbingo intake structure for maintenance. The tunnel will be inaccessible to the public.	SHL access only
Barge launch area (Exploratory Works)	Boat and barge launching facilities to allow for water access to intakes during construction and for removal of the rock plug, and for assembling and launching of barges.	The launch area will be available for the duration of construction.	Permanent infrastructure	Rehabilitated land returned to NPWS. The launch area will be retained in some form for use during operation for maintenance access. Opportunity for use by NPWS and the public at other times subject to agreement with NPWS.	✓





KEY

Existing environment

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

Snowy 2.0 Main Works operational elements

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

Snowy 2.0 Main Works construction elements

- Temporary construction compounds and surface works
- Temporary access road
- Geotechnical investigation
- Indicative rock emplacement area
- Disturbance area*

Note: the disturbance area is the extent of construction works required to build Snowy 2.0. It has been identified to allow an assessment of impacts for the EIS, and represents a defined maximum extent where construction works will be carried out. The area will be minimised as much as possible during detailed design.

Talbingo Reservoir - project elements

Snowy 2.0
Environmental Impact Statement
Main Works
Figure 2.6

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

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Table 2.2 Lobs Hole – project elements, purpose and description

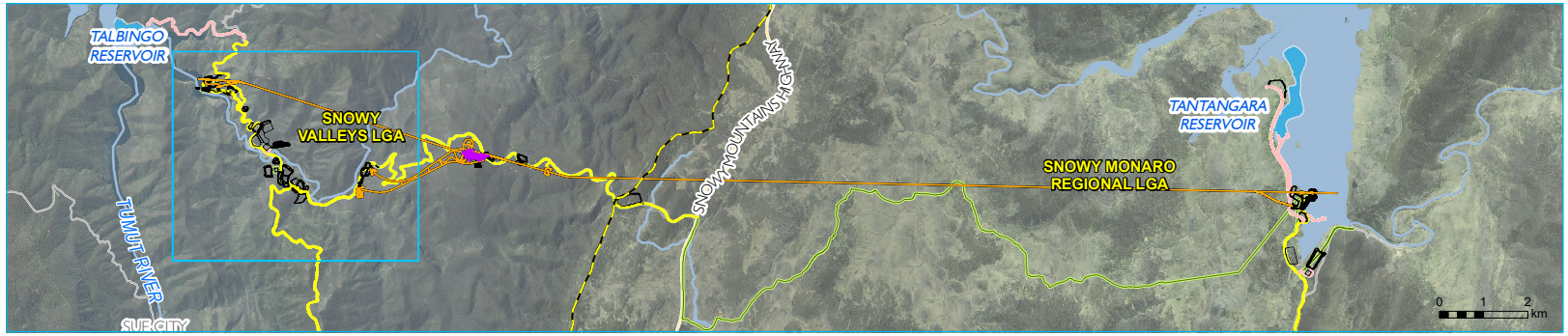
		Temporary use during construction		Permanent/long-term use during operation	
Element	**Purpose**	**Method summary**	**Rehabilitated to previous use**	**Long-term use**	**Public access**
Exploratory camp	Approved as part of the Snowy 2.0 Exploratory Works, and provides accommodation for around 150 workers at any one time during construction. Note that approval for an increase to about 250 beds will be sought under a modification to the Exploratory Works approval.	Already constructed as part of Exploratory Works and will be used during construction of Snowy 2.0 Main Works. Rehabilitation will include landforming using excavated rock material.	✓	Rehabilitated land returned to NPWS.	✓
Main Works camp	Provides accommodation for around 1250 workers at any one time during construction.	Constructed using standard techniques. Rehabilitation will include landforming of the site using excavated rock material.	✓	Rehabilitated land returned to NPWS.	✓
On land excavated rock stockpiles and management	Dedicated area to manage excavated rock material in the short and long term. Some of the long term placement will provide improved areas for recreational activities within KNP.	Excavated rock from the tunnels will be placed and compacted with earthmoving plant and equipment. Appropriate batters, drainage and landforming will be carried out to create a safe, non-polluting landform.	✓	Rehabilitated land returned to NPWS. Landform will comprise around 1,000,000 cubic metres (m^3) of excavated rock material used to establish the construction pads and re-shaped to a natural landform commensurate with the surrounding environment.	✓
Main yard	This is the main laydown and construction area for Snowy 2.0 Main Works.	Earth works will be carried out to create stable and flat landforms. Additional materials, in the form of excess cut materials, will be used to create these landforms to enable construction pads to be established and used. Appropriate drainage and erosion and sediment controls will be installed.	✓	Rehabilitated land returned to NPWS.	✓

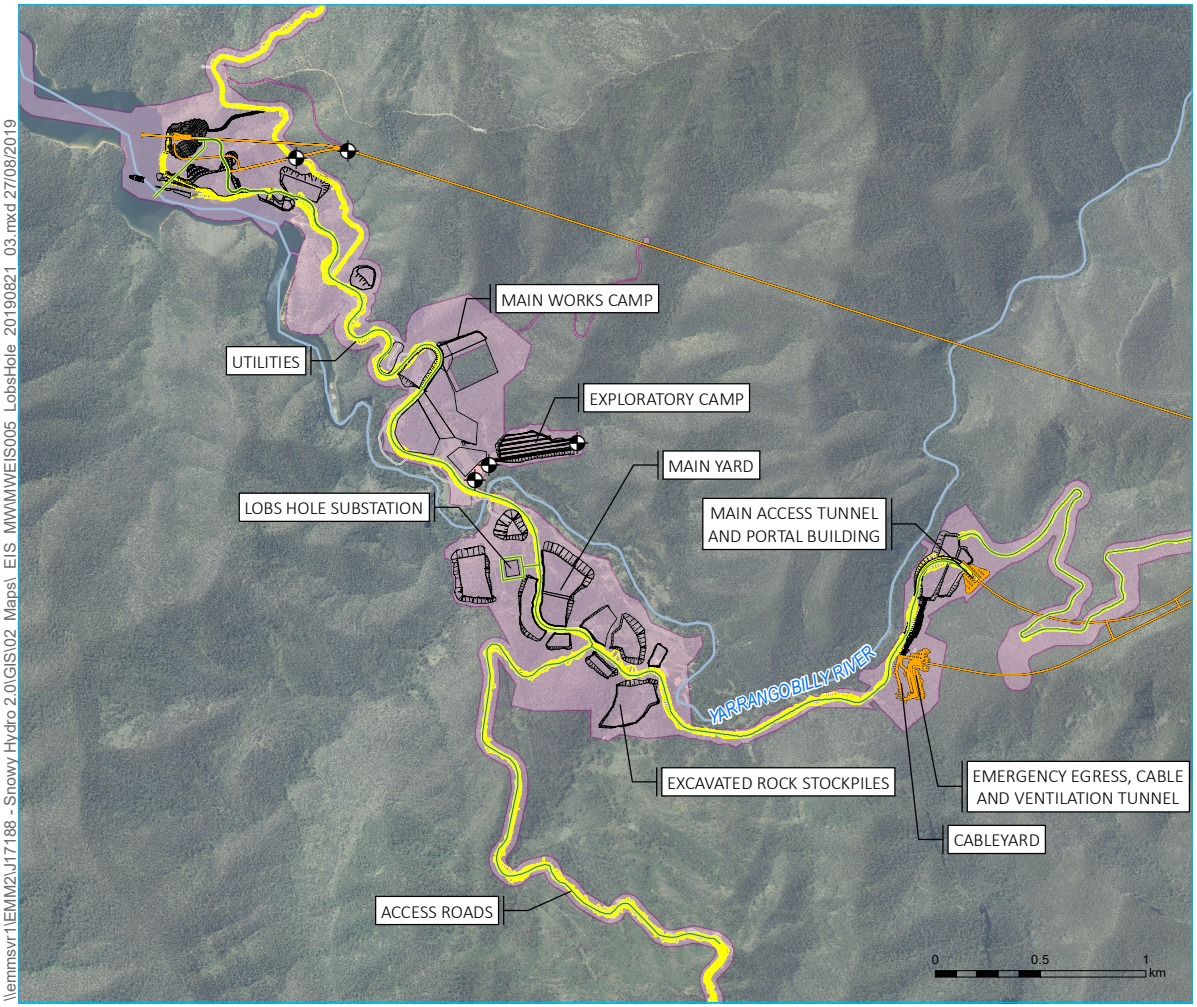
Table2.2 Lobs Hole – project elements, purpose and description

		Temporary use during construction		Permanent/long-term use during operation	
Element	**Purpose**	**Method summary**	**Rehabilitated to previous use**	**Long-term use**	**Public access**
MAT and portal building	The exploratory tunnel approved under Snowy 2.0 Exploratory Works will become the MAT to the underground power station from the surface. It will provide access for staff and equipment during operations and for maintenance of the power station. The portal building and attached facilities accommodate several operational services such as fire protection systems, potable water supply storage and staff facilities.	Already constructed as part of Exploratory Works and will be used during construction of Snowy 2.0 Main Works. The portal building works will be constructed during Snowy 2.0 Main Works and include water treatment facilities.	Permanent infrastructure	Portal will provide access to the power station complex for maintenance and operations. The portal, building and facilities will be retained permanently. Access road will be restricted from Wallaces Creek to MAT portal.	SHL access only
Emergency egress, cable and ventilation tunnel and portal	To provide the route for the high voltage cables to exit from the transformer hall to the above ground cable yard. It also provides a means for emergency evacuation.	This will be excavated by a TBM launching from the ECVT portal. Drill and blast will be carried out for the last section connecting the tunnel to the transformer hall	Permanent infrastructure	The ECVT is parallel to the MAT with its portal adjacent to the MAT portal.	SHL access only
Lobs Hole substation	The primary supply to be used during construction. It will be retained during operations to provide power supply to the power station complex, intake structures and control buildings.	Already constructed as part of Exploratory Works and will be used for construction and operation of Snowy 2.0 Main Works.	Permanent infrastructure	The substation will be fenced and inaccessible to the public.	SHL access only
Cable yard	Connects the power station to the transmission network (NEM).	The construction pad will be levelled, civil and mechanical works to erect and fit-out the gas insulated switchgear (GIS) building and cable yard infrastructure.	Permanent infrastructure	The cable yard will be fenced and inaccessible to the public.	SHL access only

Table2.2 Lobs Hole – project elements, purpose and description

		Temporary use during construction		Permanent/long-term use during operation	
Element	**Purpose**	**Method summary**	**Rehabilitated to previous use**	**Long-term use**	**Public access**
Utilities	To provide for the efficient working of construction areas through provision of water and electricity. Discharge of process and waste waters will also be needed.	Wherever possible, electricity and water pipelines will be placed along roads (or adjacent to) and reticulate to the relevant locations within the construction area. Construction methods will comprise a combination of overhead, trenching and underboring, depending on the identified constraints (such as geology and watercourse crossings) or where there are opportunities to minimise disturbance of new areas.	✓	Utilities required for operation will be retained and maintained. Utilities to facilitate construction areas only will be decommissioned and areas rehabilitated. Rehabilitated land returned to NPWS.	✓
Access roads	Roads will provide access to the reservoir emplacement area and ancillary facilities, accommodation camps and MAT and ECVT portals.	Roads will be a combination of upgraded existing access roads and new access roads.	✓	Roads established during construction that are not required for operation will be rehabilitated. Existing access roads upgraded to facilitate these activities will be retained permanently. Lobs Hole Ravine Road and Lobs Hole Road will be publicly accessible, however access on Mines Trail Road east past Wallaces Creek will be restricted to Snowy Hydro and NPWS access only.	✓





KEY

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

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

Snowy 2.0 Main Works construction elements
- Temporary construction compounds and surface works
- Temporary access road
- Geotechnical investigation
- Indicative rock emplacement area
- Disturbance area*

Note: the disturbance area is the extent of construction works required to build Snowy 2.0. It has been identified to allow an assessment of impacts for the EIS, and represents a defined maximum extent where construction works will be carried out. The area will be minimised as much as possible during detailed design.

Lobs Hole - project elements

Snowy 2.0
Environmental Impact Statement
Main Works
Figure 2.7

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

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Table 2.3 Marica – project elements, purpose and description

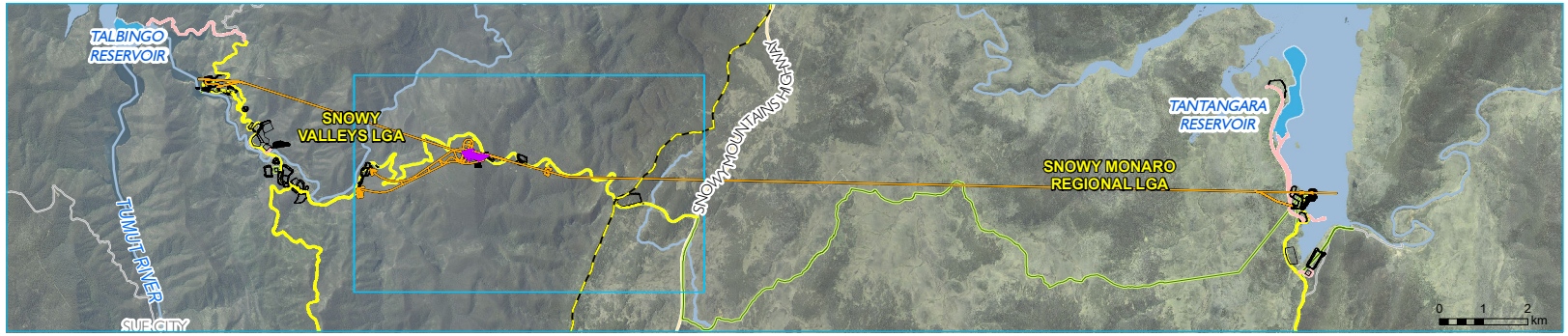
		Temporary use during construction		Permanent/long-term use during operation	
Element	**Purpose**	**Method summary**	**Rehabilitated to previous use**	**Long-term use**	**Public access**
Headrace surge shaft	The shaft ensures safe hydraulic operation of the power station by reducing transient pressures in particular during load change conditions. The upstream surge shaft will absorb sudden rises of pressure on top of the headrace tunnel extension. The shaft is approximately 227 m deep, divided into surge shaft and lower surge riser, and extends to about 15 m above surface level.	A shaft structure constructed from the surface and breaking through to the headrace tunnel, most likely using a blind sink method. A 15 m structure will be visible at the surface. Excavated material will be transported from the shaft to surface at Marica and then to Tantangara for management.	Permanent infrastructure	The shaft structure at the surface will be fenced and inaccessible to the public.	SHL access only
Surge shaft yard	To provide an area to excavate the surge shaft, including storage of equipment, explosives and stockpiles for excavated rock. The area will also allow for site office, first aid and worker facilities.	Construction will involve clearing and levelling of the site, a crane bridge to support blind sinking excavation downward excavation to the headrace tunnel, rock support, concrete works and steel works.	✓	Most of the construction compound area will be rehabilitated, with only the shaft structure remaining at surface. Rehabilitated land returned to NPWS	✓
Pressure tunnels	To transfer water from the headrace tunnel to the power station complex. This includes a single inclined pressure tunnel, branching into three high pressure tunnels and then into six penstock tunnels.	The high pressure tunnels will be constructed using drill and blast. The single-inclined pressure shaft will be excavated by utilising the TBM that excavates the MAT, by continuing past (east) the powerhouse complex and up to the upstream end of the high pressure tunnel manifolds. Excavated material will be transported from the tunnel to Lobs Hole for management.	**N/A** (underground)	The underground tunnels will be inaccessible to the public.	SHL access only

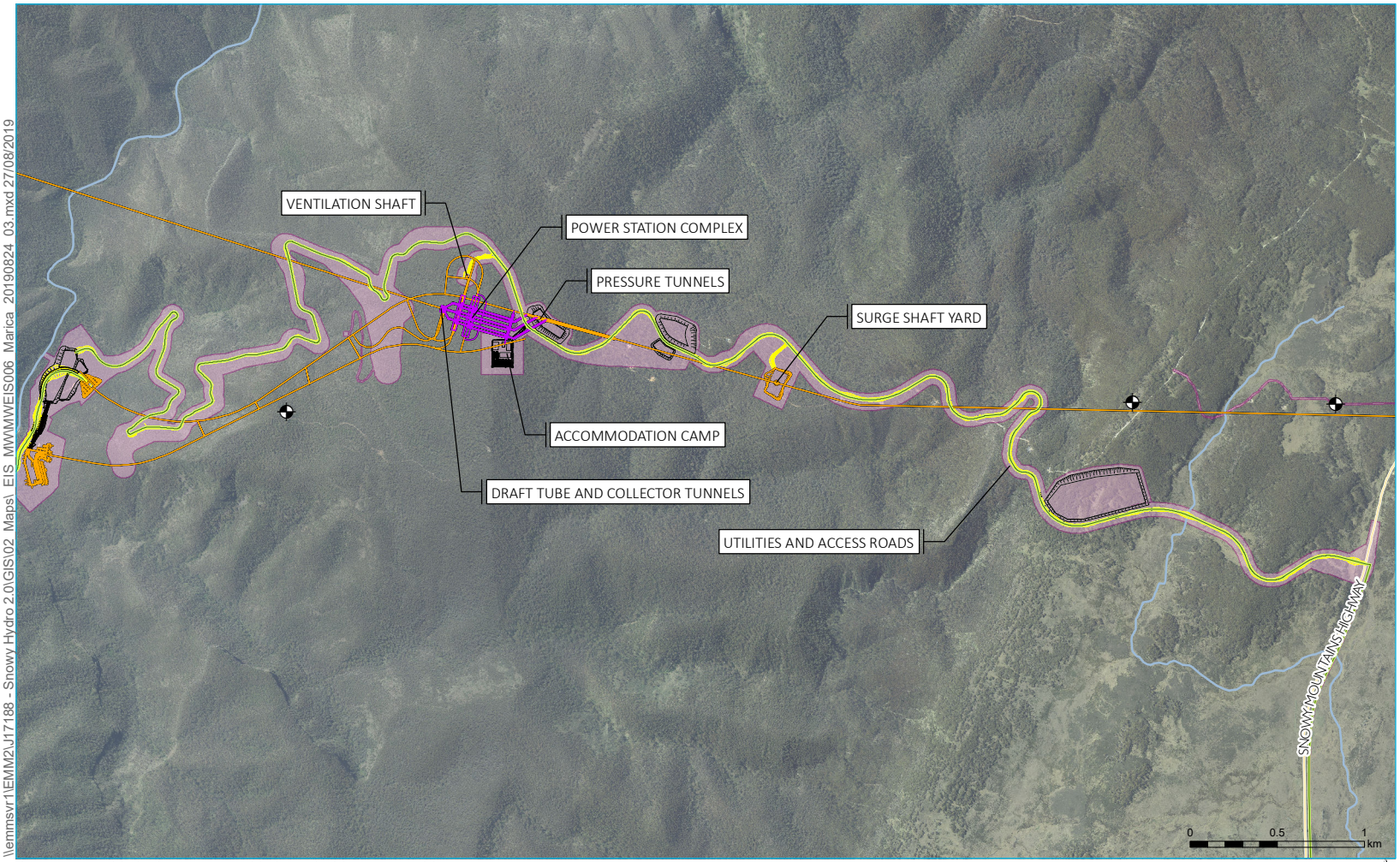
Table 2.3 Marica – project elements, purpose and description

		Temporary use during construction		Permanent/long-term use during operation	
Element	**Purpose**	**Method summary**	**Rehabilitated to previous use**	**Long-term use**	**Public access**
Power station complex (including machine hall and transformer hall)	The power station will generate electricity from water transfer and pump water in reverse between Tantangara and Talbingo reservoirs. The machine hall will house the six pump-turbine and motor-generator units. The transformer hall will house the six, three-phase transformers and six draft tube gates.	The complex location will be accessed initially by TBM from the exploratory tunnel. From there, the primary construction method will be drill and blast. The complex will be oriented using the results of the geotechnical drilling carried out following completion of the exploratory tunnel. Excavated material will be transported from the complex to Lobs Hole for management.	**N/A** (underground)	Underground and accessed from the MAT via the Lobs Hole portal. The power station complex will be inaccessible to the public.	SHL access only
Draft tube and collector tunnels	Underground tunnels to transfer water from the power station draft tube gates to the tailrace surge tank. This includes six draft tube tunnels, converging into three collector tunnels.	These draft tube and collectors tunnels will be constructed via drill and blast method.	**N/A** (underground)	The underground tunnels will be inaccessible to the public.	SHL access only
Ventilation shaft	To provide ventilation to the underground power station during excavation of the caverns, and during operation if required.	The shaft will likely be constructed by raise bore or blind sink method. It will be accessed by the Marica Trail off the Snowy Mountains Highway.	Permanent infrastructure	The shaft will have a permanent building at the surface about 6 m in height. It will be fenced and inaccessible to the public.	SHL access only
Marica accommodation camp	Provides accommodation for up to 100 workers at any one time during construction.	Constructed during standard techniques. Rehabilitation will include landforming using excavated rock material.	✓	Rehabilitated land returned to NPWS.	✓

Table 2.3 Marica – project elements, purpose and description

		Temporary use during construction		Permanent/long-term use during operation	
Element	**Purpose**	**Method summary**	**Rehabilitated to previous use**	**Long-term use**	**Public access**
Utilities	To provide for the efficient working of construction areas through provision of water and electricity. Discharge of process and waste waters will also be needed.	Wherever possible, electricity and water pipelines will be placed in roads (or adjacent to) and reticulate to the relevant locations within the construction area. Construction methods will comprise a combination of overhead, trenching and underboring, depending on the constraints identified (such as geology and watercourse crossings) or where there are opportunities to minimise disturbance of new areas. Options to source water locally (eg via groundwater supply wells) or transported to site (eg water carts) will be investigated during detailed design.	✓	Utilities to facilitate construction areas will be decommissioned and areas rehabilitated. Rehabilitated land returned to NPWS.	✓
Access roads	To provide for safe access for materials, equipment and workforce during the construction period.	A new intersection with Snowy Mountains Highway will be built, enabling access directly to the existing Marica Trail. From the intersection to the surge tank, the road will be gravel and two lanes. A new track (single lane) will be created extending Marica Trail down to the MAT portal to provide an alternate access to Lobs Hole. Roads and tracks will be built using standard construction techniques.	Permanent infrastructure	From its intersection with the Snowy Mountains Highway, Marica Trail will be retained permanently for use during operation by Snowy Hydro and NPWS.	SHL access only





KEY

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

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

Snowy 2.0 Main Works construction elements
- Temporary construction compounds and surface works
- Temporary access road
- Geotechnical investigation
- Indicative rock emplacement area
- Disturbance area*

Note: the disturbance area is the extent of construction works required to build Snowy 2.0. It has been identified to allow an assessment of impacts for the EIS, and represents a defined maximum extent where construction works will be carried out. The area will be minimised as much as possible during detailed design.

Marica - project elements

Snowy 2.0
Environmental Impact Statement
Main Works
Figure 2.8

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

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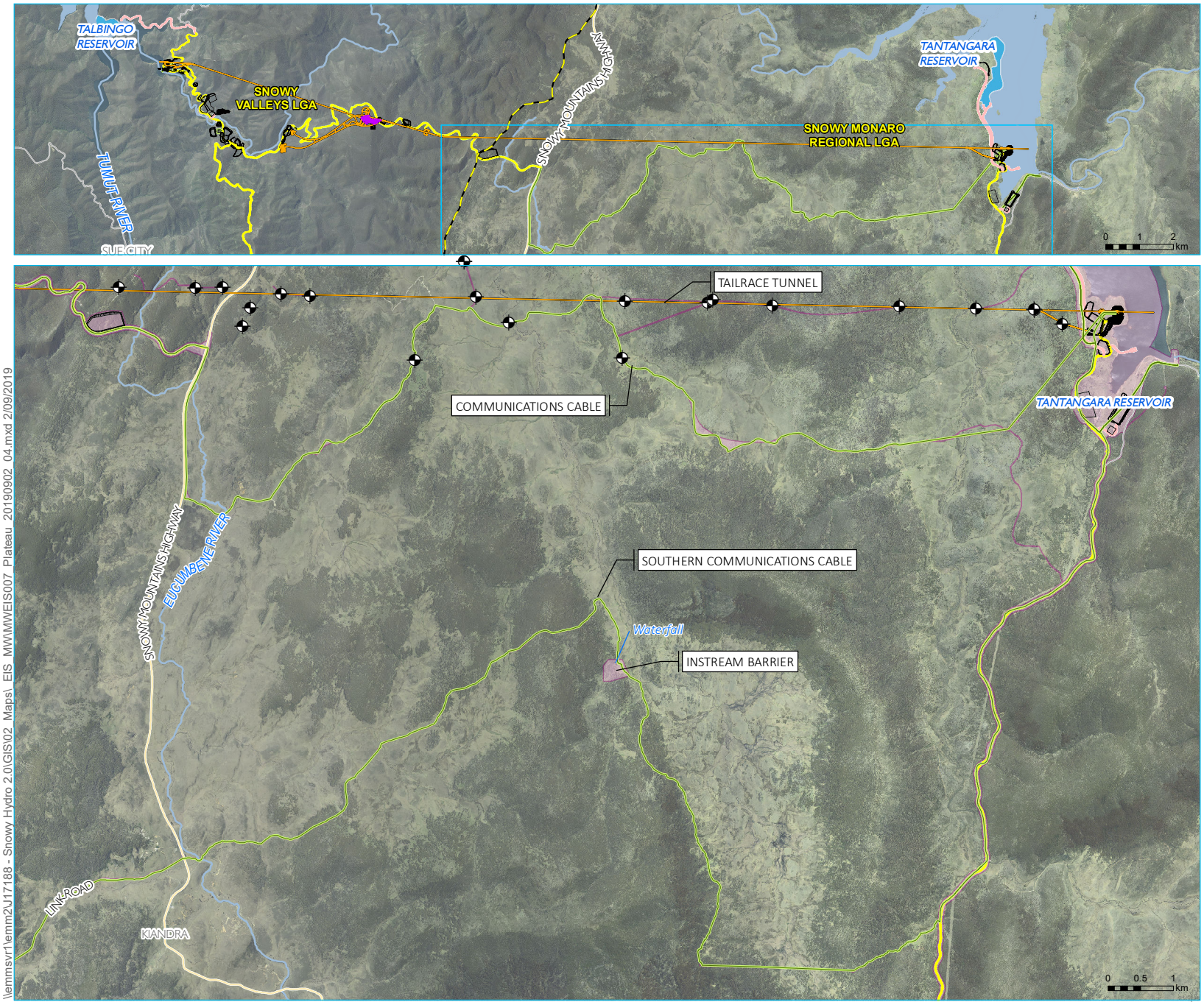
Table 2.4 Plateau- project elements, purpose and description

		Temporary use during construction		Permanent/long-term use during operation	
Element	**Purpose**	**Method summary**	**Rehabilitated to previous use**	**Long-term use**	**Public access**
Headrace tunnel	During generation mode: to transfer water from Tantangara Reservoir to the underground power station. During pumping mode: to transfer water from the underground power station to Tantangara Reservoir.	Constructed via a TBM launched from Tantangara adit heading westwards to the surge shaft at Marica. Excavated material will be transported from the tunnel to Tantangara for management.	**N/A** (underground)	During generation mode: to transfer water from the Tantangara intake to the underground power station. During pumping mode: to transfer water from the underground power station to Tantangara Reservoir. Underground and restricted access for Snowy Hydro via the surge tank and Tantangara intake structure for maintenance. The tunnel will inaccessible to the public.	SHL access only
Communications cable	To provide secure and redundant communications between Talbingo intake, power station and Tantangara intake and the main control centre in Cooma.	Two communications cables will be installed. One will be within sections of the Snowy Mountains Highway and Gooandra track corridors between the power station and Tantangara Reservoir. A more southern route will also be built. This route is mainly within the Snowy Mountains Highway and Tantangara Road corridors. These cables will be laid in a trench with some sections also underbored or bridged where suitable. Temporary passing bays enabling vehicles to safely manoeuvrer and pass will be established where required.	✓	It will provide a communication system that connects the Snowy 2.0 assets for operations. The cable will be buried and the existing KNP tracks and public roads will be accessible the public.	✓
Instream barrier	To prevent the potential upstream migration of Climbing galaxias	A structure will be built on Tantangara Creek. The construction method will be determined as part of the detailed design process.	Permanent structure	Rehabilitated land returned to NPWS.	✓



KEY

Existing environment

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

Snowy 2.0 Main Works operational elements

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

Snowy 2.0 Main Works construction elements

- Temporary construction compounds and surface works
- Temporary access road
- Geotechnical investigation
- Indicative rock emplacement area
- Disturbance area*

Note: the disturbance area is the extent of construction works required to build Snowy 2.0. It has been identified to allow an assessment of impacts for the EIS, and represents a defined maximum extent where construction works will be carried out. The area will be minimised as much as possible during detailed design.

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

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Plateau - project elements

Snowy 2.0
Environmental Impact Statement
Main Works
Figure 2.9

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Table 2.5 Tantangara Reservoir – project elements, purpose and description

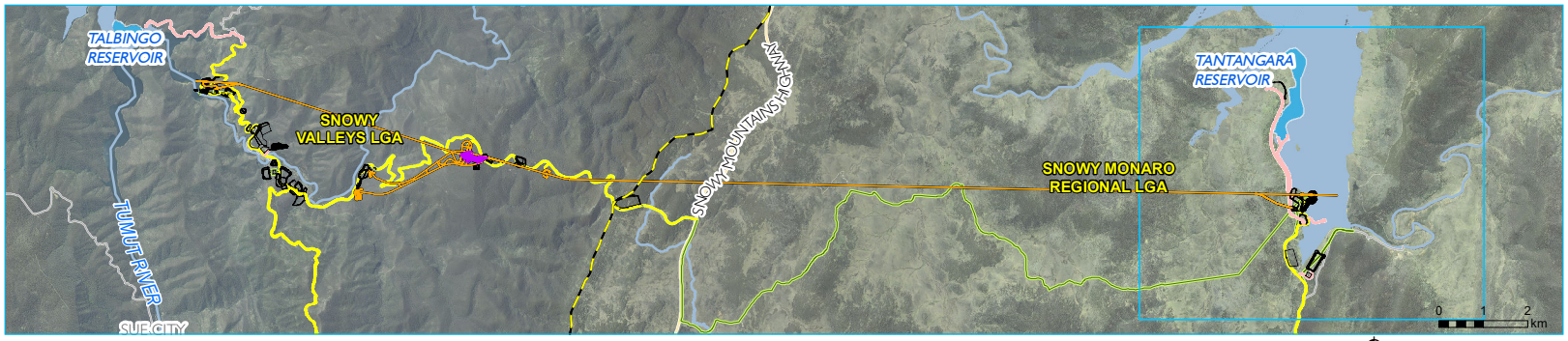
		Temporary use during construction		Permanent/long-term use during operation	
Element	**Purpose**	**Method summary**	**Rehabilitated to previous use**	**Long-term use**	**Public access**
Portal and construction compound	Portal and tunnelling associated construction area or TBM support and for removal of excavated material from the tailrace tunnel.	The portal will be excavated using drill and blast techniques. Excavated material will be transported to Tantangara for management. The compound will be created using earthworks to create stable and flat areas for use.	✓	Construction compound area will be rehabilitated with small hard-standing areas remaining at the portal to enable Snowy Hydro access for maintenance and long-term operations.	SHL access only
Tantangara adit	To provide access for a TBM into the headrace tunnel.	One TBM will be launched from the Tantangara construction adit.	✓	The adit will be appropriately capped and closed off preventing access.	SHL access only
Tantangara laydown area	An area for laydown and maintenance of construction plant, equipment and materials storage.	Earthworks will be carried out to create stable and flat areas for use. Appropriate drainage and erosion and sediment controls will be installed.	✓	Rehabilitated land returned to NPWS.	✓
Reservoir emplacement areas	Excavated rock will be emplaced at this location as a cost-effective solution with minimal long-term environmental impacts.	Disposal of excavated material with mobile plant and equipment between FSL and MOL. The final height of the emplacement area will be above FSL level to allow for rehabilitation for use as a recreational area.	✓	Material will be permanently placed within the reservoir. This area will be accessible to the public, however may be inundated more often than existing Snowy Scheme operations. Appropriate signage/navigation hazard warnings will be in place identifying the subaqueous landform.	✓
Access roads and ancillary facilities for emplacement activities	Roads will provide access to the reservoir emplacement area and ancillary facilities.	Roads will be a combination of upgraded existing access roads and new access roads. New access road to the Tantangara intake structure will be permanent. Other access roads will be temporary and rehabilitated. Improvements to the intersection at Tantangara Road and Snowy Mountains Highway will be built to facilitate access for construction traffic. A bridge over Nungar Creek on Tantangara Road will be built.	✓	Existing access roads upgraded to facilitate these activities will be retained permanently. New access road to the Tantangara intake structure will be restricted to SHL access only. Rehabilitated land returned to NPWS.	✓

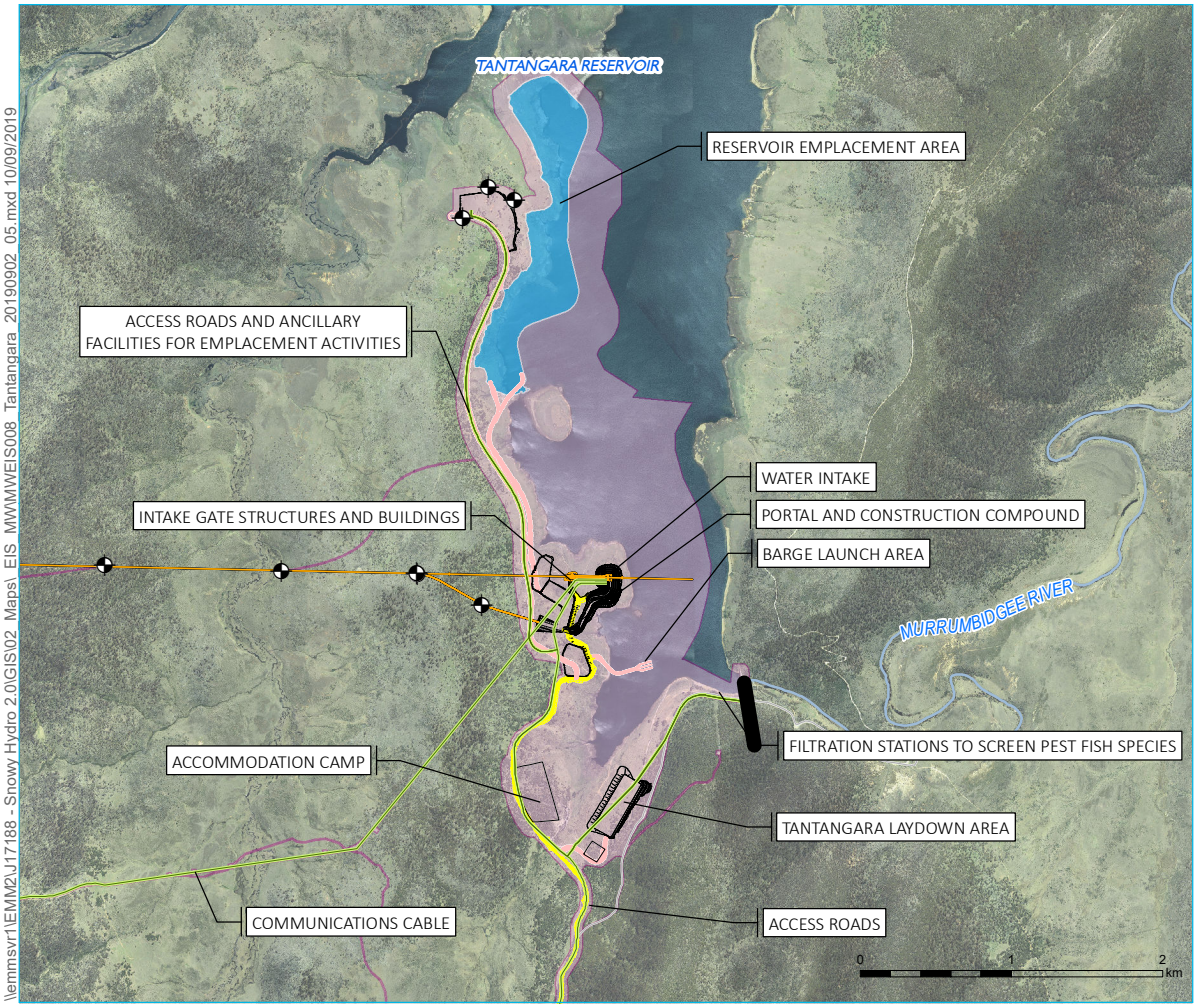
Table 2.5 Tantangara Reservoir – project elements, purpose and description

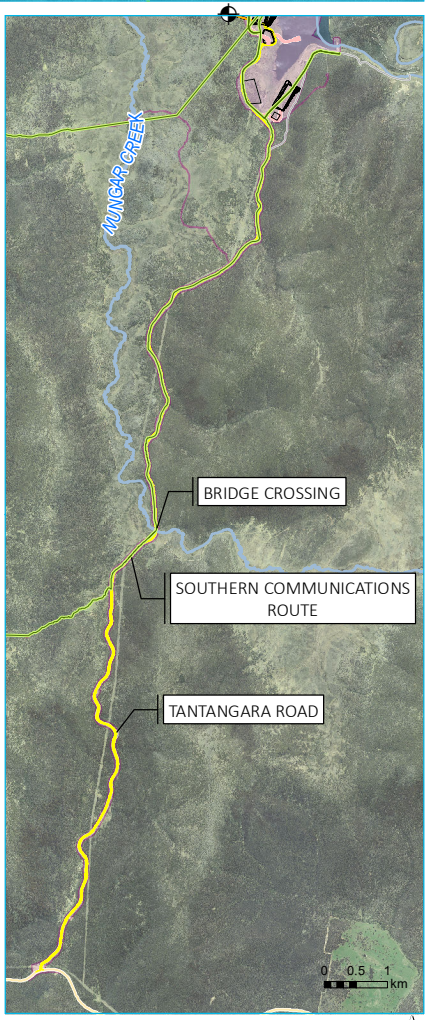
		Temporary use during construction		Permanent/long-term use during operation	
Element	**Purpose**	**Method summary**	**Rehabilitated to previous use**	**Long-term use**	**Public access**
Intake structure	To draw water from the reservoir into the tunnels, and to release water from the tunnels to the reservoir – in both generation and pumping modes.	Primary construction method will be drill and blast from shore-based plant and equipment.	Permanent infrastructure	Intake structure retained within the reservoir. A floating boom across the end of the approach channel will be placed to restrict public access for safety reasons.	SHL access only
Intake gate structures (underground) and buildings (at surface)	To isolate the tunnels from the reservoir for maintenance and if required during operation.	Primary construction method will be drill and blast from shore-based plant and equipment. The connection between the intake and reservoir (rock plug) will be removed via water-based equipment, launched from the barge launch area.	Permanent infrastructure	Gate structures within the intake, approximately 250 m west of the trashracks and diffuser structure. Access will be restricted to use by Snowy Hydro.	SHL access only
Barge launch area	Boat and barge launching facilities to allow for water access to intakes during construction and for removal of the rock plug, and for assembling and launching of barges.	The launch area will be available for the duration of construction.	Permanent infrastructure	Rehabilitated land returned to NPWS. The launch area will be retained in some form for use during operation for maintenance access. Opportunity for use by NPWS and the public at other times subject to agreement with NPWS.	✓
Tantangara accommodation camp	Provides accommodation for around 500 people to facilitate construction of the headrace tunnel, intake and excavated rock emplacement.	Earthworks will be carried out to create stable and flat areas for use. Appropriate drainage and erosion and sediment controls will be installed.	✓	Rehabilitated land returned to NPWS.	✓
Utilities	To provide for the efficient working of construction areas through provision of water and electricity. Discharge of process and waste waters will also be needed.	Wherever possible, electricity and water pipelines will be placed in roads (or adjacent to) and reticulate to the relevant locations within the construction area. Construction methods will comprise a combination of overhead, trenching and underboring, depending on the identified constraints (such as geology and watercourse crossings) or where there are opportunities to minimise disturbance of new areas.	✓	Utilities to facilitate construction areas will be decommissioned and areas rehabilitated. Rehabilitated land returned to NPWS.	✓

Table 2.5 Tantangara Reservoir – project elements, purpose and description

		Temporary use during construction		Permanent/long-term use during operation	
Element	**Purpose**	**Method summary**	**Rehabilitated to previous use**	**Long-term use**	**Public access**
Fish control structures	To limit the potential range expansion of any fish species of concern that may be potentially transferred to Tantangara Reservoir as a result of the project.	A filtration station/s to screen pest fish species from being discharged through the Murrumbidgee-Eucumbene Tunnel will be installed upstream of Tantangara Reservoir wall.	Permanent infrastructure	Permanent infrastructure to be maintained by Snowy Hydro.	SHL access only







KEY

Existing environment

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

Snowy 2.0 Main Works operational elements

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

Snowy 2.0 Main Works construction elements

- Temporary construction compounds and surface works
- Temporary access road
- Geotechnical investigation
- Indicative rock emplacement area
- Disturbance area*

Note: the disturbance area is the extent of construction works required to build Snowy 2.0. It has been identified to allow an assessment of impacts for the EIS, and represents a defined maximum extent where construction works will be carried out. The area will be minimised as much as possible during detailed design.

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

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Tantangara Reservoir - project elements

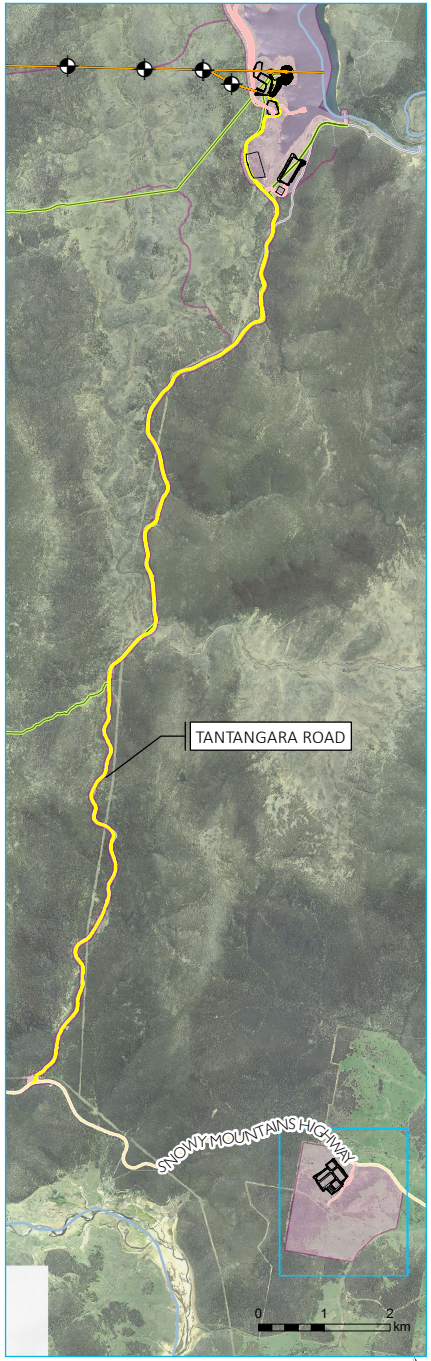
Snowy 2.0
Environmental Impact Statement
Main Works
Figure 2.10

snowy 2.0

EMM creating opportunities

Table 2.6 Rock Forest – project elements, purpose and description

		Temporary use during construction		Permanent/long-term use during operation	
Element	**Purpose**	**Method summary**	**Rehabilitated to previous use**	**Long-term use**	**Public access**
Logistics yard	Laydown, stockpile and staging area for materials and heavy vehicles. This is a private landholding under lease to Snowy Hydro.	Earthworks will be carried out to create stable and flat areas for use. Appropriate drainage and erosion and sediment controls will be installed.	✓	Rehabilitated landform returned to landowner.	N/A
Access	Provide safe access to and from the logistics yard via the Snowy Mountains Highway.	A new intersection from the Snowy Mountains Highway will be built.	✓	The access will be able to be used by the landowner.	N/A



KEY

Existing environment
- Main road
- Local road
- Watercourse

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

Snowy 2.0 Main Works construction elements
- Temporary construction compounds and surface works
- Temporary access road
- Geotechnical investigation
- Disturbance area*

Note: the disturbance area is the extent of construction works required to build Snowy 2.0. It has been identified to allow an assessment of impacts for the EIS, and represents a defined maximum extent where construction works will be carried out. The area will be minimised as much as possible during detailed design.

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

GDA 1994 MGA Zone 55

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Rock Forest - project elements

Snowy 2.0
Environmental Impact Statement
Main Works
Figure 2.11

snowy 2.0

EMM creating opportunities

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2.2.4 Summary of project elements

A summary of the key elements that form Snowy 2.0 Main Works is provided in Table 2.7.

Table 2.7 Snowy 2.0 Main Works summary

Project element	Summary of the project
Project area	The project area is the broader region within which Snowy 2.0 will be built and operated, and the extent within which direct impacts from Snowy 2.0 Main Works are anticipated.
Permanent infrastructure	Snowy 2.0 infrastructure to be built and operated for the life of the assets include the: • intake and gate structures and surface buildings at Tantangara and Talbingo reservoirs; • power waterway tunnels primarily comprising the headrace tunnel, headrace surge structure, inclined pressure tunnel, pressure pipelines, tailrace surge tank and tailrace tunnel; • underground power station complex comprising the machine hall, transformer hall, ventilation shaft and minor connecting tunnels; • access tunnels (and tunnel portals) to the underground power station comprising the MAT and ECVT; • fish control structures in proximity to Tantangara Reservoir wall; • establishment of a portal building and helipad at the MAT portal; • communication, water and power supply including the continued use of the Lobs Hole substation; • cable yard adjacent to the ECVT portal to facilitate the connection of Snowy 2.0 to the NEM; and • access roads, permanent bridge structures and barge launch ramps needed for the operation and maintenance of Snowy 2.0 infrastructure.
Temporary infrastructure	Temporary infrastructure required during the construction phase of Snowy 2.0 Main Works are: • construction compounds, laydown, ancillary facilities and helipads; • accommodation camps for construction workforce; • construction portals and adits to facilitate tunnelling activities; • barge launch ramps; • water and wastewater management infrastructure (treatment plants and pipelines); • communication and power supply; and • temporary access roads.
Disturbance area	The disturbance area is the extent of construction works required to build Snowy 2.0. The maximum disturbance area is about 1,680 ha which is approximately 0.25% of the KNP. Most of the disturbance area will be rehabilitated and landformed and other parts will be retained permanently for operation (operational footprint).
Operational footprint	The operational footprint is the area required for permanent infrastructure to operate Snowy 2.0. The maximum operational footprint is about 99 ha which is approximately 0.01% of the KNP.
Tunnelling and excavation method	The primary tunnelling method for the power waterway is by TBM, with portals and adits using drill and blast methods. Excavation for other underground caverns, chambers and shafts will be via combinations of drill and blast, blind sink, or raise bore techniques.
Excavated rock management	Excavated rock will be generated as a result of tunnelling activities and earthworks. The material produced through these activities will be stockpiled and either reused by the contractor (or NPWS), placed permanently within Tantangara or Talbingo reservoirs, used in final land forming and rehabilitation of construction pads in Lobs Hole, or transported offsite.

Table 2.8 Snowy 2.0 Main Works summary

Project element	Summary of the project
Construction water and wastewater management	Water supply for construction will be from the two existing reservoirs (Talbingo and Tantangara) and reticulated via buried pipelines (along access roads). Raw water will be treated as necessary wherever potable water is required (eg at accommodation camps). Water to be discharged (comprising process water, wastewater and stormwater) will be treated before discharge to the two existing reservoirs (Talbingo and Tantangara) as follows: treated process water will be reused onsite where possible to reduce the amount of discharge to reservoirs, however excess treated water will be discharged to the reservoirs; collected sewage will be treated at sewage treatment plants to meet the specified discharge limits before discharge and/or disposal; and stormwater will be captured and reused as much as possible.
Rehabilitation	Rehabilitation of areas disturbed during construction including reshaping to natural appearing landforms or returning to pre-disturbance condition, as agreed with NPWS and determined by the Rehabilitation Strategy (see Appendix F). This includes construction areas at Lobs Hole which comprise surplus cut materials. Areas to be used by Snowy Hydro in the long-term may be re-shaped and rehabilitated to maintain access and operational capabilities (eg intakes and portal entrances)
Construction workforce	The construction workforce for the project is expected to peak at around 2,000 personnel.
Operational life	The operational life of the project is estimated to be 100 years.
Operational workforce	The operational workforce is expected to be 8-16 staff, with fluctuations of additional workforce required during major maintenance activities.
Hours of operation	Construction of Snowy 2.0 will be 24/7 and 365 days per year. Operation of Snowy 2.0 will be 24/7 and 365 days per year.
Capital investment value	Estimated to be $4.6 billion.

2.3 Construction of Snowy 2.0 Main Works

2.3.1 Construction phases and activities

The construction of Snowy 2.0 Main Works has different and overlapping phases during the approximate six year period. This is shown in Figure 2.12, with each of the different phases described in the following sections.

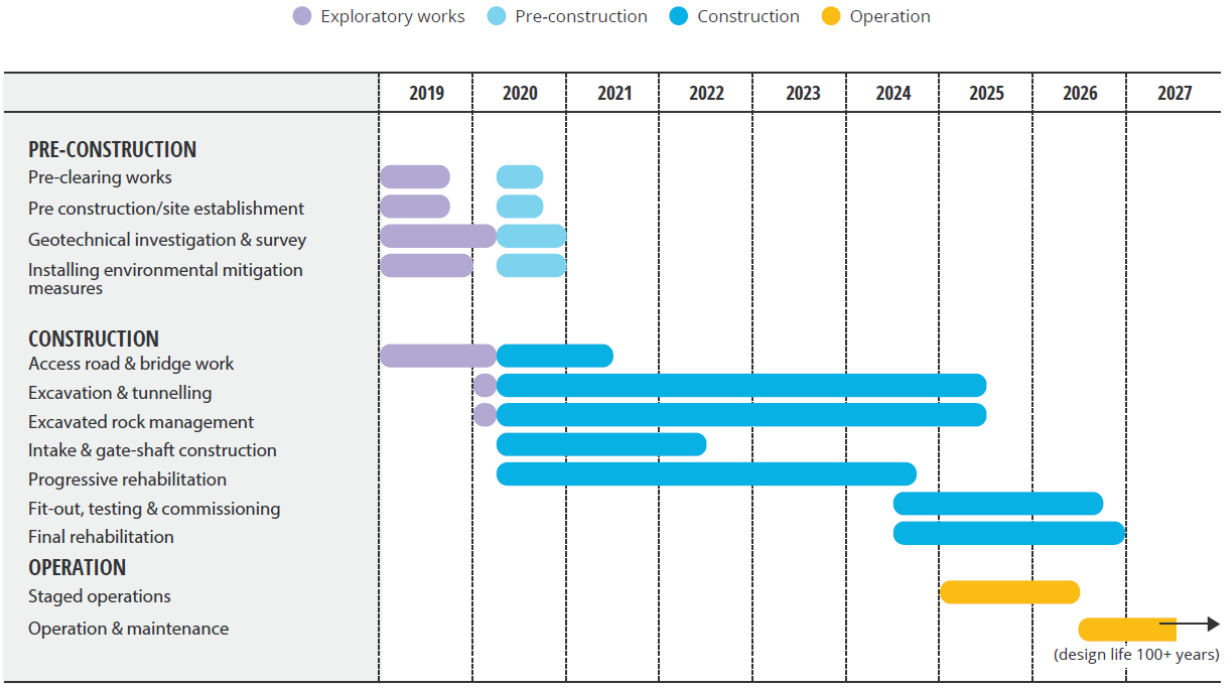

Figure 2.12 Indicative construction sequencing

i Pre-construction works

Pre-construction works will follow well-established practices with the following indicative steps carried out:

- prior to the commencement of work, all sites will be surveyed and clearly marked;
- site fencing will be erected to provide security and safety;
- erection of a temporary site compound at each site to support pre-construction activities;
- erosion and sediment control measures will be installed on site. This includes mitigation around stockpile areas. Topsoil and general fill material will be stockpiled in clearly separated areas;
- trees and shrubs will be cleared only within the demarcated disturbance boundary (clearing works includes removing tree stumps and roots up to 600 millimetres (mm) below ground);
- hazardous tree assessment of trees that are outside the disturbance boundary but within close proximity, and removal of any trees deemed to be hazardous or at-risk to ensure the safety of workers; and
- expansion of the initial site compound to provide facilities for the main construction activities.

Table 2.9 provides a summary of the activities to be carried out during the pre-construction phase of the works.

Table 2.9 Overview of pre-construction activities and methods

Component/stage	Construction area	Typical activities
Site establishment	• All	• Site boundary delineation and establishment of survey control network • Clearing and grubbing • Hazardous tree assessment within and adjacent to disturbance boundary and removal/trimming of hazardous trees as per assessment recommendations • Drainage and environmental controls • Earthworks and levelling • Establish construction ancillary facilities and access • Construct water and wastewater treatment facilities • Continued use of construction power substation
Construction – geotechnical investigation and survey	• All	• Clearing and levelling of drill pads including temporary access tracks and support infrastructure such as water supply and waste management systems • Drilling and in situ testing and characterisation
Archaeological and heritage salvage and test excavations	• All	• Carry out archaeological and heritage surveys of project area as required • Record sites as required • Salvage items as required and carry out reporting as documented in Aboriginal Cultural Heritage Assessment (ACHA) and Historic Heritage Assessment
Pre-clearance surveys	• All	• Carry out ecological surveys in accordance with requirements of the Biodiversity Development Assessment Report (BDAR) and relevant species
Building and road dilapidation studies	• Lobs Hole • Tantangara • Relevant public roads	• Identify buildings and/or roads to be subject to dilapidation studies • Carry out dilapidation surveys and report • Execute relevant recommendations of dilapidation studies
Environmental management, monitoring and mitigation	• All	• Establish committed environmental management, monitoring and management measures
Groundwater monitoring bores	• All	• Clearing and levelling of drill pads including temporary access tracks and support infrastructure such as water supply and waste management systems • Drilling and bore establishment • Rehabilitation of drill pad with access maintained

Management plans will be prepared as required by the conditions of approval and submitted to the relevant authority.

ii Construction and progressive rehabilitation

A detailed schedule will be prepared for the construction of Snowy 2.0 Main Works. It is anticipated the schedule will further detail the sequencing of construction and is expected to include the following discrete but overlapping activities:

Construction works: Once relevant designs are completed and approved, construction works will commence. The timing of the construction works is shown in Figure 2.12.

- Construction activities will occur concurrently at several sites across the project area.

- Progressive revegetation and rehabilitation, management and monitoring: Rehabilitation will be carried out progressively during the construction works where practicable. All non-permanent infrastructure will be decommissioned, and the disturbance area rehabilitated in accordance with a rehabilitation plan.

Table 2.10 Overview of construction activities and sequencing

Component/stage	Construction area	Typical activities
Construction - access road and bridge work	• All	• Site preparation of all roads (new or upgraded), including: – Clearing boundary is surveyed and pegged out – Removal/trimming of any hazardous trees following pre-construction survey if required as per assessment recommendations – Any pre-clearing activities are completed, such as facilitating the egress of fauna – Erosion and sediment control measures will be installed prior to works commencing, or as early as practicable • Construct retaining walls where needed • Excavate road level • Lay road base, pavement and drainage • Construct bridges and culverts • Install road furniture such as signs and safety barriers
Construction - excavation and tunnelling	• Talbingo Reservoir • Lobs Hole • Marica • Tantangara Reservoir	• Construct portals and adits • Mobilisation and site setup of TBMs (where required) • Excavate power waterways, power station cavern, and associated tunnel infrastructure • Install ground support where required • Receipt and use of precast segments for tunnels where required • Excavated rock management and haulage
Construction - excavated rock management	• Talbingo Reservoir • Lobs Hole • Marica • Tantangara Reservoir	• Transport of excavated rock from tunnels, adits, portals and surge shaft to stockpile areas • Testing of excavated rock for suitability of placement (where required) • Transport to and filling of placement areas within the reservoirs and on-land placement for construction pads and/or permanent landforming
Construction - intake and gate shaft construction	• Talbingo Reservoir • Tantangara Reservoir	• Clearing and grubbing • Cut excavation and benching to required depth, retaining a temporary rock plug to allow dry works zone • Install permanent rock anchors where required • Concrete works • Removal of rock plug
Construction – progressive rehabilitation	• All	• Collection and storage of indigenous/native seed and alpine sods • Progressive rehabilitation comprising: – Stabilisation of slopes and preparation of sites for revegetation – Mitigation of sediment runoff – Hydroseeding/hydro mulching/planting of slopes – Decommissioning of infrastructure by removal of all temporary facilities – Reinstatement of topsoil and seeding and planting of vegetation – Protection of revegetation and weed management

iii Testing and commissioning

Commissioning activities will be carried out over approximately a two-year period and will involve:

- operation and testing of all plant in both generating and pumping modes, at all required power output and input ranges for operations;
- the associated transfer of water between Tantangara and Talbingo reservoirs at various reservoir levels; and
- the testing of operating and protection systems for the plant and equipment.

Table 2.11 Overview of testing and commissioning activities and methods

Component/stage	Construction area	Typical activities
Commissioning - fit-out, testing and commissioning	• Talbingo Reservoir • Lobs Hole • Marica • Tantangara Reservoir	• For all permanent structures: – Concrete works – Install electrical and mechanical – Test and commission plant equipment

iv Final rehabilitation

Most disturbed areas, not retained for operations, will be returned to land uses generally consistent with their pre-disturbance use, subject to ongoing consultation with NPWS. Snowy Hydro will liaise closely with NPWS to determine the extent of decommissioning of temporary construction facilities and rehabilitation activities to be carried out during and following the construction of Snowy 2.0 of 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 and be consistent with the KNP Plan of Management (PoM) (NPWS 2006). An overview of final rehabilitation activities and methods is provided in Table 2.12. Further engagement with NPWS will be carried out to understand the opportunities to allow for recreational uses where appropriate and practical to do so within the rehabilitation activities implemented post-construction. This is discussed further in Section 2.3.8.

Table 2.12 Overview of final rehabilitation activities and methods

Component/stage	Construction area	Typical activities
Completion of rehabilitation	• All	• Detailed completion criteria, performance measures and associated indicators will be used to demonstrate success of rehabilitation. These include: – Phase 1: Active – Phase 2: Decommissioning – Phase 3 – Landform establishment – Phase 4 – Growth medium development – Phase 5 – Ecosystem and Land use establishment – Phase 6 – Ecosystem and Land use development – Phase 7 – Rehabilitation complete
Rehabilitation monitoring	• All	• Ongoing monitoring will be carried out as required using analogue/references sites for a comparison of the development and success of rehabilitation

2.3.2 Permanent infrastructure

i Intake structures and gate shafts

Intake structures 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 optimised to reduce impacts on the environmental setting of the structures within KNP where possible. Each intake will comprise:

- a permanently submerged approach channel; and
- an integrated gate tower and diffuser structure.

The construction of intake structures will be divided into two stages. Firstly, the intake structures will be constructed on-land by excavating the intake pit, creating a natural rock plug to prevent reservoir water flowing into the tunnel and flooding the underground works. The rock plug will be removed in the second stage once the permanent approach channel has been excavated and all underground and tunnelling works are completed. Detailed description of the construction process for each intake is provided in Appendix D, with a snapshot provided in Figure 2.13 and Figure 2.14.

ii Power waterway tunnels, chambers and shafts

The main power waterway comprises the headrace tunnel and the tailrace tunnel. However, there are several other underground tunnels, chambers and shafts that enable the transfer of water between the two reservoirs and through the underground power station. Most of the power waterway infrastructure will be established underground, with access to the surface provided via several access tunnels and portals.

For the headrace and tailrace tunnels in particular, two single shielded TBMs will be utilised (refer to Figure 2.4). A dual mode TBM will be used to excavate the headrace tunnel, capable of operating as a single shield TBM or operating in slurry mode to manage naturally occurring asbestos (NOA) material expected along the way. The choice of the shielded TBM has been driven by safety considerations during construction and a higher rate of advance. When compared with drill and blast, shielded TBM excavation provides almost no exposure of workers to an unsupported rock mass.

The TBMs will be fully equipped to perform the excavation, ventilation, lining, removal of excavated material. Geotechnical drilling or 'probing' as well as seismic reflection and geo-electrical surveys will also be conducted ahead of the TBMs to identify potentially critical areas with poor rock conditions, high fracturing or the presence of an aquifer. Application, where required, of pre-grouting and secondary grouting from the TBM to prevent excessive leakage and aquifer drainage during tunnel construction, as well as to consolidate the rock mass and reduce the risk of jamming the TBM, will be undertaken.

iii Power station complex

Central to the operation of Snowy 2.0 is the underground power station, at a site to be optimised as a result of the further geotechnical investigations to be undertaken as part of Exploratory Works. While the location of the power station is 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 transformer hall will house the power station's six transformers, power transmission equipment and the draft tube valves. The two caverns will be connected through Isolated Phase Busduct (IPB) galleries, which contain electrical equipment needed between the generating units and transformers.

The cavern complex is deep underground and will be accessible from the MAT and from the ECVT (described in the next section). The construction methods for the key components of the underground power station are shown in Table 2.13. The drill and blast method has been considered most suitable for the deep underground excavation works involving short length and changing geometries.

Table 2.13 Snowy 2.0 power station complex summary

Primary component	Description/location	Construction method	Approximate size
Machine hall	Houses the six turbines	Drill and blast	About 240 m long, 34 m wide and 55 m high
Transformer hall	Houses the six transformers	Drill and blast	About 204 m long, 20 m wide and 34 m high
IPB galleries	Houses electrical equipment between generating units and transformers	Drill and blast	About 50 m long, 10 m wide, and 16 m high
Ventilation shaft and air intake structure	From the power station to the surface. The shaft and air intake structure (at the surface) will provide air to the cavern during construction and operation of the power station	Raise bore or blind sink	About 4 m in diameter below surface and about 680 m in height from the power station to the surface Air intake structure at the surface is 7.5 m long, 7.5 m wide and about 6 m high

Figure 2.13 **Construction method – Talbingo Intake**

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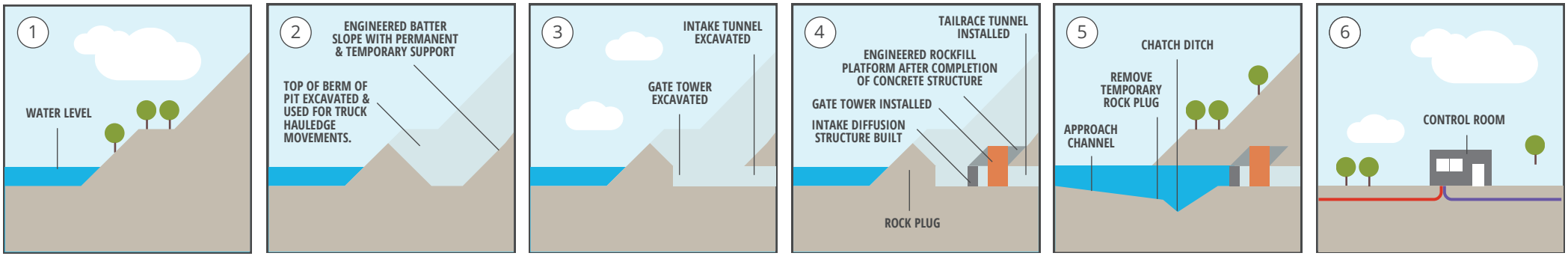

TEMPORARY WORKS AND PRECONSTRUCTION ACTIVITIES

Temporary works and significant pre-construction activities to prepare for commencement of the main works include installation of:

- Setting out of the construction battery limits
- Temporary erosion and sediment control measures
- Clearing and grubbing within the battery limit
- Temporary bench access road from the Quarry Trail
- Security fence, entrance gate and safety signs around the construction and stockpile area battery limit
- Temporary stormwater drainage channel for work area and stockpile area.

EXCAVATION OF THE INTAKE

Future Gen will construct this intake using the open cut method. Drilling, blasting and mass
excavation will be carried out to reach the bottom of the intake structure with design batter slope for corresponding rock materials.

As the excavation progress downwards, permanent rock anchors will be installed to stabilise the cut surface depending on the rock materials found on site.

A temporary pit will be fitted with a pump to remove any possible surface water and rain water that accumulates during construction.

EXCAVATION OF THE GATE SHAFT

To gain access at the bottom area of the Intake Structure, Future Gen will excavate an additional tunnel from the Tailrace Adit tunnel. This tunnel will then be connected to the benching platform via a shaft done in Raise Boring method.

The remaining excavation from the FSL level will be carried out from the surface, with spoil mucking through the shaft and out of the access tunnel. Figure 2 shows the sequence of excavation and how to gain access in to the invert level of intake structure.

INSTALLATION OF INTAKE INFRASTRUCTURE & CONCRETE WORKS

The unique design at Talbingo intake requires the gate tower to be constructed as a freestanding tower from ground up. Once the concrete works of each lift of the intake structure have been completed and obtained sufficient design strength, backfilling works will commence to form the ground for construction of the next lift of the gate tower. Suitable site-won materials or materials improved with a mix of other materials and compacted to earthworks specification will be used for backfilling. A concrete face wall will be designed and constructed parallel to the mouth of intake opening to retain the base of this backfill work. The estimated backfill volume is 110,000m3.

The finished, backfilled batter slope will be rehabilitated with landscaping features as detailed in the contract landscaping reference design drawings.

Significant concrete works are required to construct both intake structures, specifically the diffusion structure and gate shaft.

The exposed portion of the diffusion structure will be constructed using conventional reinforced concrete, which will commence once excavation reaches the intake invert levels.

REMOVAL OF ROCK PLUG

The rock plug will be removed from the front of the intake structure. Due to the large volume of rock to be excavated and discarded, various excavation options are being considered.

The rock plugs will be removed using a combination of the following construction methods:

• Drill and blast to remove a portion of the rock plugs (to be confirmed with during the project execution phase) from the dry side in the excavated pit area. The amount of rock excavation to be completed to remove the plugs at Tantangara intake site is significant however, the majority may be able to be removed by blasting during dry conditions while the reservoir water level is low.

• Underwater blasting to break down the remaining rock material in the plug and remove by dredging machine or barge-mounted excavator.

• Long-arm excavator on a barge to remove bigger boulders, which are then crushed into smaller sizes before being transported to the dumping site, if required.

CONTROL ROOM/ CABLES & CONDUITS

The control room will house all equipment such as the hydro mechanical components, hoist, control instrumentation, sensors, DC Systems, transformers, switchboards and emergency diesel generator.

This building will be pre-fabricated with all components fitted and tested in factory before transporting it to site for connection, testing and commissioning. The trenches will be formed for laying the cables and conduits.

Figure 2.14 Construction method – Tantangara Intake

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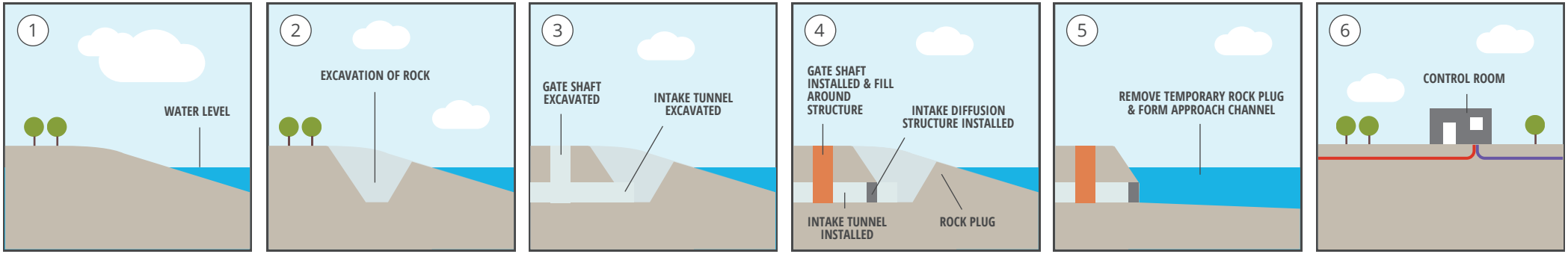


TEMPORARY WORKS & PRECONSTRUCTION ACTIVITIES

Temporary works and significant pre-construction activities to prepare for commencement of the main works include installation of:

- Setting out of the construction battery limits
- Temporary erosion and sediment control measures
- Clearing and grubbing within the battery limit
- Temporary bench access road from the Quarry Trail
- Security fence, entrance gate and safety signs around the construction and stockpile area battery limit
- Temporary stormwater drainage channel for work area and stockpile area.

EXCAVATION OF THE INTAKE

The intake pit excavation incorporates an open-cut trench into the various excavation levels as the works progress down below the natural surface level.

There will be drilling, blasting and mass excavation to be carried out to reach to the bottom of the intake structure.

As the excavation progress downwards, permanent rock anchors will be installed to stabilise the cut surface.

The temporary pit will be fitted with a pump to remove any water that accumulates during construction.

EXCAVATION OF THE GATE SHAFT

The shaft for the gate tower will be bored at the highest ground along the wet tunnel alignment, approximately 200m away from the intake mouth and will be completely hidden underground. Therefore, the intake transition piece will be connected to the gate tower transition piece with a stretch of wet tunnel.

The gate tower in Tantangara intake will be formed by a blind sink shaft boring method and the gate tower will be constructed from the bottom up with concrete filling in the void between the tower and shaft.

INSTALLATION OF INTAKE INFRASTRUCTURE & CONCRETE WORKS

Significant concrete works are required to construct both intake structures, specifically the diffusion structure and gate shaft.

The exposed portion of the diffusion structure will be constructed using conventional reinforced concrete, which will commence once excavation reaches the intake invert levels.

The diffusion structure at the opening of the Tantangara intake site will be open excavated from the top down and the concrete works will be constructed from the bottom up. Once completed concrete works, it shall be backfilled with local site-won material, which will be crushed to a consistent size to meet design backfill requirements.

REMOVAL OF ROCK PLUG

The rock plug will be removed from the front of the intake structure. Due to the large volume of rock to be excavated and discarded, various excavation options are being considered.

The rock plugs will be removed using a combination of the following construction methods:

- Drill and blast to remove a portion of the rock plugs from the dry side in the excavated pit area.
- Underwater blasting to break down the remaining rock material in the plug and remove by dredging machine or barge-mounted excavator.
- Long-arm excavator on a barge to remove bigger boulders, which are then crushed into smaller sizes before being transported to the disposal area.
- Personnel will use of depth silt curtain around the dredging and underwater blasting work zone during the construction phase to contain water pollution away from the rest of the reservoir.

CONTROL ROOM, CABLES AND CONDUITS

The control room will house all equipment such as the hydromechanical components, hoist, control instrumentation, sensors, DC Systems, transformers, switchboards and emergency diesel generator.

This building will be pre-fabricated with all components fitted and tested in factory before transporting it to site for connection, testing and commissioning.

The trenches will be formed for laying the cables and conduits.

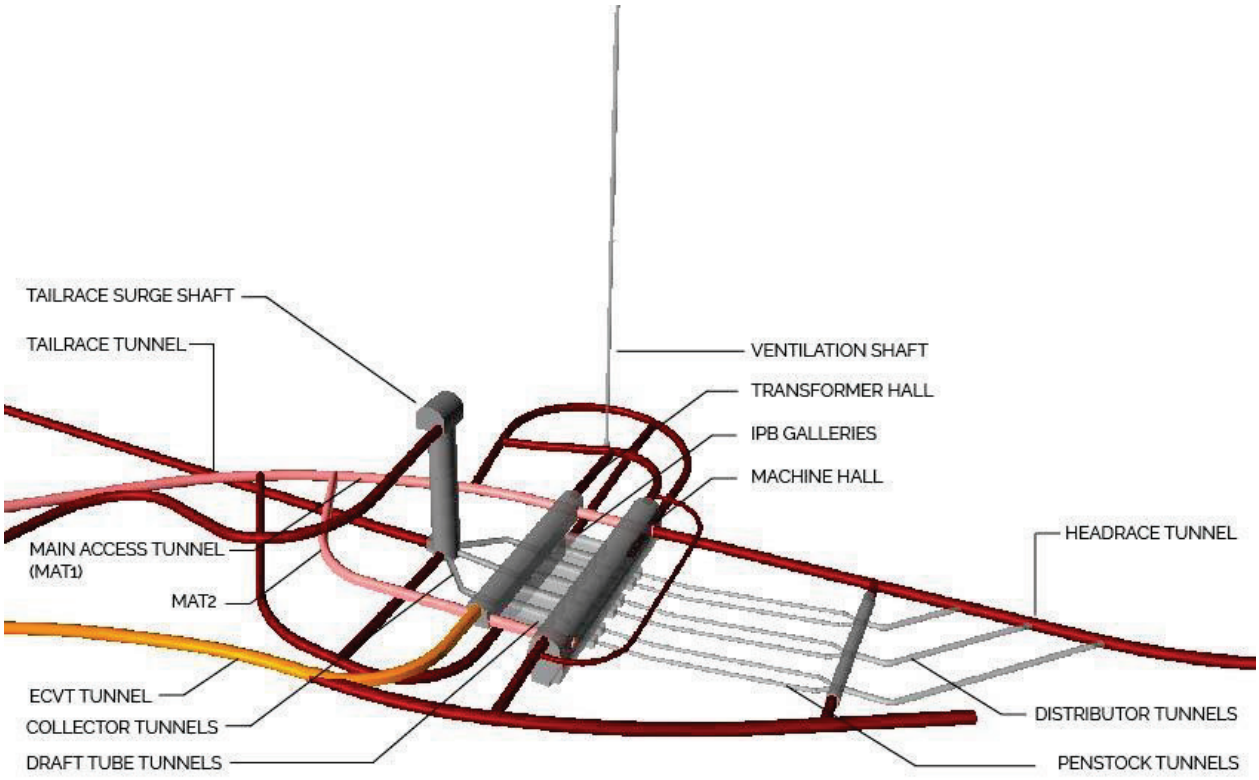


Figure 2.15 Powerhouse complex indicative general layout (3D)

iv Power station main access tunnel and the ECVT

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.

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 (adjacent to the MAT).

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.

iii Substations and power connection

One substation is required to provide permanent power to Snowy 2.0, at Lobs Hole. This substation will be built for use as part of Snowy 2.0 Exploratory Works (approval currently being sought under Modification 1) with a capacity of 80 megavolt amps (MVA). It will continue to be used for Snowy 2.0 Main Works, however requires the establishment of additional power supply cables to provide power to the work sites, in particular to power the TBMs via the MAT, ECVT, Talbingo and Tantangara portals, as well as construction and accommodation camps at Talbingo, Marica and Tantangara. The supporting high voltage cable route therefore follows access roads to these locations (refer to utilities alignment shown on Figure 2.6 to Figure 2.11).

The cables will be overhead or underground (buried in a trench) from Lobs Hole to Marica and then on to Tantangara, along existing or proposed access roads. The cable trenches will be excavated to the required depth and in some areas direct drilled (such as for crossing sensitive environments such as watercourses). Bedding sand will be laid, and the conduit placed. Trenches will be backfilled and compacted with the excavated material.

The Lobs Hole substation will become a permanent feature of Snowy 2.0, with power to be reticulated to the power station and other operational facilities at Lobs Hole including the Talbingo intake control buildings and gates.

v Communication system

In addition to communications and construction power links established for Snowy 2.0 Exploratory Works, communications infrastructure will be established for Snowy 2.0 Main Works. The links will connect infrastructure at Tantangara and Talbingo reservoirs to the existing communications system at the Tumut 3 power station (via the submarine communications cable in Talbingo Reservoir established during Exploratory Works) and to Snowy Hydro's communications infrastructure at Cabramurra. This system will include fibre-optic cables, and will serve all fixed construction communication needs, as well as providing the permanent communication network. Buried fibre-optic cable will connect the Talbingo intake, the underground power station, headrace tunnel surge shaft and Tantangara intake.

The fibre-optic cable will be buried in conduits generally within access roads and established tracks. This involves excavating a trench, laying the conduits, pulling the cables through, and backfilling and restoring the surface. Communication pits will be required along the route to join lengths of cable. Watercourse crossings will be carried out in a manner that minimises environmental impacts where possible, and may include some trenching of ephemeral creeks (during dry periods only), bridging of creeks, temporary creek diversion and burying conduits below watercourse beds and some horizontal drilling or underbore methods, to minimise impacts to the watercourse and adjacent riparian zone. Horizontal drilling methods will also be considered to minimise impacts to other sensitive areas where possible.

vi Secondary containment controls

An instream barrier is proposed to prevent the potential upstream migration of Climbing galaxias (*Galaxias brevipinnus*), a native but translocated species, into the habitat of the critically endangered Stocky galaxias (*Galaxias tantangara*). The Climbing galaxias has the potential ability to climb out of the water up moist to wet vertical surfaces. While the potential transfer of this species between reservoirs is considered possible to unlikely, detailed scientific investigations have not been able to categorically rule out this potential upstream migration of Climbing galaxias through the power waterways connecting the two reservoirs.

Currently, Climbing galaxias have not yet been recorded in Tantangara Reservoir, however the pumping mode of Snowy 2.0 has the potential to transfer the species from Talbingo Reservoir as individuals have been detected in the hydrologically connected Yarrangobilly River. The upper reaches of Tantangara Creek contains habitat for the critically endangered Stocky galaxias (*Galaxias tantangara*). The existing waterfall is a barrier to other non-indigenous species such as Trout, however there is the potential risk this natural barrier may not be as effective for the Climbing galaxias. The construction of this instream barrier in the upper reaches of Tantangara Creek is a secondary control to avoid its potential upstream migration and establishment and resultant potential impact upon Stocky galaxias.

Concept designs have been developed for a section of Tantangara Creek about 15 km upstream of the reservoir, above an existing waterfall just upstream of the Alpine Creek Firetrail. An indicative area is shown in Figure 2.9.

In addition, a filtration station/s to screen pest fish species from being discharged through the Murrumbidgee-Eucumbene Tunnel from Tantangara Reservoir is proposed. Detailed scientific investigations have not been able to categorically rule out potential transfer of pest species through the tunnels connecting the two reservoirs. Given the residual risk of potential transfer, it is proposed to avoid the potential secondary transfer of any pest fish species that may establish in Tantangara Reservoir as a result of Snowy 2.0.

Concept designs have been developed that would aim to prevent the potential transfer of all life stages of pest fish through the River Outlet Works of Tantangara Reservoir to the Upper Murrumbidgee River and through the Murrumbidgee-Eucumbene tunnel to Lake Eucumbene. This control is designed to limit the potential range expansion of any fish species of concern that may be potentially transferred to Tantangara Reservoir as a result of the project. The location of the station will be upstream of the existing reservoir wall, near the intake of the Murrumbidgee-Eucumbene tunnel within the disturbance footprint indicated in Figure 2.10.

2.3.3 Supporting construction sites and infrastructure

i Construction portals, tunnels and adits

Numerous construction adits are needed to provide access and facilitate the construction of the power station complex, tailrace tunnel and headrace tunnel. The adits will be excavated and accessed from portals established at Tantangara and Talbingo reservoirs, as well as the MAT and ECVT portals.

A level site area (a construction pad) is needed for launching TBMs from the portals. Therefore, construction of these sites will involve clearing and levelling of the site (which may include placement of surplus cut materials at Lobs Hole), with hardstand areas established. The portals and adits will be excavated using drill and blast techniques, with rock support and concrete works as needed. These areas are shown in Figure 2.16.

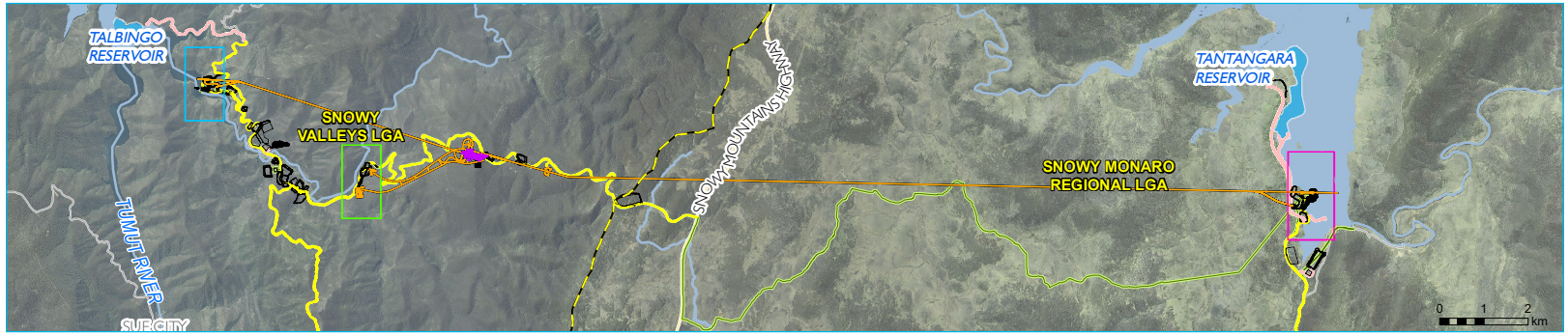
ii Primary construction compounds and laydown areas

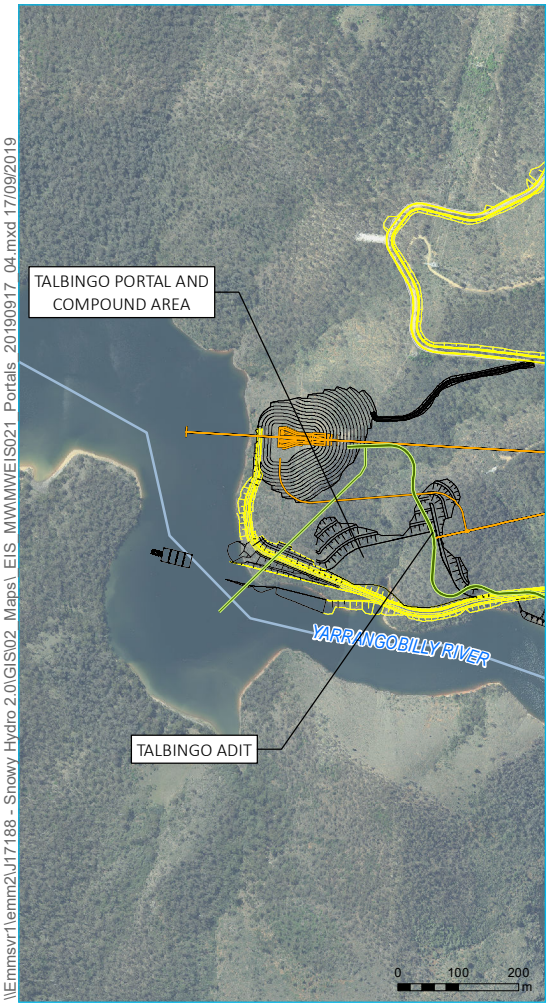
Within each of the construction areas, temporary construction compounds will be required (as previously listed in Table 2.1 to Table 2.6) to provide construction support facilities, such as CBPs, water and wastewater treatment facilities, material storage, material testing and laboratory facilities, lay down areas, stockpiles and hardstand areas. Construction will require the areas to be cleared of vegetation and earthworks involving cut and fill to ensure a level site area. Once these areas are no longer required for the construction of Snowy 2.0, they will be rehabilitated in line with the requirements of the Rehabilitation Strategy (see Appendix F).

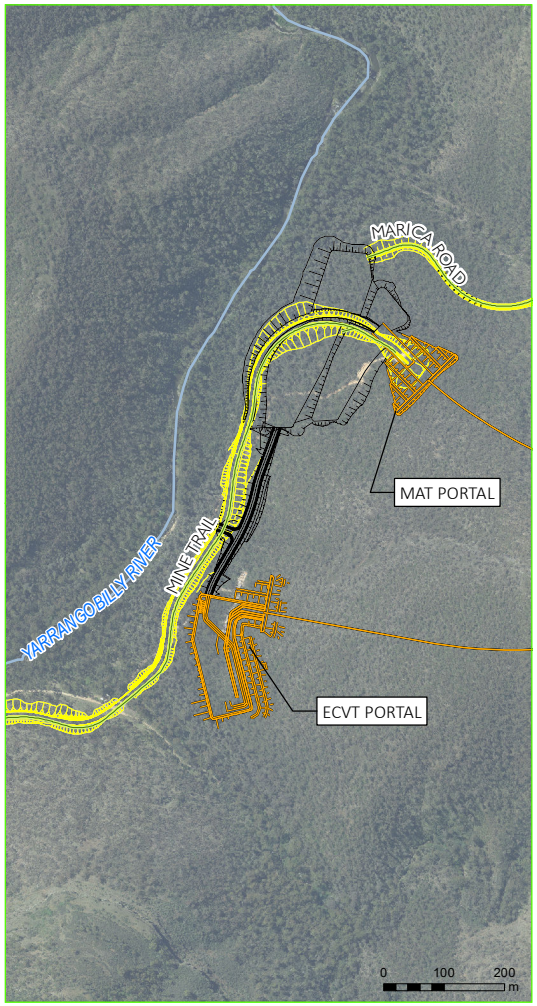
Compound areas associated with portals for the TBMs will contain the necessary facilities to support TBM operation. This includes storage of power plant, site offices, medical facilities, warehouse and workshops, TBM parts and tools storage, grouting system, water storage and storage of segments.

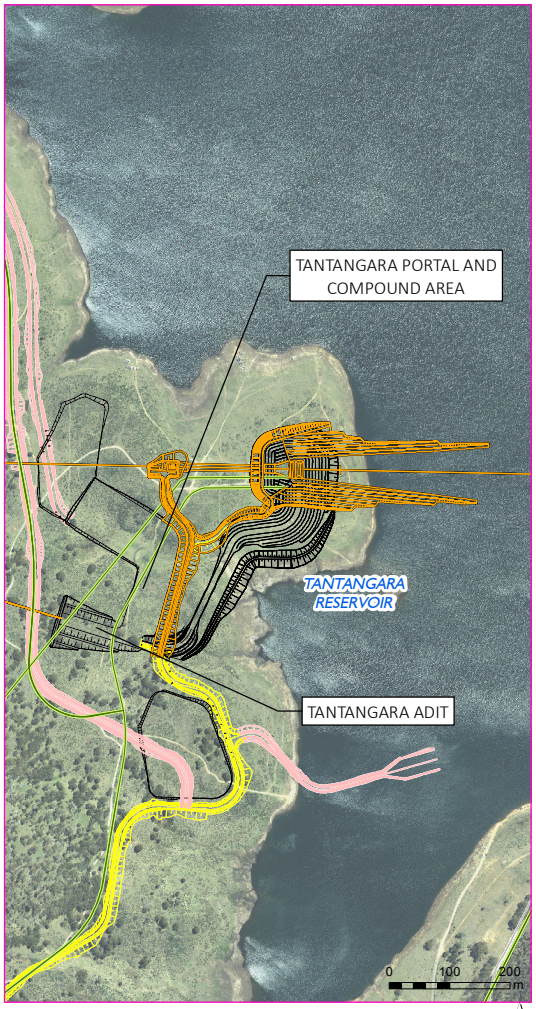
The Main Yard (Lobs Hole) will be the largest construction compound, providing most of the ancillary construction facilities and areas for laydown. It is likely to include ancillary construction facilities, warehouses, maintenance sheds, first aid buildings, medical facilities, helipad, explosive storage magazine, stockpiles (aggregate, and other materials), truck and vehicle parking, workshops and stores, offices, site worker facilities, site laboratory for testing of materials including concrete, aggregate, excavated rock and water quality, wood carpentry workshop and a steel fabrication yard.

Rock Forest, outside KNP, will be used as a storage and staging/logistics area for the delivery of materials to site. During adverse weather or unsafe conditions, the site would be used to hold deliveries and staff for a short timeframe. Facilities likely to be established at the site include storage yards (for segments and other goods), turn around and parking yard for trailer/trucks and portable toilet facilities.









KEY

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

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

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

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

GDA 1994 MGA Zone 55

N

Portals to underground works

Snowy 2.0
Environmental Impact Statement
Main Works
Figure 2.16

snowy 2.0

EMM creating opportunities

iii Ancillary construction facilities

Several supporting facilities are required to support construction activities within the construction areas. These are provided in Table 2.14.

Table 2.14 Ancillary construction facilities

Item	Description
CBPs	To ensure supply of concrete products (eg for grout), particularly during critical, large scale pours.
Crushing plants	To receive excavated material directly from the intakes and other sources such as cuts from road works.
Laydown areas	To host temporary installation such as machinery, formwork and oversize deliveries, as well as use for storage, equipment maintenance or work areas. Laydown areas will be provided at each of the main construction yards, providing space to store all plant, equipment and materials required for all construction activities.
Stockpile areas	To support both excavated rock from tunnelling and clearing activities, as well as aggregate and other building materials imported for construction.
Accommodation camps	To provide on-site accommodation for workers to deliver Snowy 2.0 Main Works. Snowy 2.0 Main Works will also utilise existing accommodation at Snowy Hydro's Cabramurra township where possible.
Helipads	Helipads will be near each accommodation camp where medical facilities are based, to provide emergency egress.
Water supply infrastructure	Raw water will be primarily sourced from Talbingo and Tantangara reservoirs for use in concrete mixing and supply to CBPs, tunnelling activities and supply to TBM (TBM cooling) and drill and blast sites as well as dust suppression and firefighting supply. Potable water will require the commissioning of water treatment plants within construction areas. Potable water will be reticulated to facilities in each accommodation camp site (ie Lobs Hole, Marica and Tantangara) via a reticulated system or via truck mounted water bowser.
Wastewater	A separate collection and treatment system is proposed to manage the tunnel seepage and construction wastewater (referred to as process water). The treated seepage water will be prioritised for reuse to supply construction demands. Treated water will be reused onsite where possible to reduce the amount of discharge to reservoirs, however excess treated water will be discharged to the reservoirs. Sewage will be generated at accommodation camps from showers, kitchens, laundries and toilet facilities. Collected sewage will be treated at sewage treatment plants to meet the specified discharge limits before effluent is discharged. To minimise raw water intake and runoff, stormwater will be captured and reused as much as possible. Sedimentation basins and stormwater diversions would be installed as part of erosion and sediment control measures. Higher order erosion and sediment controls such as clean and dirty water separation and minimisation of disturbed areas will significantly reduce the quantity and improve the quality of sediment-laden water required to be treated. Any stormwater to be treated and released to the surrounding environment would need to meet specific water quality criteria before being discharged.

2.3.4 Temporary and permanent access roads

i Construction access

Access works are required to:

- provide for the transport of excavated material between the tunnel portals and the excavated rock emplacement areas;
- accommodate the transport of oversized loads as required; and
- facilitate the safe movement of plant, equipment, materials and construction workers into and out of construction sites.

Construction of Snowy 2.0 Main Works will require use of existing roads and tracks within KNP, some of which will need to be restricted from the public for the entire construction period for safety reasons. Once construction has finished, Snowy Hydro will either return the existing road to a standard agreed to with NPWS or rehabilitate constructed roads and return access to NPWS and the public. Some new roads will be constructed to provide access to permanent infrastructure with these roads maintained in the long term and some public access restrictions signposted.

The primary access roads to the construction areas are listed below.

- Talbingo Reservoir and Lobs Hole – accessed by Lobs Hole Ravine Road;
- Marica – accessed by Marica Trail;
- Plateau – accessed by Gooandra Trail;
- Tantangara Reservoir – accessed by Tantangara Road; and
- Rock Forest – accessed by Snowy Mountains Highway.

Road conditions will be impacted by the heavily loaded construction traffic and the climatic conditions of the region, including snow, rain, heat and dry weather. To adequately maintain safe access and use of roads through to completion, maintenance crews will be employed, undertaking maintenance activities such as using snow ploughs and blowers, grade, patch, fill pot holes, water and re-mark roads as necessary.

Section 2.5 of this chapter provides a summary of works required for these roads and the access arrangements for both the construction period and long-term once construction has finished.

ii Road works

Snowy Hydro has been liaising with NSW Roads and Maritime Services (RMS) to understand the existing program of works within the region to be carried out during the planned construction of Snowy 2.0 Main Works and the requirements of the project. Road works required for the Snowy 2.0 Main Works are as follows:

- widening of the intersection with Snowy Mountains Highway and Tantangara Road – to allow safe passage for light and heavy vehicles through this intersection;
- new intersection with Snowy Mountains Highway and the Marica Trail – to allow direct access to construction areas for project-related traffic;

- new access from Rock Forest with Snowy Mountains Highway – to allow ingress and egress from the Rock Forest property to the Snowy Mountains Highway for light and heavy vehicles; and
- widening of the intersection with Link Road and Lobs Hole Ravine Road - to allow direct access to construction areas for project-related traffic.

2.3.5 Management of excavated rock

i Management strategy

The strategy for the management of excavated rock will aim to maximise beneficial reuse of materials for construction activities. Beneficial re-use of excavated material may include use for road base, pad establishment, selected fill and tunnel backfill and rock armour as part of site establishment for construction areas. Excess excavated material that cannot be re-used during construction will be placed within Talbingo and Tantangara reservoirs. During the construction phase, surplus cut materials used to establish construction pads within Lobs Hole may be used to assist with landforming and rehabilitation.

This section provides an overview of the proposed strategy for excavated material management including the methods proposed for placement within the reservoirs.

ii Sources of excavated rock

Approximately 9 million m^3 (unbulked) of excavated material will be generated by Snowy 2.0 Main Works. Excavated material will be generated by the activities listed below:

- intake construction at both reservoirs;
- tunnelling for power waterways, access tunnels and adits;
- excavation of underground caverns, chambers and shafts;
- road establishment and upgrades; and
- site establishment for construction areas and accommodation camps.

The management of excavated material generation and disposal has been divided into two management systems based on the east (Tantangara) and west (Talbingo) sides of the Snowy 2.0 Main Works project area. Excavation work at Marica will be managed by the Tantangara management system. This is shown in Figure 2.17. The predicted excavated material is categorised according to the main methods of tunnel excavation, TBM and drill and blast.

iii Re-use of excavated material

Several sections along road alignments and construction sites will have large cut and fill quantities. It is also considered much of this material will be suitable for reuse as embankment material. Suitable material will be crushed and screened on site as necessary at stockpile locations, minimising the need to import material and reducing road traffic. Material reuse is expected for:

- compound and camp locations to level the site as part of construction (construction pads);
- fill at the MAT, ECVT, Talbingo and Tantangara portal (permanent operational pads and structures); and
- road works in the project area.

Estimated reuse volumes are shown in Table 2.15.

Table 2.15 Estimated excavated material volumes reused or permanently placed

Management area	Total estimate	In-reservoir placement	Re-used for permanent operational structures (eg roads and operational pads and portals)	Retained as shaped final landform
Talbingo	4,974,784 m^3	2,834,212 m^3	1,140,573 m^3	1,000,000 m^3
Tantangara	3,627,419 m^3	2,800,677 m^3	826,742 m^3	Not applicable

iv In-reservoir placement

Excavated material not used for beneficial re-use will be permanently emplaced within Talbingo and Tantangara reservoirs. Emplacement areas have been identified in both reservoirs. It is expected that approximately 2.8 million m^3 will be emplaced within each reservoir. Placement of excavated material will be carried out 24 hours a day, seven days a week and 365 days a year.

Emplacement within Talbingo Reservoir is proposed from the bed of the reservoir to just above FSL (approximately 0.3% of the total storage). Emplacement within Tantangara Reservoir is proposed within the active storage (approximately 1.1% of the storage) of the reservoir from the MOL to just above FSL.

The final elevation of the emplacement areas will be above FSL to allow for permanent rehabilitation of the landform. This is to prevent inundation of the emplacement area when the reservoir is at capacity. Further engagement with NPWS will be carried out regarding the end use of these areas, such as recreational areas.

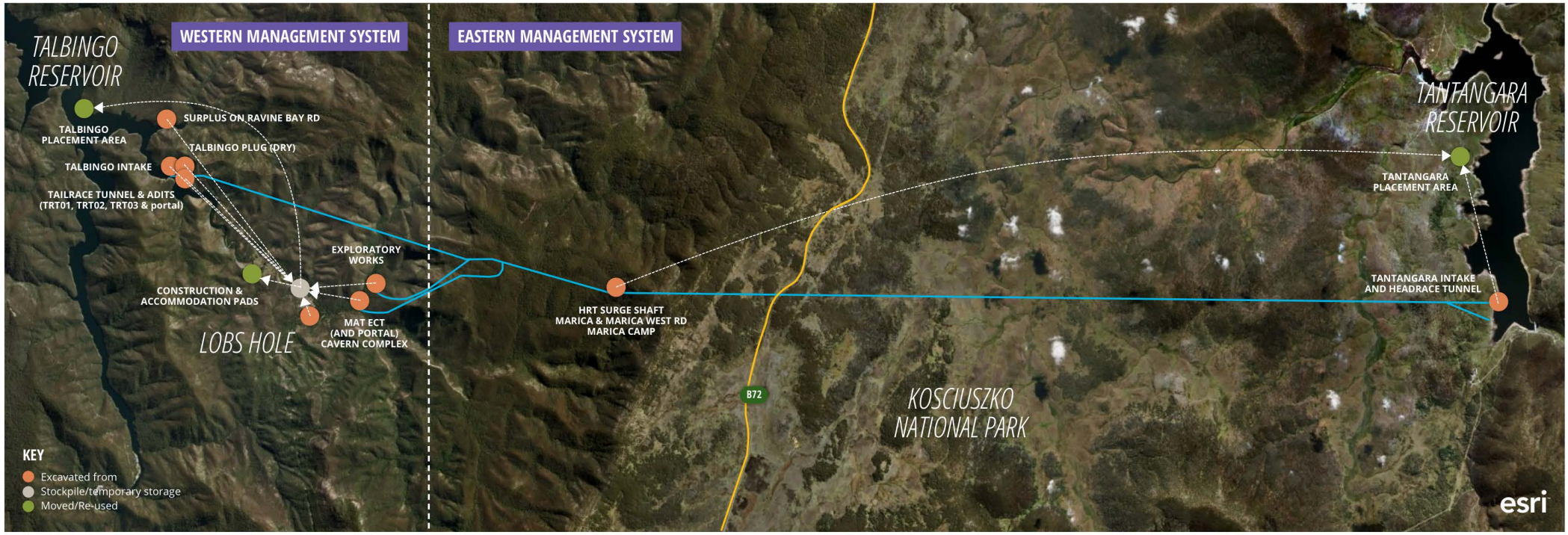
a Transport and placement within Talbingo Reservoir

Placement of excavated rock within Talbingo Reservoir involves placing materials from the northern edge of Ravine Bay into the Talbingo Reservoir by conventional earth-moving plant, such as trucks and excavators, and installing a rock armour layer formed by large size excavated rock on the emplacement slope batter by barges.

A new access road will be constructed from Lobs Hole Ravine Road North along the shoreline of Ravine Bay for about 5.8 km. This access road will be used to transport materials suitable for placement within Ravine Bay.

Ravine Bay placement activities will commence with the installation of a silt curtain to reduce turbidity within the reservoir during placement activities. Rock armouring materials will be placed on the outer areas of emplacement area to provide a barrier for the finer materials (sourced from TBM excavated rock) to be placed in the area to the shore. The rock armouring will encapsulate the finer materials and prevent them from entering the reservoir. These activities will progress in a westerly direction over an anticipated three year placement program and fill the Ravine Bay placement area. This is shown in Figure 2.18.

A nominal 1 m layer of rock armouring will be placed above MOL to protect the slope of submerged emplacement area. The placement area will be rehabilitated to about 1 m above FSL to allow for revegetation. Figure 2.19 and Figure 2.20 provide an indicative rehabilitated landform at the Ravine Bay placement area. The future use, including recreational, of this area will be subject to ongoing engagement with NPWS.



Satellite image © Esri, CGIAR | Vicmap, Esri, HERE, Garmin, METI/NASA, USGS | Earthstar Geographics

Figure 2.17 **Excavated materials management systems**

ALL FIGURES IN M3 (UNBULKED)
LOCATIONS ARE APPROXIMATE ONLY

snowy 2.0

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WESTERN MANAGEMENT SYSTEM
TALBINGO SCHEME

TOTAL VOLUME GENERATED:

4,974,784

AMOUNT OF MATERIAL REUSED: 2,140,573

1. EXCAVATED EXCAVATED FOR SUB-AQUEOUS PLACMENT	REUSED IN PERMANENT STRUCTURES*	LAND FORMING
2,834,212	1,140,573	1,000,000

EASTERN MANAGEMENT SYSTEM
TANTANGARA SCHEME

TOTAL VOLUME GENERATED:

3,627,419

3. EXCAVATED FOR SUB-AQUEOUS PLACMENT & ACTIVE STORAGE	REUSED IN PERMANENT STRUCTURES*
2,800,677	826,742

* e.g. roads and operational pads - MAT, ECVT etc

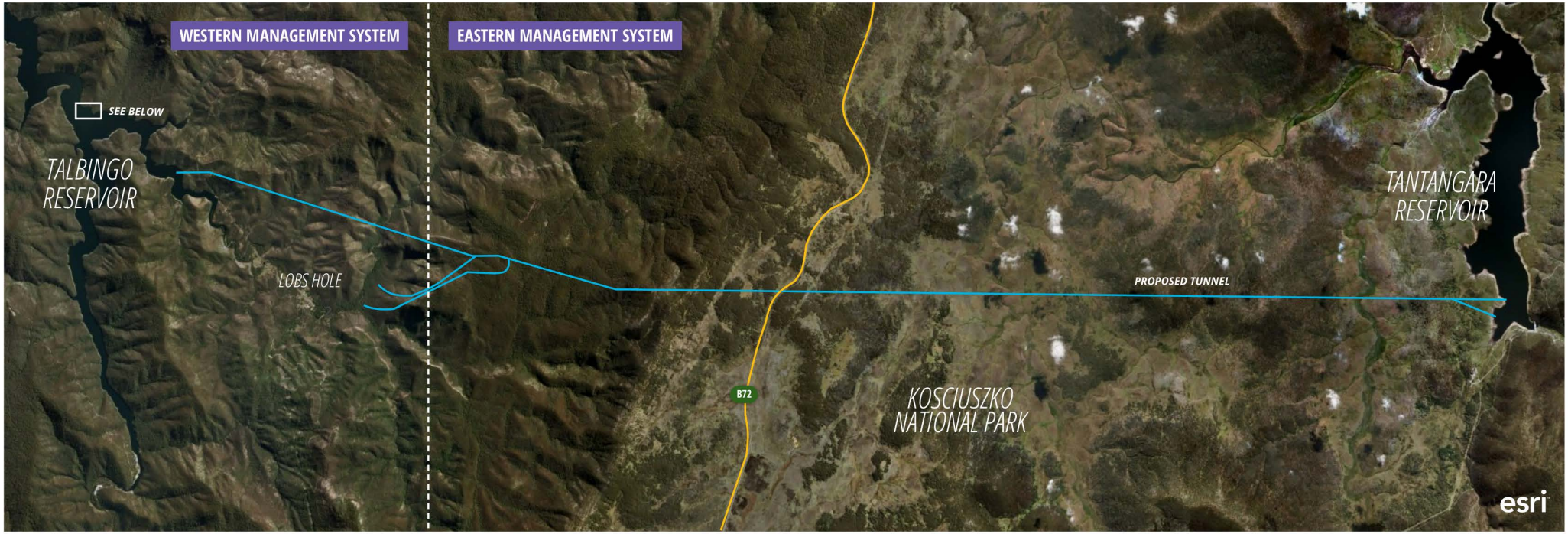
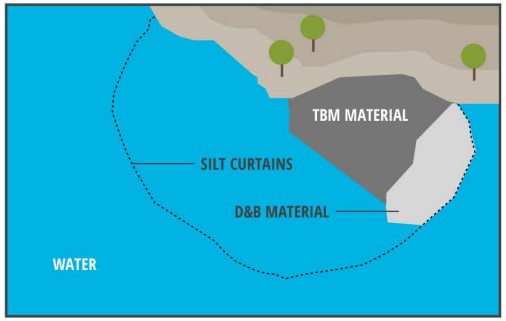


Figure 2.18 **Placement of material at Talbingo Reservoir**

● Tunnel boring machine (TBM) material ● Drill & blast (D&B) material

snowy 2.0 EMM creating opportunities

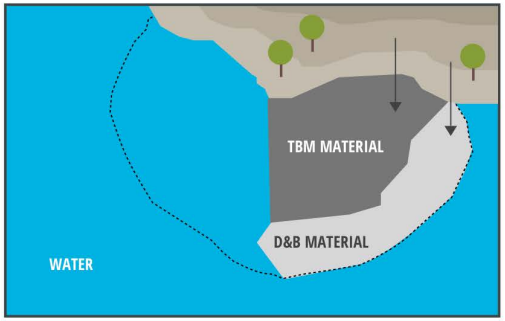
AERIAL VIEW



STAGE 1

Install silt curtains along placement area.

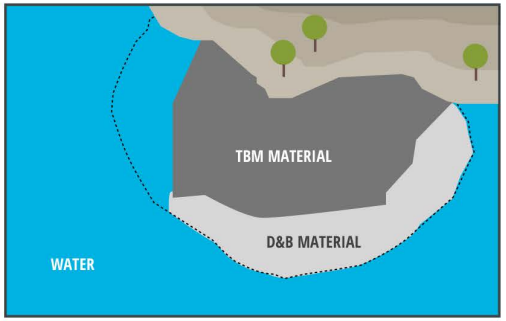
AERIAL VIEW



STAGE 2

Push material from shoreline edge into reservoir.

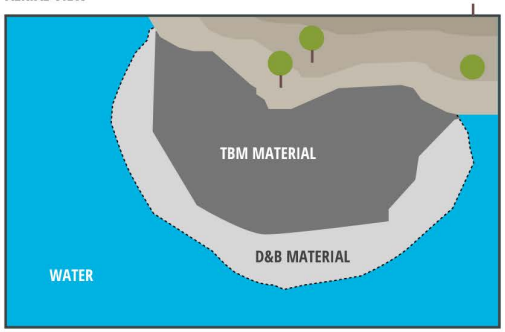
AERIAL VIEW



STAGE 3

Continue placement.

AERIAL VIEW



STAGE 4

Install rock armour on emplacement area surface for long term erosion protection.

Artist impression: Existing full supply level

Artist impression: Rehabilitated full supply level

Figure 2.19 Talbingo – Ravine Bay placement area rehabilitation (aerial view)

Artist impression: Existing full supply level

Artist impression: Rehabilitated full supply level

Figure 2.20 Talbingo – Ravine Bay placement area rehabilitation (water view)

b Transport and placement within Tantangara Reservoir

Placement of materials within Tantangara Reservoir utilises an area within the active storage of the reservoir, between MOL and FSL. During the placement of materials, Snowy Hydro is able to manage the water levels within the reservoir through existing approved operating practices for the Snowy Scheme. This will provide for efficient conditions for effective placement within the reservoir using conventional earth-moving equipment and techniques.

Like the Ravine Bay placement, appropriate erosion and sediment control measures, such as temporary diversion drains will be installed prior to the commencement of placement activities. As placement activities will be carried out on land (albeit within active storage of the reservoir), materials will be placed in cells to minimise potential for impacts. Finer materials will be placed within the cells whilst the batters of these cells will be covered by larger sized materials. As a cell is nearing completion, the next cell is prepared to commence receiving materials. The placement area is progressively filled over an anticipated three year placement program. This is shown in Figure 2.21.

To reduce the potential of finer materials leaching from the cells, a geotextile layer will be installed on the emplacement surfaces in the cell establishment phase. During placement activities, water will be managed in the work areas through temporary diversion drains taking water into sediment control ponds where the water will be reused where possible. Given the potential for rising water levels during placement activities at Tantangara Reservoir, a trigger action response plan (TARP) will be developed to manage these activities.

A nominal 1 m thick rock armour will be installed for protection of the placement surface as it will be submerged for periods of time given the variation in water levels between MOL and FSL, similar to the currently approved practices of Snowy Hydro. The placement area will be rehabilitated to about 1 m above FSL to allow for revegetation. Figure 2.22 provides an indicative rehabilitated landform at the Tantangara Reservoir placement area. The future use, including recreational, of this area will be subject to ongoing engagement with NPWS.

v On-land placement and rehabilitation

The continued use of the Main Yard at Lobs Hole requires considerable materials in the form of surplus cut to create safe and stable areas for construction. Following completion of construction activities for Snowy 2.0 Main Works, these surplus materials and areas will be landformed, reshaped and rehabilitated to their pre-construction condition. The Lobs Hole area is a remote area of KNP and is used by recreational users for these values. Snowy Hydro will continue to engage with NPWS regarding the opportunities for future recreational use of these areas at Lobs Hole.

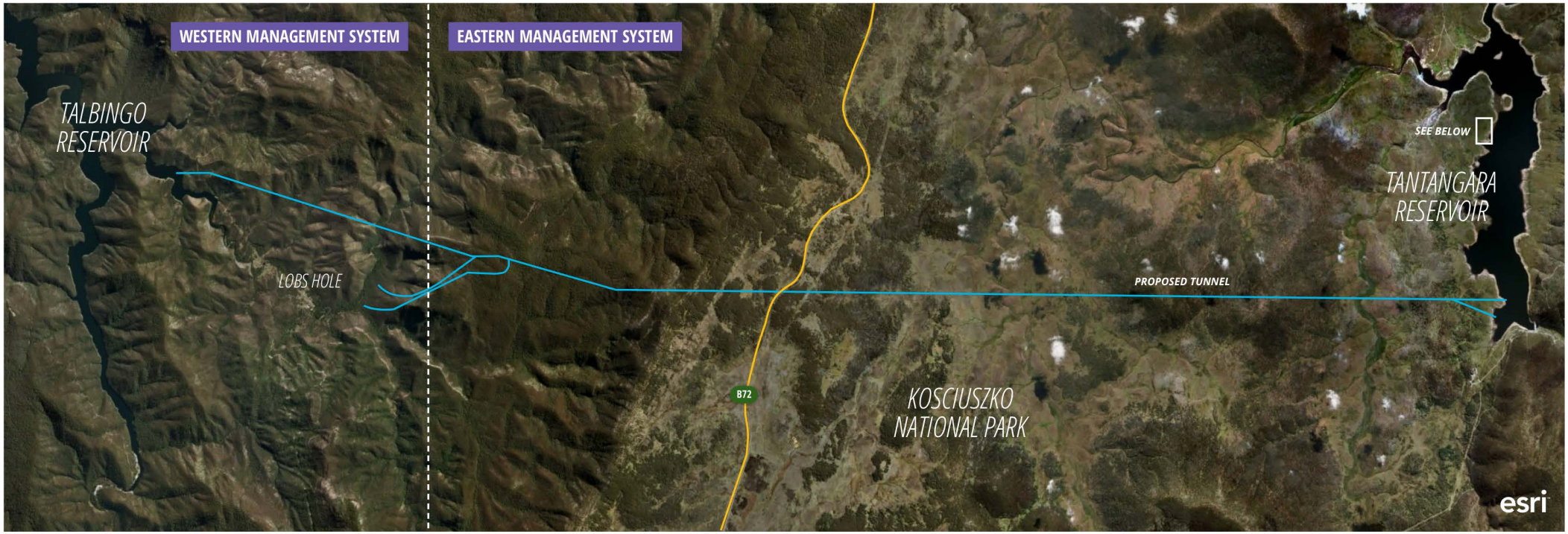
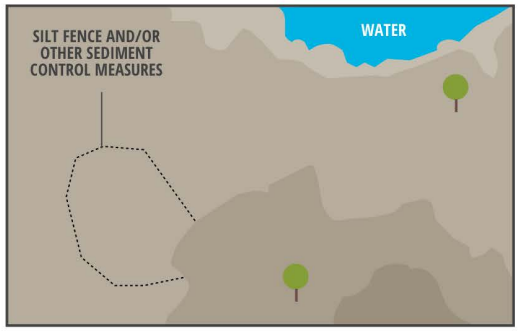


Figure 2.21 **Placement of material at Tantangara Reservoir**

● Tunnel boring machine (TBM) material ● Drill & blast (D&B) material

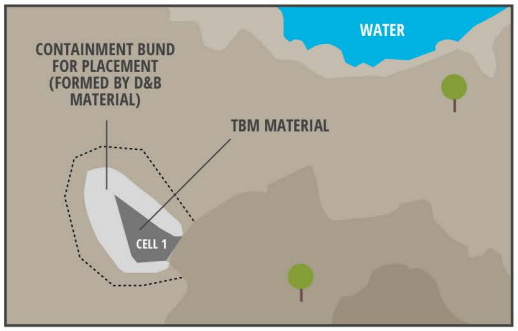
AERIAL VIEW ◀ NORTH



STAGE 1

Install erosion and sediment control (ESC) measures for construction of containment bund.

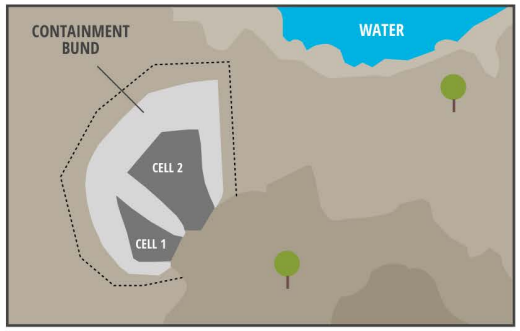
AERIAL VIEW



STAGE 2

Push soil from full supply level (FSL) boundary into active storage areas to construct cell 1 storage cell containment bund and at the same time fill cell 1.

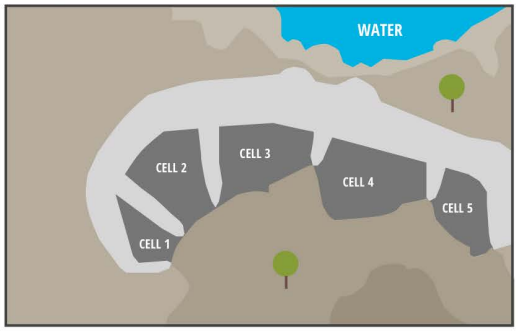
AERIAL VIEW



STAGE 3

Construct cell 2 containment bund for placement and fill cell 2.

AERIAL VIEW



STAGE 4

Repeat the same construction staging until completion

Artist impression: Full supply level

Artist impression: Full supply level optimised for recreational use

Figure 2.22 Tantangara placement area rehabilitation (aerial view)

2.3.6 Traffic and transport requirements

i Traffic generating activities and volumes

Throughout the construction period there will be several traffic generating activities, including:

- deliveries of materials, plant and equipment to and from site, including materials such as aggregate and cement as well as delivery of segments;
- transport of personnel to designated airports;
- busing of personnel to and from shifts on site;
- servicing of accommodation camps (eg waste collection, food delivery, etc); and
- haulage of excavated rock and materials from surface works and tunnelling activities.

The regular types and volumes of vehicles estimated over the life of the construction works will range from semi-trailers delivering concrete and segments for the tunnels, truck and dogs bringing in road-base and other construction materials, agitators for the concrete pours to smaller vehicles such as mini-busses and coaches for the workforce and light vehicles for internal movements by personnel. These movements will occur on both the external and internal site road network.

In June 2019, Snowy Hydro lodged an application seeking planning approval from the NSW Minister for Planning and Public Spaces for an ancillary facility to Snowy 2.0, being a segment factory in Polo Flat (SSI-10034). Should the factory be approved and constructed, segments would be manufactured and delivered to site from Polo Flat.

ii Transport routes

The bulk of the deliveries and transport requirements for Snowy 2.0 Main Works are expected to approach the project from the east, travelling through Cooma, due to likely availability and source of materials required for the construction of Snowy 2.0 Main Works. Roads from the east are predominantly established designated transport routes. The primary transport routes for delivery of materials and equipment to site are shown on Figure 2.23, and comprise:

- route to Talbingo Reservoir and Lobs Hole:
  - main access: Snowy Mountains Highway > Link Road > Lobs Hole Ravine Road; and
  - alternative access/egress: Snowy Mountains Highway > Marica Trail > Marica Road West > Lobs Hole Road;
- route to Marica:
  - Snowy Mountains Highway > Marica Trail > Marica Road West;
- route to Tantangara Reservoir:
  - Snowy Mountains Highway > Tantangara Road > Quarry Trail.

Transport routes outside of the ones described above and shown in Figure 2.23 will also be used, but are likely to be used for minor supplies of materials or services. These include approaching the project from the west (using Elliot Way) or from the north (using Snowy Mountains Highway).

iii Marine access

Barge launch facilities on Talbingo will have already been established during Snowy 2.0 Exploratory Works for the placement of the submarine communications cable, and will continue to be used for Snowy 2.0 Main Works for construction works associated with the Talbingo intake structure. Snowy 2.0 Main Works will require the establishment of launch facilities on Tantangara Reservoir to enable these similar works (removal of the intake plug).

iv Movement of personnel and shifts

Personnel working on the project will generally not be permitted to drive to the camps, in order to reduce the volume of traffic on the roads and reduce travel time and improve safety outcomes for the workforce. This also has the benefit of reducing parking requirements at the accommodation camps. They will be transported from designated towns and airports to the accommodation camps by project-supplied buses.

When on site, buses will collect workers and transport them between accommodation camps to various worksites before and after shifts. Bus pick-up and drop-off points will be marked at accommodation camps and at worksites, along with safe pedestrian routes. Sufficient buses will be allocated to each camp to ferry the workforce back and forth at the start and end of each shift. Exceptions will apply for superintendents and engineers or for personnel who require flexibility of movement as a result of the nature of their role.

The site roster for personnel will be developed as part of FGJV's human resources and recruitment initiatives. However, it is expected to be 20 days on, 10 days off, with two shifts of 12 hours each, or similar arrangement.

The use of Lobs Hole Ravine Road North for an alternative light vehicle access to Lobs Hole, which is currently part of a proposed modification to the Snowy 2.0 Exploratory Works approval, will be continued under Snowy 2.0 Main Works.

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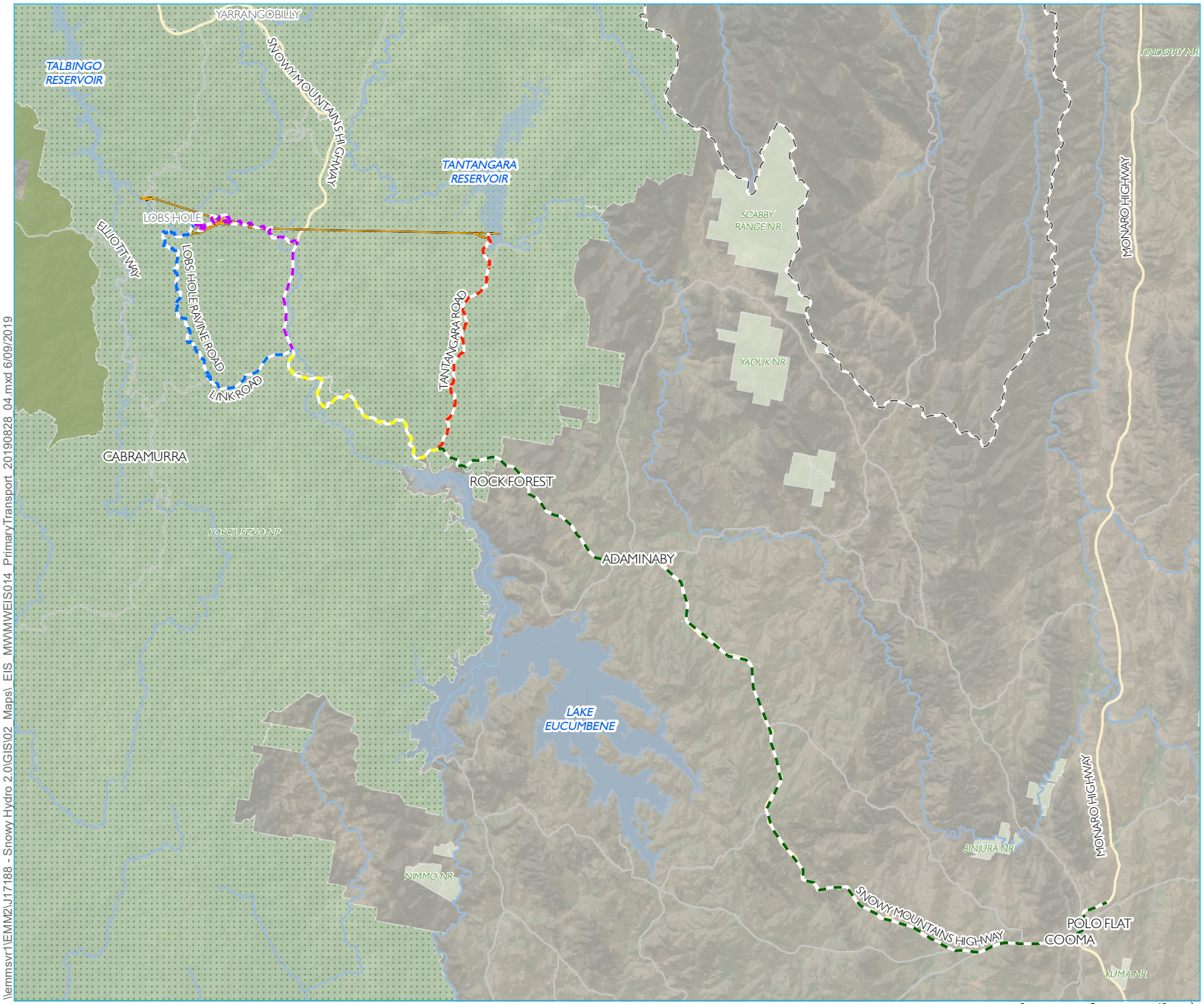

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KEY

Primary transport route

- All site access from Cooma to KNP and Rock Forest
- Route to Tantangara Reservoir
- Route to Talbingo Reservoir and Lobs Hole
- Route to Marica and Lobs Hole
- Route to Marica, and alternative access to Lobs Hole

Snowy 2.0 Main Works operational elements

- Tunnels, portals, intakes, shafts
- Power station

Existing environment

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

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

Primary transport routes

Snowy 2.0
Environmental Impact Statement
Main Works
Figure 2.23

snowy 2.0

EMM creating opportunities

2.3.7 Workforce requirements

i Workforce

The workforce is expected to reach about 2,000 workers at peak construction, based on current labour requirements forecast by the contractor. The indicative distribution of the workforce over the construction program is shown below in Figure 2.24.

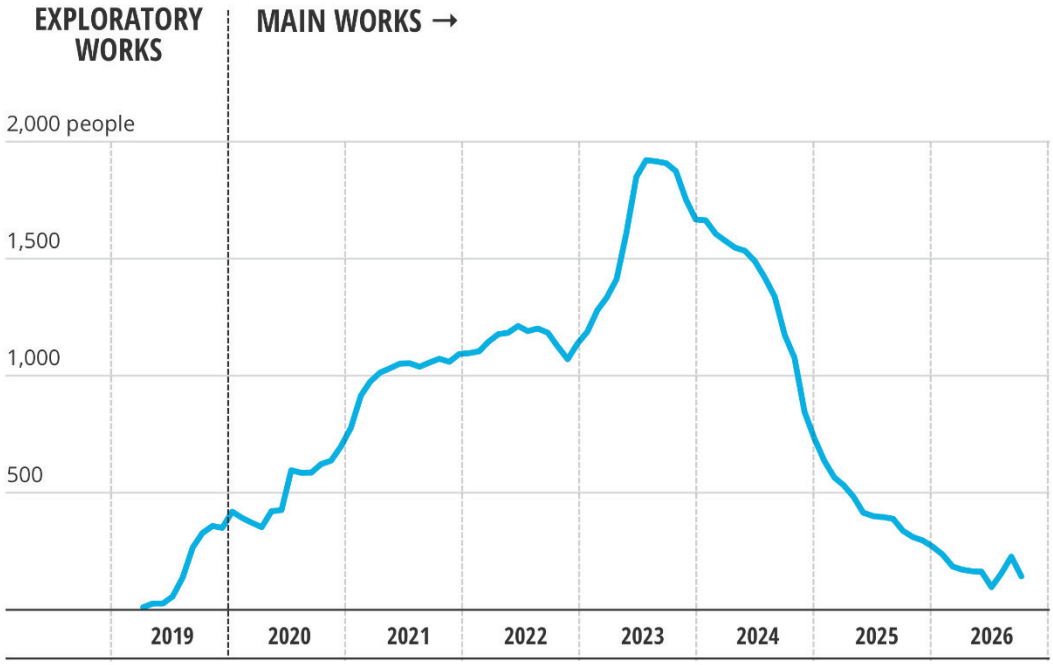


Figure 2.24 Indicative workforce histogram

The segment factory (subject to a separate application) is likely to require a workforce of about 125 people during its operation. The construction workforce for the Transmission Connection Project (subject to a separate application) is likely to require an average workforce of about 75 people.

ii Construction hours

Construction works will be undertaken 24 hours a day, seven days a week and 365 days a year. This includes all activities needed to support tunnelling and construction (eg segment production and receipt, use of batching plants and mixer trucks, and haulage of excavated material), as well as operation of accommodation camps.

2.3.8 Progressive rehabilitation

Snowy Hydro has established key principles to restore disturbed land within KNP following disturbance from the project. These include:

- preserve KNP's natural assets and values;
- agree on future land use and consider long-term site management;
- establish processes prior to construction works to engage organic matter to be used in revegetation and ongoing rehabilitation during the construction works phase;
- establish appropriate treatments for minimisation of runoff into waterways;
- protect existing native fauna and their habitats;
- rehabilitate disturbed areas to their pre-existing or improved state at completion of construction activities in consultation with NPWS; and
- minimise visual impact of construction works from significant public viewpoints.

Rehabilitation will be carried out in several phases through the construction period to achieve the desired outcome for KNP and also for Rock Forest which is outside KNP. Activities during (or prior to) construction to enhance rehabilitation will be performed, such as salvaging habitat resources and native seed collection. Other progressive rehabilitation techniques will be carried out including temporary stabilisation of batters and construction of appropriate erosion and sediment control devices, collection of seeds, sods or cuttings from appropriate plant community types (PCTs) for use in final rehabilitation.

A Rehabilitation Strategy for Snowy 2.0 Main Works has been prepared and is provided in Appendix F. This document provides information on the objectives and desired outcomes for rehabilitation activities from Snowy 2.0 Main Works.

2.4 Operation of Snowy 2.0

2.4.1 Scheme operation and reservoir management

The existing Snowy Scheme reservoir operating principles essentially aim to deliver the following:

- continue meeting the drought proofing objective of the Snowy Scheme through the required water releases for downstream water users, including the environment, of the Murray and Murrumbidgee valleys, and complying with the Snowy Water Licence;
- minimise spill from the Snowy Scheme; and
- maximise value through utilising the scheme's flexibility.

These will not change during the operation of Snowy 2.0.

Following the commencement of the operation of Snowy 2.0, both Tantangara and Talbingo reservoirs will have increased operational functions. Tantangara Reservoir will have the additional operational functions of acting as a head storage for generation from the Snowy 2.0 power station and also acting as a storage for water pumped up from Talbingo Reservoir. Talbingo Reservoir will have the additional operational function of acting as a tail storage from Snowy 2.0 generation.

Due to these additional operational functions proposed for Tantangara and Talbingo reservoirs, the short and longer term water levels in both reservoirs, as well as the rates of water level rise and fall, are expected to experience some degree of change compared to the historical operations. However:

- the water levels in both reservoirs will remain within the MOL and FSL approved for the existing Snowy Scheme;
- there will be no more water in the Snowy-Tumut Development as a whole. The flexible storage of that water across the storages within the Snowy-Tumut Development below FSL is currently approved under the EP&A Act (by virtue of the deeming provisions within the SHC Act); and
- 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 factors for change and the degree of noticeability of change are detailed further in the following sections.

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. The deemed approval is explained in more detail in Chapter 4.

2.4.2 Water storages and their continued use under Snowy 2.0

i Tantangara Reservoir

Tantangara Reservoir currently has the following operational functions within the Snowy Scheme:

- collects inflows from the Murrumbidgee River and the Goodradigbee River Aqueduct;
- provides a means for storage and diversion of water to Lake Eucumbene via the Murrumbidgee-Eucumbene Tunnel; and
- provides environmental releases through the Tantangara Dam river outlet gates to the Murrumbidgee River.

Tantangara Reservoir is a straight concrete gravity dam with active storage of 238.8 GL and gross storage of 254.1 GL, meaning the active storage (ie the amount of water available for use in the Snowy Scheme) is approximately 93.9% of the gross storage. Tantangara Reservoir has a MOL of 1,205.83 m AHD and FSL of 1,228.69 m AHD, an operating range of 22.86 m.

Due to the bathymetry of Tantangara Reservoir (which can be visualised as a cone – wide at the top and narrow at the bottom), the maximum rate of change in water levels is dependent on the water level, meaning that for the same volume of water flowing into or out of Tantangara Reservoir, the maximum rate of change in water level is more rapid when the reservoir is emptier (ie near MOL) compared to when it is at FSL.

ii Talbingo Reservoir

Talbingo Reservoir currently has the following operational functions:

- collects releases from Tumut 2 power station;
- collects inflows from the Yarrangobilly and Tumut rivers;
- acts as head storage for water pumped up from Jounama Pondage; and
- acts as head storage for generation at Tumut 3 power station.

Due to its historic relationship to both the upstream Tumut 2 power station and downstream Tumut 3 power station, Talbingo Reservoir has had more operational functions than Tantangara Reservoir in the current Snowy Scheme.

The bathymetry and storage characteristics of Talbingo Reservoir are different from Tantangara Reservoir. Talbingo Reservoir has a rated MOL of 534.35 m AHD, an FSL of 543.19 m AHD, an operating range of 8.84 m. The historic, long term average level for Talbingo Reservoir is 541.47 m AHD, which just under the FSL.

Talbingo Reservoir has an active storage of 160 GL and a gross storage of 921 GL, meaning the active storage is approximately 17.3% of the gross storage. The active storage, or operating range, is a small range of levels near the top of the reservoir, and as a result, throughout its rated operating range, Talbingo Reservoir levels have a largely linear relationship with flows, and therefore unlike Tantangara Reservoir, the maximum rate of change in water level is less dependent on where the water level is relative to MOL and FSL.

iii Continued water storage variability as part of Snowy 2.0

Under the current approved 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 reservoirs, the environmental releases required by the Snowy Water Licence as well as variations of annual flows into the existing scheme.

In operating the Snowy 2.0 power station, Snowy Hydro will move water directly (in both directions) between Tantangara and Talbingo reservoirs (rather than in only one direction via Lake Eucumbene, Tumut Pond and Tumut 2 Pondage), and as a consequence will store water at different locations in the Snowy-Tumut Development. For example, more water is likely to be held for longer (whilst still meeting existing obligations) in Tantangara than was previously diverted from Tantangara Reservoir to Lake Eucumbene.

However, there will be no more water in the Snowy-Tumut Development as a whole, and the flexible storage of that water across the storages within the Snowy-Tumut Development below FSL is currently part of the approved operation of the existing Snowy Scheme.

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.

Accordingly, no further impact assessment of any variations in storage levels in the Snowy-Tumut Development below FSL has been carried out for the purposes of this EIS.

2.4.3 Scheme infrastructure and maintenance

i Infrastructure servicing

The operation of Snowy 2.0 infrastructure requires ongoing servicing by power, communications and water. These requirements will be met by retaining select utility infrastructure established during construction, such as buried power and communication cables, as well as relevant water treatment plants and pipelines. A summary of infrastructure services provided during operation is provided in Table 2.16.

Table 2.16 Permanent infrastructure servicing requirements during operation

Servicing requirement	Purpose	Source/infrastructure provided
Electrical supply	To provide ongoing power for MAT and ECVT tunnel services (such as lighting, ventilation, groundwater pumps and surge shaft), control buildings (intake gates, MAT and cable yard) and raw water pumping infrastructure.	Permanent electrical supply will continue to be provided from Lobs Hole substation.
Communication supply	To provide communications between power station and access tunnels (MAT and ECVT), MAT control building, cable yard and control building, intake gates and control buildings.	Communication to be provided via cables installed during construction.
Raw water supply	To provide water for fire fighting at the power station, MAT and portal and the ECVT, and water source for treatment to potable standard.	Raw water will be sourced from Talbingo Reservoir via buried pipelines and water inlet established during construction.
Potable water supply	To provide potable water to the MAT portal building and the underground power station for staff facilities.	Water treatment plant at the MAT portal (established during Snowy 2.0 Exploratory Works). The plant receives water from the raw water supply system.

ii Maintenance requirements

Maintenance activities required for Snowy 2.0 will be integrated with the maintenance of the existing Snowy Scheme. Maintenance activities that will be required include:

- maintenance of equipment and systems within the power station complex, intake structures, gates and control buildings;
- maintenance of access roads (vegetation clearing, pavement works, snow clearing);
- dewatering the headrace and tailrace tunnel (estimated once every 15 to 50 years, or as required); and
- maintenance of electricity and communications infrastructure (cables, cable yard, cable tunnel).

iii Permanent access for operation and maintenance

Permanent access to Snowy 2.0 infrastructure is required. During operation, a number of service roads established during construction will be used to access surface infrastructure including the power station's ventilation shaft, the water intake structures, and the headrace tunnel surge shaft. Permanent access tunnels (the MAT and ECVT) will be used to enter and exit the power station. For some roads, permanent access by Snowy Hydro will require restricted public access arrangements. These arrangements are described in Section 2.5.

2.5 Interactions with Kosciuszko National Park

2.5.1 Final rehabilitation of disturbed areas within KNP

i Final land uses

The Rehabilitation Strategy developed for Snowy 2.0 has developed final land use domains characterised by similar final land use objectives. Each final land use domain will require site-specific decommissioning and rehabilitation methods. Table 2.17 provides a summary of the final land use domains with these shown on Figure 2.26 to Figure 2.31.

Table 2.17 Final land use domains

Domain	Description
Retained infrastructure	• Water intake structures at Talbingo and Tantangara reservoirs. • Permanent access tunnel portals and associated infrastructure including the MAT and ECVT. • Ventilation shaft and headrace tunnel surge shaft at Marica. • Transmission cableyard at the ECVT portal. • Lobs Hole substation and associated power and communication cables between operational infrastructure.
Roads	New access roads or those which are upgraded, widened and sealed will be retained with agreement from NPWS. These roads will remain open to the public post-construction and will enable access to locations previously accessible by four-wheel drive.
Recreation sites	It is intended, and agreed with NPWS, that Lobs Hole and Tantangara areas will be retained as remote campsites.
Native vegetation	Areas will be revegetated and returned to a native vegetation final land use. The species used for each area will be commensurate with that present prior to disturbance as per the PCTs mapped for the area. Areas to be rehabilitated to native vegetation will include rehabilitated access roads.
Water management	The Talbingo and Tantangara reservoirs will remain as water storages that will continue to allow fishing and boating. Appropriate safety exclusion zones will be put in place in the vicinity of the intake structures.

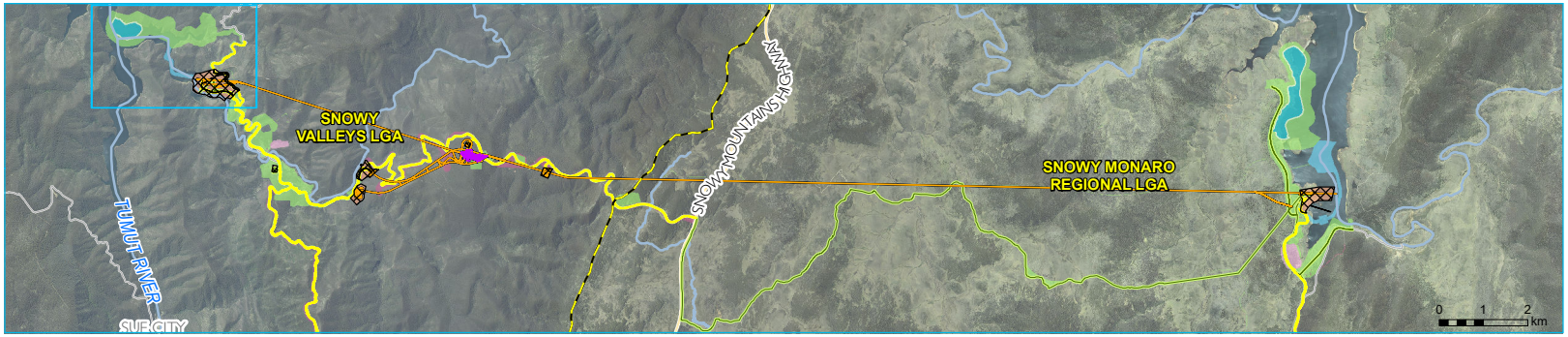
ii Landform design

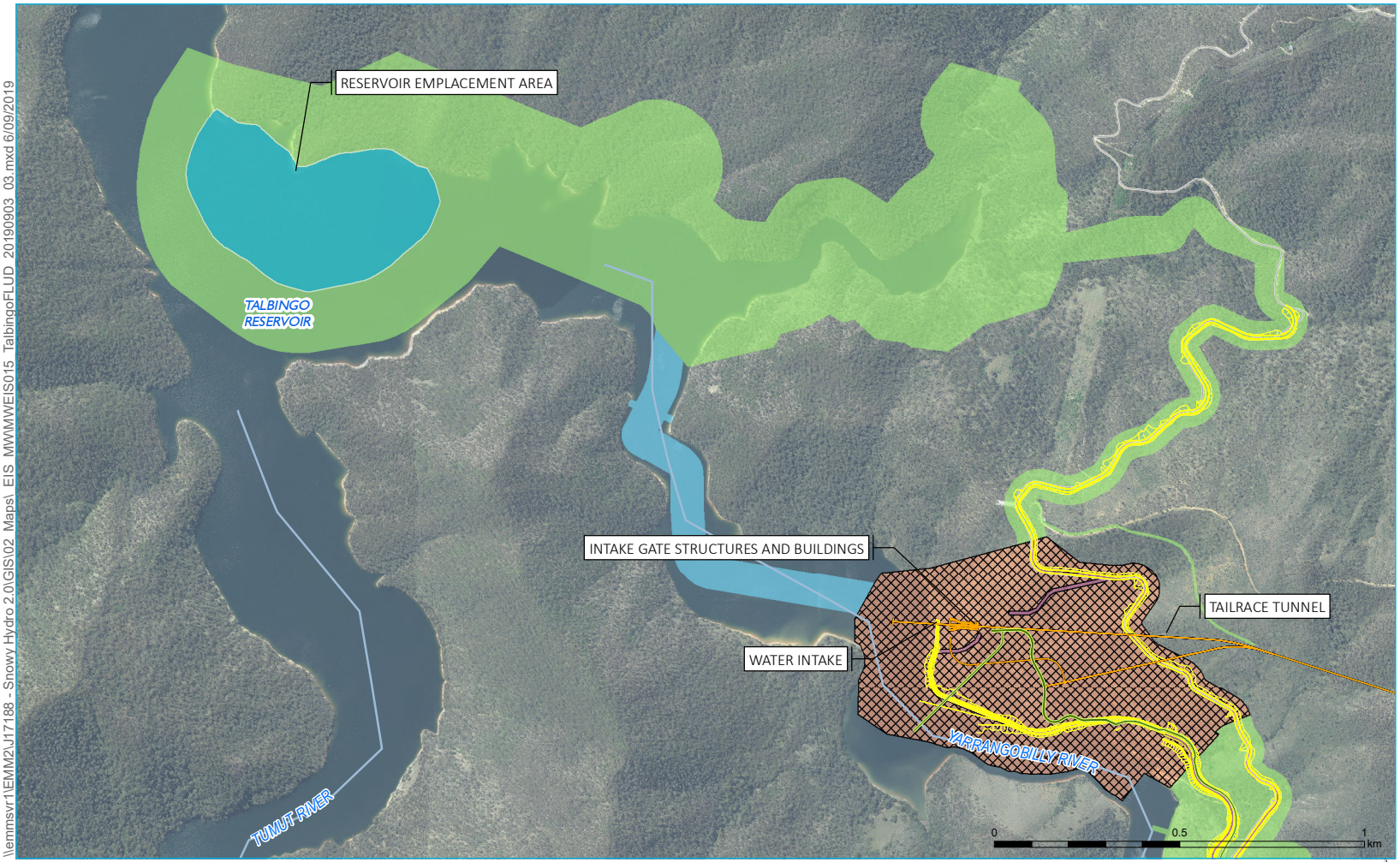
Final landform design and planning has been carried out to identify opportunities for the reuse of excavated material in rehabilitation and in construction of final landforms which complement the surrounding landscape of KNP and provide recreational opportunities for users of KNP where appropriate. Reuse of excavated material in the final landform will be subject to geochemical testing to confirm it is suitable to remain in situ. Any unsuitable materials will be remediated and removed from the areas to be rehabilitated. An example of potential landforming activities at Lobs Hole is presented in Figure 2.25.

Artist impression: Possible rehabilitation optimised for recreational use

Artist impression: Profile of indicative re-shaping and landforming optimised for recreational use

Figure 2.25 Indicative rehabilitated landform of the Lobs Hole area post construction of Snowy 2.0 Main Works





KEY

- Operational footprint

Final land use domain

- A - Retained infrastructure
- B - Upgraded roads
- C - Recreation sites
- D - Native vegetation
- E - Water management

Existing environment

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

Snowy 2.0 Main Works operational elements

- Tunnels, portals, intakes, shafts
- Power station
- Utilities
- Permanent road
- Indicative rock emplacement area

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MWMWEIS015 TalbingoFLUD 20190903 03.mxd 6/09/2019

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

GDA 1994 MGA Zone 55

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Talbingo Reservoir - final land use domains

Snowy 2.0
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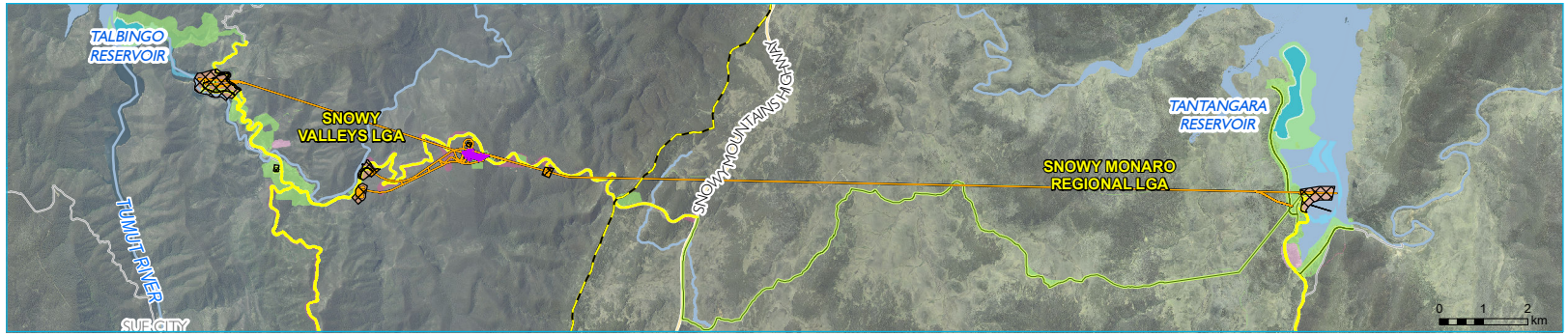
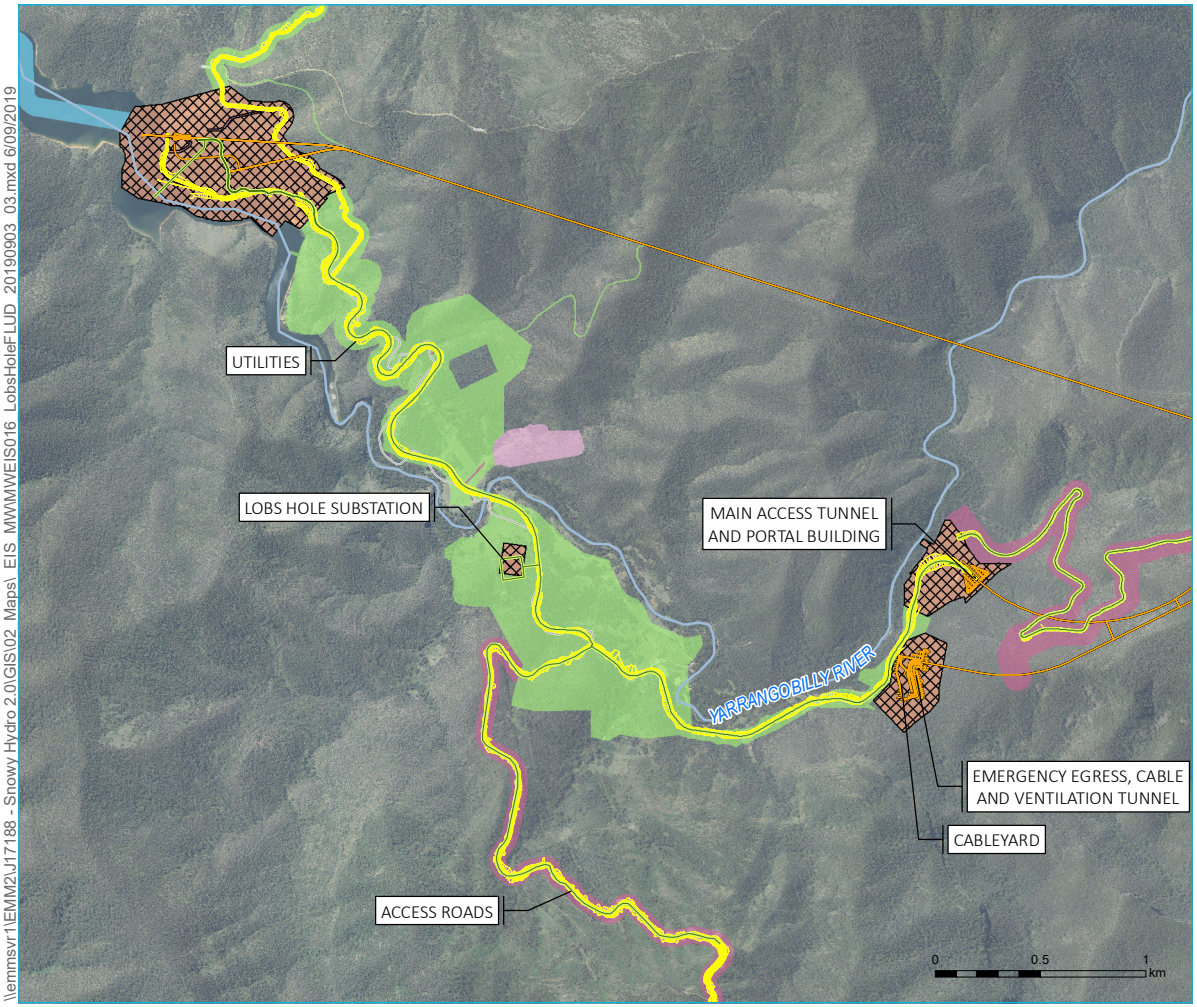
Figure 2.26

snowy 2.0

EMM creating opportunities





KEY

- Operational footprint

Final land use domain

- A - Retained infrastructure
- B - Upgraded roads
- C - Recreation sites
- D - Native vegetation
- E - Water management

Existing environment

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

Snowy 2.0 Main Works operational elements

- Tunnels, portals, intakes, shafts
- Power station
- Utilities
- Permanent road
- Indicative rock emplacement area

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MWMWEIS016 LobsHoleFLUD 20190903 03.mxd 6/09/2019

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

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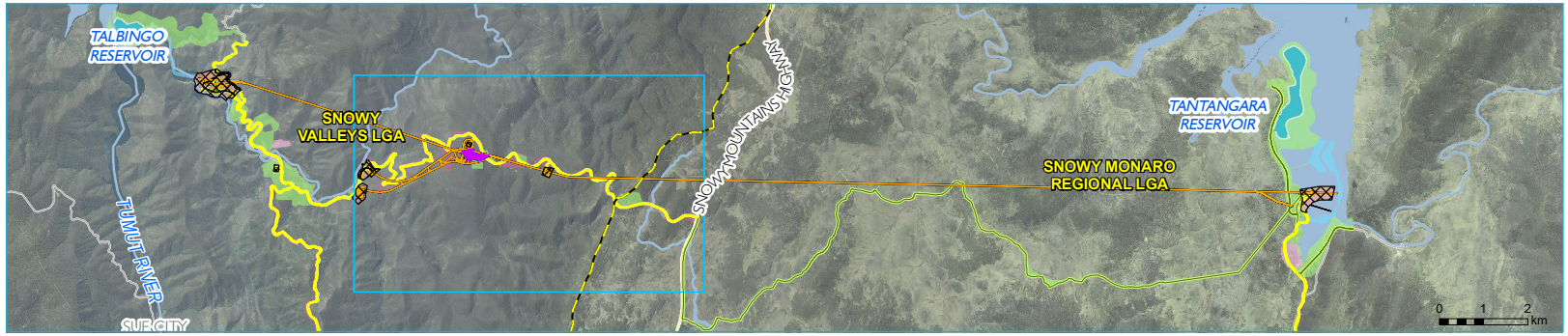
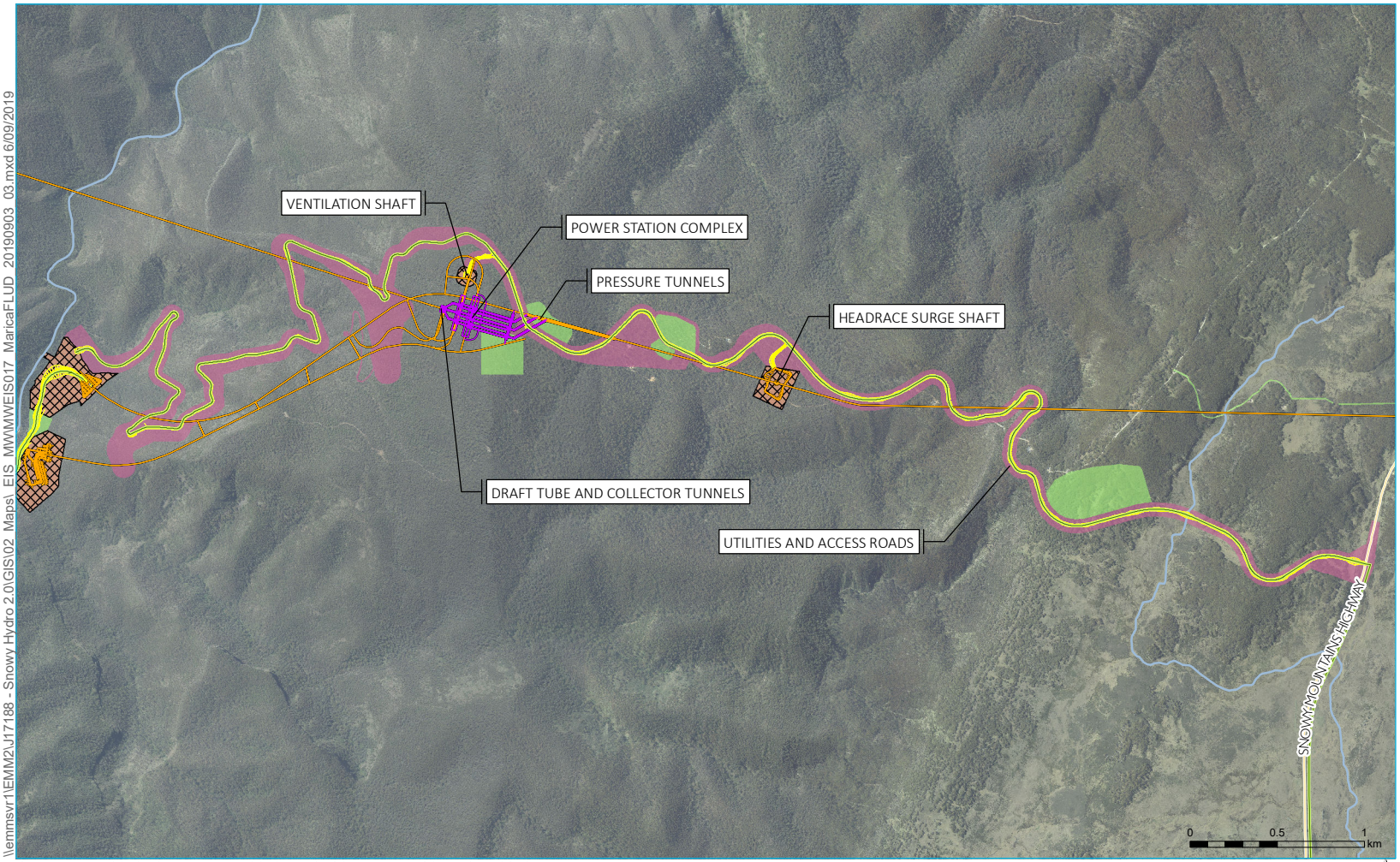
Lobs Hole - final land use domains

Snowy 2.0
Environmental Impact Statement
Main Works
Figure 2.27

snowy 2.0

EMM creating opportunities





KEY

Operational footprint

Final land use domain

- A - Retained infrastructure
- B - Upgraded roads
- C - Recreation sites
- D - Native vegetation
- E - Water management

Existing environment

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

Snowy 2.0 Main Works operational elements

- Tunnels, portals, intakes, shafts
- Power station
- Utilities
- Permanent road
- Indicative rock emplacement area

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MWMWEIS017 MaricaFLUD 20190903 03.mxd 6/09/2019

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

GDA 1994 MGA Zone 55

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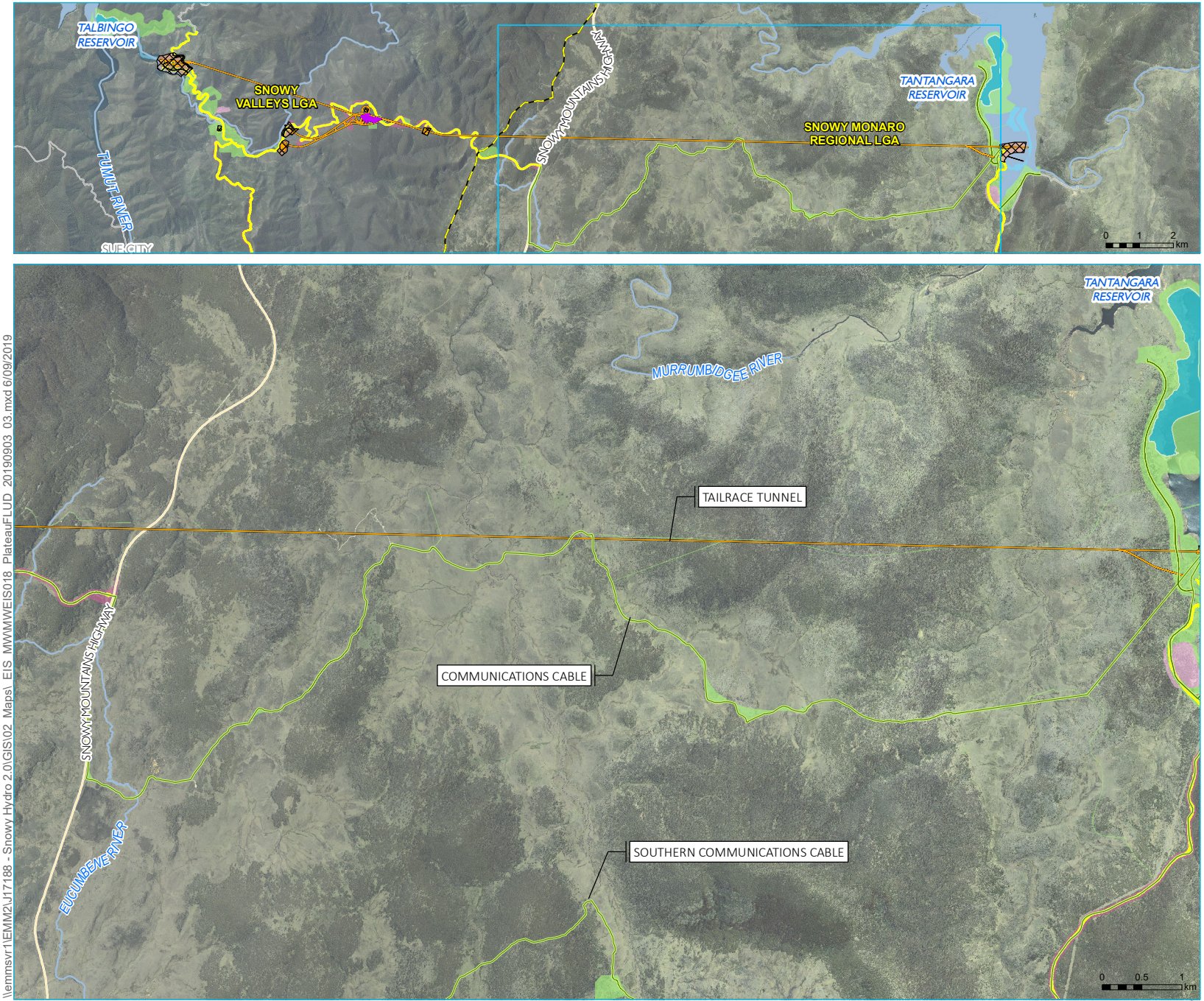
Marica - final land use domains

Snowy 2.0
Environmental Impact Statement
Main Works
Figure 2.28

snowy 2.0

EMM creating opportunities



KEY

- Operational footprint

Final land use domain

- A - Retained infrastructure
- B - Upgraded roads
- C - Recreation sites
- D - Native vegetation
- E - Water management

Existing environment

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

Snowy 2.0 Main Works operational elements

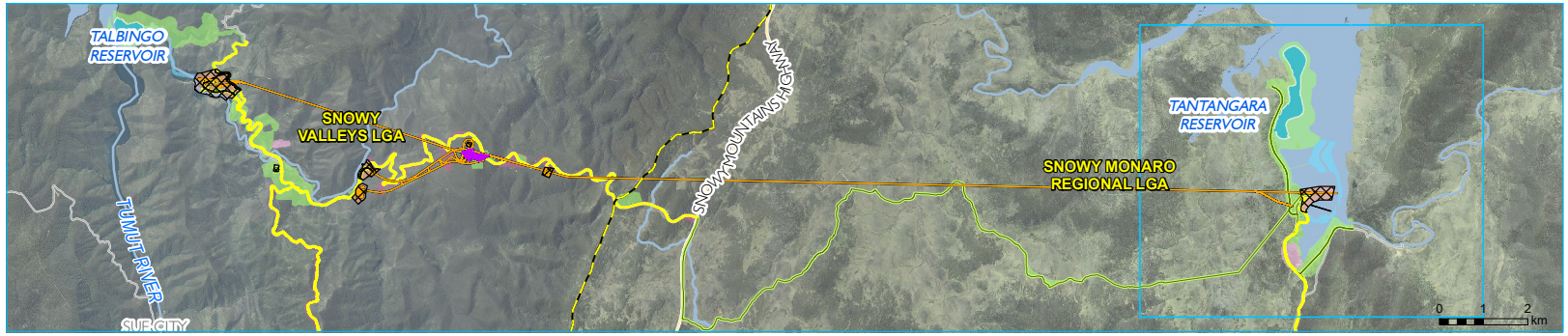
- Tunnels, portals, intakes, shafts
- Power station
- Utilities
- Permanent road
- Indicative rock emplacement area

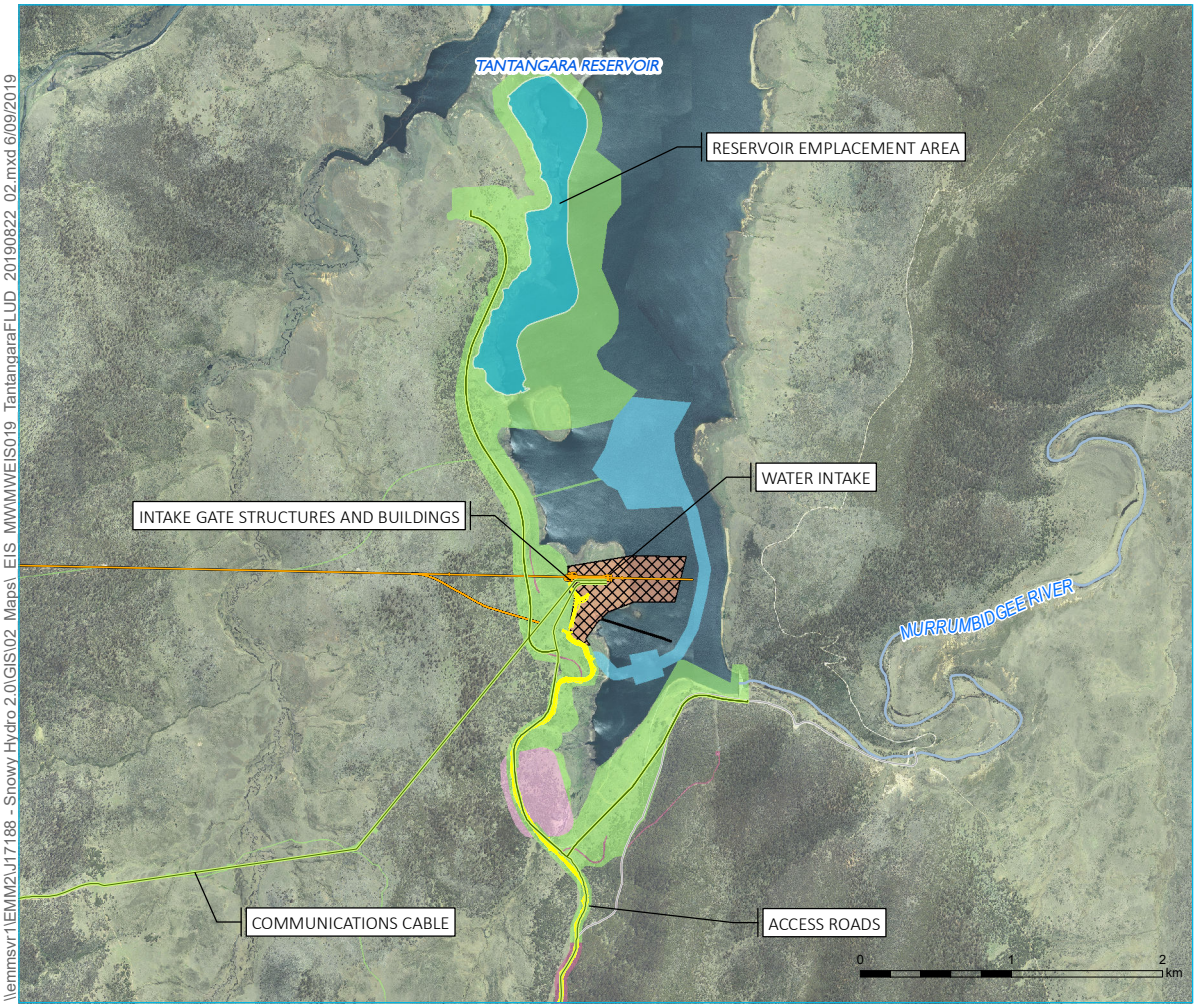
\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MWMWEIS018 PlateauFLUD 20190903 03.mxd 6/09/2019

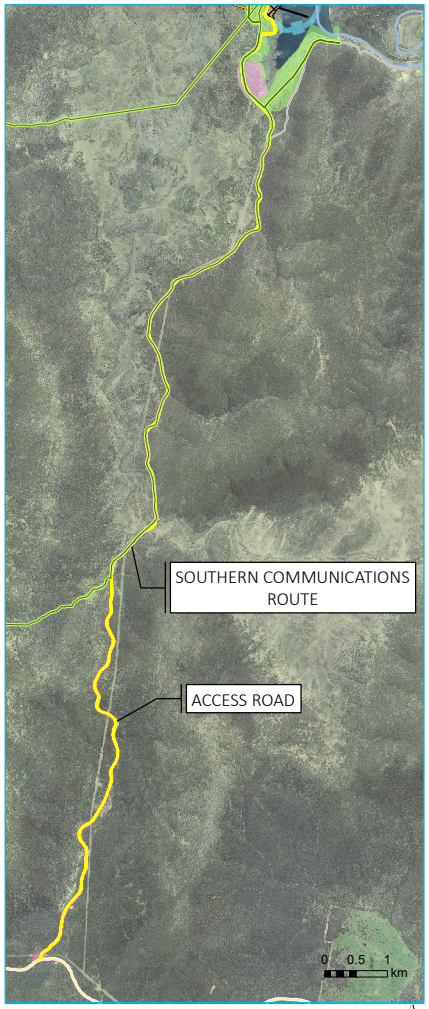
Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011); SLR (2019)

Plateau - final land use domains

Snowy 2.0
Environmental Impact Statement
Main Works
Figure 2.29







KEY

Operational footprint

Final land use domain
- A - Retained infrastructure
- B - Upgraded roads
- C - Recreation sites
- D - Native vegetation
- E - Water management

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

Snowy 2.0 Main Works operational elements
- Tunnels, portals, intakes, shafts
- Power station
- Utilities
- Permanent road
- Indicative rock emplacement area

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MWMWEIS019 TantangaraFLUD 20190822 02.mxd 6/09/2019

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

GDA 1994 MGA Zone 55

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Tantangara Reservoir - final land use domains

Snowy 2.0
Environmental Impact Statement
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Figure 2.30

snowy 2.0

EMM creating opportunities

KEY

Operational footprint

Final land use domain

- A - Retained infrastructure
- B - Upgraded roads
- C - Recreation sites
- D - Native vegetation
- E - Water management

Existing environment

- Main road
- Local road
- Watercourse

Snowy 2.0 Main Works operational elements

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

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MWMWEIS020 RockForestFLUD 20190822 02.mxd 6/09/2019

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

GDA 1994 MGA Zone 55

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Rock Forest - construction areas, purpose and description

Snowy 2.0
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Main Works
Figure 2.31

snowy 2.0

EMM creating opportunities

iii Completion criteria

Following completion of construction of Snowy 2.0 Main Works, rehabilitation of disturbed areas will continue and be measured against established completion criteria as outlined in the Rehabilitation Strategy. Completion criteria are objective target levels or values assigned to a variety of indicators (eg slope, species diversity, groundcover) which can be measured against to demonstrate progress and the ultimate success of rehabilitation. As such, they provide a useful and defined end point at which time rehabilitation can be deemed successful.

Indicative completion criteria, performance measures and associated indicators have been developed for Snowy 2.0 Main Works by rehabilitation specialists with experience in alpine environments and are provided in the Rehabilitation Strategy in Appendix F. These criteria have been developed for each phase of the rehabilitation so that the rehabilitation success can be quantitatively tracked throughout the life of the project. The performance measures and associated indicators will be designed to provide an appropriate benchmark or guide against which to assess the management of project lands and the resulting improvements.

iv Recreational areas

Snowy Hydro will liaise closely with NPWS to determine the final end land use and the extent of decommissioning of temporary construction facilities and rehabilitation activities to be undertaken following the 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 and be consistent with the KNP PoM (NPWS 2006).

Following Snowy 2.0 Main Works, the Talbingo and Tantangara reservoirs will continue to be used for boating and fishing, however safety exclusion zones will be put in place in the vicinity of the intakes. The extent of safety exclusion zones is unknown at this stage and will be determined during the detailed design. Remote camping areas will be retained in the Lobs Hole and Tantangara areas for recreational use. These areas will either be retained or they will be recreated during rehabilitation if they are disturbed during construction activities. Following the construction of Snowy 2.0, temporary construction pads, accommodation camps, rock emplacements and some access roads, will be rehabilitated to land uses generally consistent with their pre-construction use, subject to ongoing consultation with NPWS.

Detailed design will follow the principles and concepts in this strategy to achieve stable non-polluting landforms and recreational areas consistent with the final land use domains.

2.5.2 Public access and recreational activities

i Water access

During construction of Snowy 2.0, public access to some areas of Talbingo and Tantangara reservoirs will be restricted. In Talbingo Reservoir, areas near the construction of the intake and excavated rock emplacement, including the Yarrangobilly Arm will be restricted from the public for safety reasons. Public access will be maintained in all other areas of the reservoir. Public access will also be restricted in areas near the construction of the intake and excavated rock emplacement for safety reasons.

Boat access at Tantangara Reservoir is from a public boat launching area in the south of the reservoir, accessed from Tantangara Road. However, this area will be closed to the public during construction. The barge launch area to be constructed for Snowy 2.0 Main Works will be retained and, subject to consultation with NPWS, available for public use. Boats are also currently free launched by recreational users in northern areas of Tantangara Reservoir, subject to operating water levels. It is anticipated that boat launching from these areas will continue to be available to the public during construction of Snowy 2.0 Main Works.

The operation of Snowy 2.0, either through generating or pumping mode, will result in higher velocities of water and conditions generally in the vicinity of the intakes in Talbingo and Tantangara reservoir. Public safety exclusion zones will be implemented near the intakes which will be identified by markers and/or signage.

Post-construction of Snowy 2.0 Main Works, public boat access will be maintained at both Talbingo Reservoir (at the public boat ramp in the northern end of the reservoir and at Sue City to the south) and Tantangara Reservoir (at the southern end).

ii Road access

To facilitate construction, some new roads will be constructed and existing tracks will be upgraded to provide permanent access to the new facilities such as Tantangara and Talbingo intake structures and the underground power station complex.

During construction, some existing roads will need to be closed to the public for safety reasons. During construction, Tantangara Road will be closed while it is upgraded and when any high risk activities are being undertaken (eg transport of oversized equipment and heavy periods of activity). Access along Tantangara Road will be maintained at other times with measures in place (such as vehicle escort and traffic controls) to achieve the required level of safety.

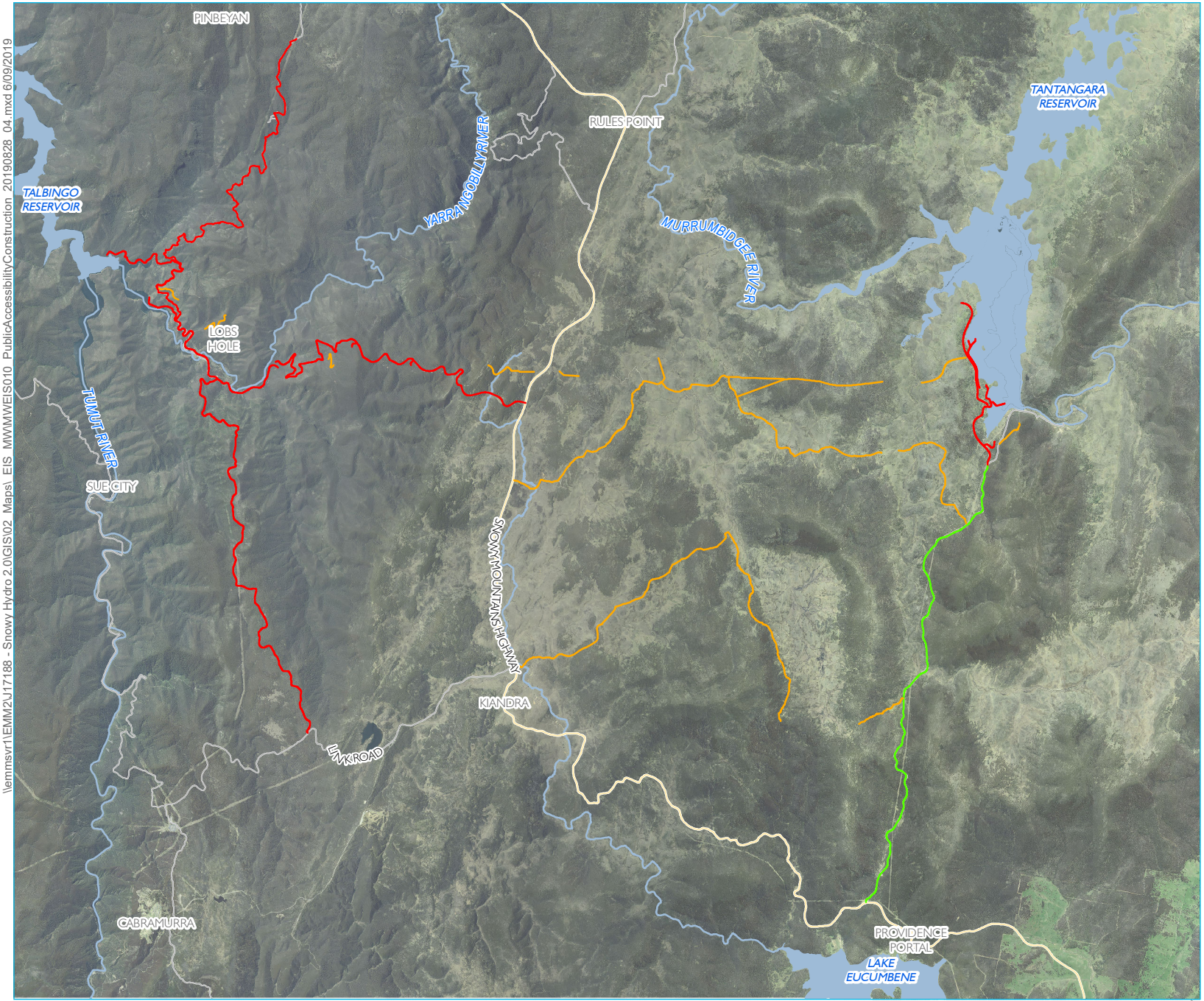
Once Snowy 2.0 is commissioned, some roads may need to remain restricted or closed to public access. Table 2.18 and Figure 2.32 and Figure 2.33 provide a summary of public access during the construction of Snowy 2.0 Main Works and once it has been finished.

Table 2.18 KNP road infrastructure changes and access arrangements summary

Road name	Project use	Current condition	Construction upgrade	Public access during construction	Final condition	Long term public access (post-construction)
Lobs Hole Ravine Road (south)	Provide suitable and permanent access to the main construction area (Lobs Hole) and the portals to access the power station complex	Single lane, gravel track	Dual lane, gravel road with new alignment	SHL access only	Dual lane, sealed road	✓
Mines Trail Road	Provide suitable and permanent access to the portals and power station complex	Dual lane, gravel road and bridge over Wallaces Creek to access MAT portal (as approved under Snowy 2.0 Exploratory Works)	No further upgrade	SHL access only	Dual lane, sealed road	✓ (SHL only for MAT and ECVT access)
Lobs Hole Road	Provide suitable and permanent access to the main construction area (Lobs Hole)	Dual lane, gravel road and bridge over Yarrangobilly Road (as approved under Snowy 2.0 Exploratory Works)	No further upgrade	SHL access only	Dual lane, gravel road	✓
Lobs Hole Ravine Road (north)	Provide suitable and permanent secondary access and emergency egress from main construction area (Lobs Hole)	Single lane, 4WD track	Single lane, 4WD track with minor work to providing turning areas at some locations	✓ (first 5 km)	Single lane, 4WD track	✓
Marica Trail/Marica Trail west	Provide suitable and permanent access to headrace surge structure and ventilation shaft building	Dead end, single lane, 4WD track	Single lane, gravel road extended to Mines Trail Road at MAT portal	SHL access only	Dual lane, gravel road	✓ (SHL only section between MAT and surge)
Wharf Road/ Pipeline Road	Provides suitable and permanent access to Talbingo intake, gate structure and wharf	-	New road, dual lane, gravel road	SHL access only	Dual lane, gravel road	SHL access only
Talbingo Excavated Rock Emplacement Access Road	Provides suitable access to the excavated rock emplacement area	-	Dual lane, gravel road	SHL access only	Rehabilitated	NA

Table 2.17 KNP road infrastructure changes and access arrangements summary

Road name	Project use	Current condition	Construction upgrade	Public access during construction	Final condition	Long term public access (post-construction)
Tantangara Road	Provide suitable access to the construction area at Tantangara	Single lane, gravel road	Dual lane, gravel road	✓ (limited, facilitated access)	Dual lane, gravel road	✓
Tantangara Camp Road	Provide suitable access to the construction area, excavated rock emplacement area and accommodation camp at Tantangara	Undefined 4WD tracks	Dual lane, gravel road	SHL access only	Rehabilitated	NA
Tantangara Excavated Rock Emplacement Access Road	Provide suitable access to excavated rock emplacement area	Undefined 4WD tracks	Dual lane, gravel road	SHL access only	Rehabilitated	NA
Quarry Trail	Provide suitable and permanent access to Tantangara intake	Single lane, gravel track	Dual lane, gravel road	SHL access only	Dual lane, gravel road	✓ (SHL only access to intake)
Gooandra/Bullock/Tantangara Dam fire trails	Provide suitable access for installation of communications cables	Single lane, gravel track	Single lane, gravel track with some minor works to allow for passing bays	SHL access only	Single lane, gravel track	✓
Link Road	Provide suitable and permanent access to the main construction area (Lobs Hole)	Dual lane, sealed	Dual lane, sealed with widening to 6 m in some areas	✓	Dual lane, sealed road	✓
Snowy Mountains Highway	Provide suitable and permanent access to all construction areas	Dual lane, sealed	No work anticipated as part of Snowy 2.0 Main Works	✓	Dual lane, sealed road	✓



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KEY

Restricted access
- No access during construction
- Temporary/short-term closure during construction
- Facilitated access during construction

Existing environment
- Main road
- Local road
- Watercourse
- Waterbodies

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

Public accessibility during construction

Snowy 2.0
Environmental Impact Statement
Main Works
Figure 2.32

snowy 2.0

EMM creating opportunities

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KEY

Restricted access post-construction

- Access tracks rehabilitated on project completion
- Full access reinstated
- Partial access - no public access to infrastructure areas
- No public access

Existing environment

- Main road
- Local road
- Watercourse
- Waterbodies

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

0 2.5 5 km

GDA 1994 MGA Zone 55

N

Public accessibility during operations

Snowy 2.0
Environmental Impact Statement
Main Works
Figure 2.33

snowy 2.0

EMM creating opportunities

CHAPTER 3

STRATEGIC CONTEXT

3 Strategic Context

The strategic context of Snowy 2.0 relates to its critical significance for the NEM, key State and Commonwealth government plans and policies, and economic, social and environmental trends driving change in the energy market. It is also important to understand the context in which the project will be constructed and operate, Kosciuszko National Park - an alpine national park with environmental and social values.

During the Feasibility Study for Snowy 2.0 and in the lead up to its FID, MJA carried out independent market modelling to understand upcoming trends and the future NEM in which Snowy 2.0 will operate. The findings of these studies confirm the strategic justification and need for Snowy 2.0 to provide large-scale storage that facilitates firming and reliability to the NEM, as the NEM decarbonises over the next few decades.

While the MJA modelling in the lead up to FID in late 2018 is still very relevant and underpins the strong economic case for the project -since this time, the energy market has evolved and changed much more quickly than originally anticipated even just a year ago. The likelihood of coal-fired generators closing earlier than previously anticipated is increasing (Aurora Energy Research 2019) and concurrently, the rapid uptake of intermittent renewables due to favourable economics is changing the energy market landscape. For example, investment in large-scale renewable energy projects doubled in 2018 compared to a previous record-breaking 2017, increasing from $10 billion to $20 billion (Clean Energy Council 2019).

The strategic context of Snowy 2.0 is summarised in this chapter, with further information also provided at Appendix H.

3.1 A changing energy system and market

3.1.1 National electricity market

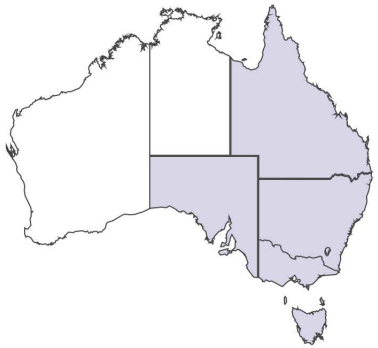
The NEM involves the wholesale generation of electricity from coal, gas and renewable sources that is transported via high voltage transmission lines from generators to local distributors. From the distributors, it is converted to low voltage electricity and delivered to almost 10 million homes and businesses across the Australian eastern and south eastern seaboard. The NEM delivers around 80% of all electricity consumption in Australia.

The NEM operates on one of the world's longest interconnected power systems and connects five regional market jurisdictions – Queensland, NSW (including the Australian Capital Territory), Victoria, South Australia, and Tasmania (as shown in Figure 3.1). The NEM has over 300 registered industry participants which include market generators, transmission network service providers, distribution network service providers and market customers.

The NEM is a wholesale commodity exchange for electricity across the five regional markets. As electricity cannot currently be stored easily, the NEM works as a 'pool', or spot market, where power supply and demand across all jurisdictions is matched instantaneously in real time through a centrally coordinated dispatch process.

The spot market is managed by a set of procedures that is managed on a five minute basis by AEMO, where generators offer to supply the market with specified amounts of electricity and AEMO decides which generators will be deployed to produce electricity, with typically the cheapest generator put into operation first. NEM operation is designed to meet electricity demand (or consumption) in the most cost-efficient way.

The NEM and how it works



There are over **300** registered participants such as generators, retailers & distributors in the NEM

States/Territories that form the NEM

40,000 km
of transmission lines and cables.

80%
of all electricity used in Australia is delivered via the NEM

9 million
customers

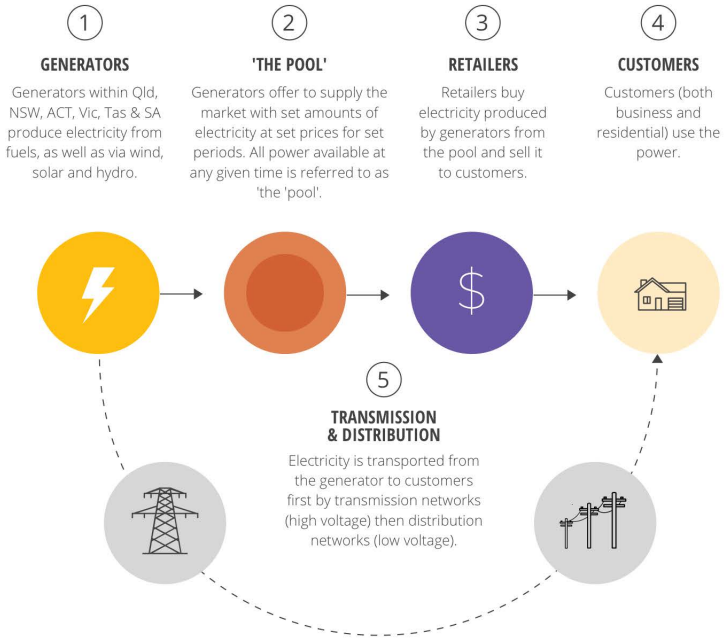


Figure 3.1 **National Electricity Market**

3.1.2 Planning policies driving change and regulation

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. These challenges create a need for more energy storage within NSW and the NEM.

This energy transition towards renewables is driven by rapidly decreasing costs of wind and solar technologies as well as legislation and several strategic plans and policies set out by the Australian Government and States in the interconnected NEM.

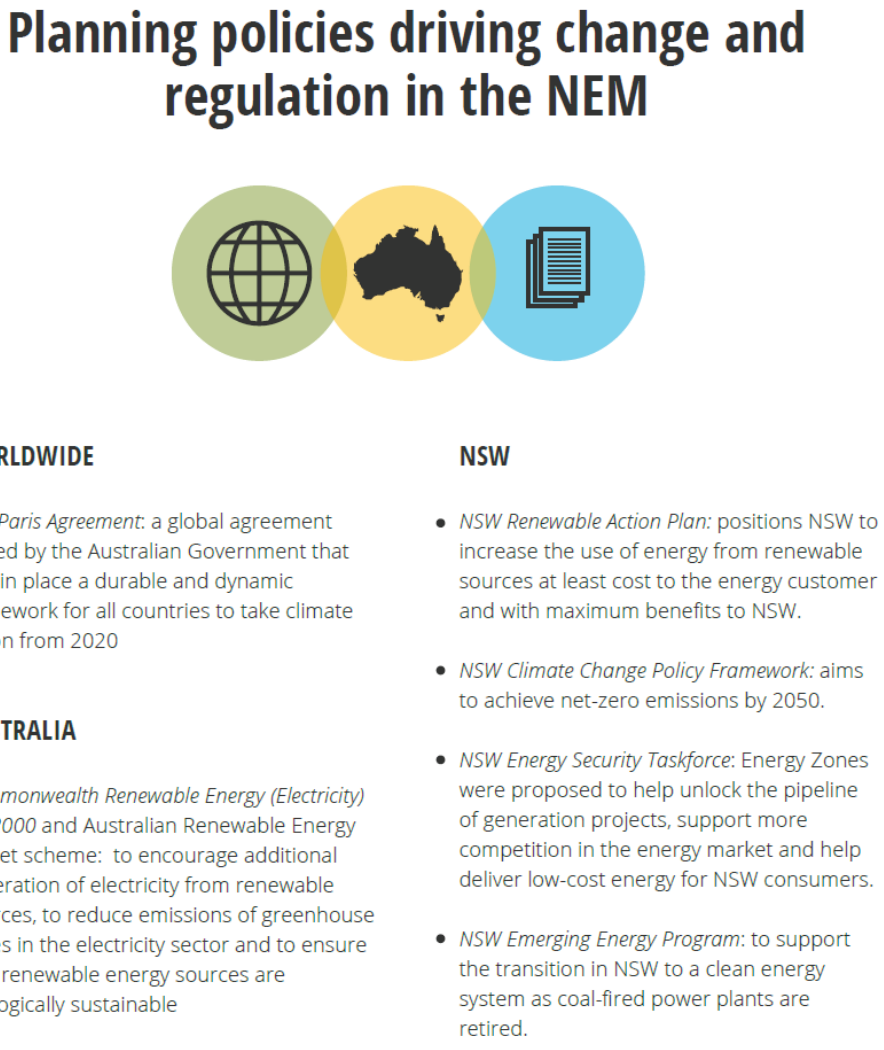


Figure 3.2 Relevant planning policies and regulation

3.1.3 Technological, economic and social trends

Currently, coal-powered generation accounts for approximately 77% of the annual generation of electricity within the NEM, with gas (9%), water (8%) and wind (5%) contributing the majority of the remainder. Solar and other generators (including biomass generators) currently account for approximately 1% of generation within the NEM (https://www.aemo.com.au/). Key system changes and operational challenges for the NEM are shown in Figure 3.3.

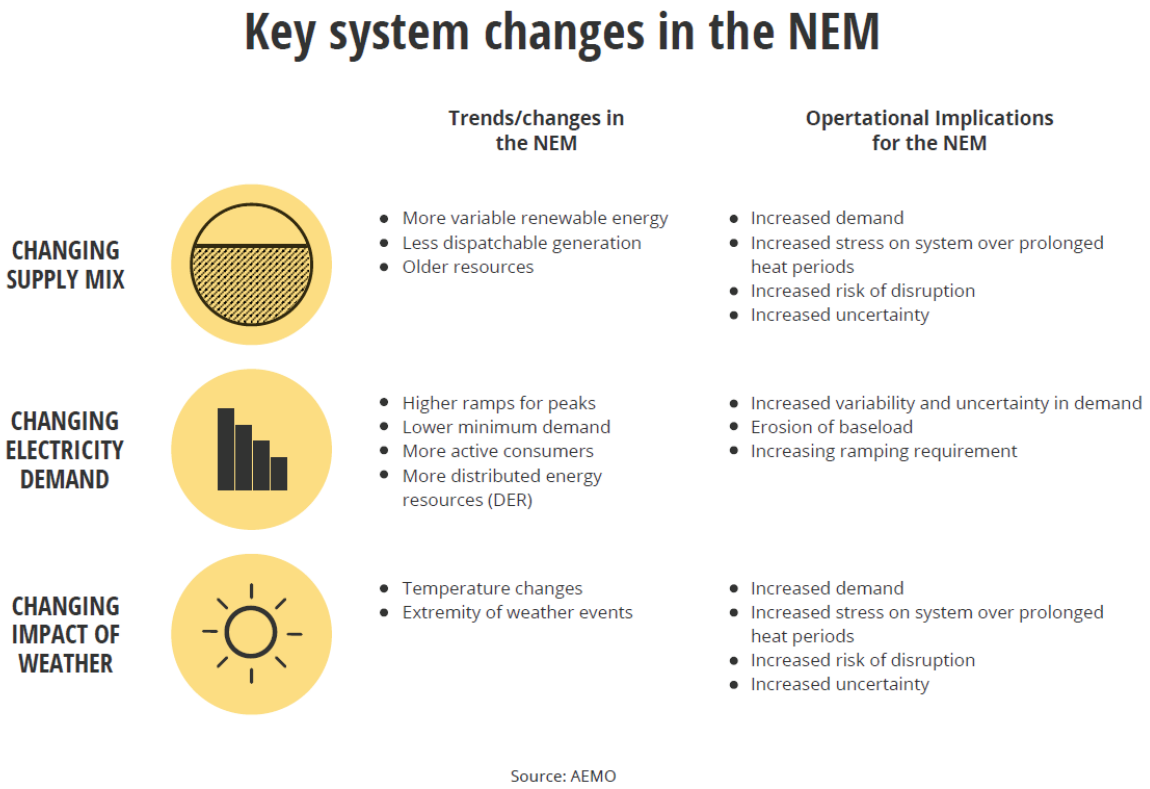


Figure 3.3 Key system changes and operational challenges

As with many electricity markets around the world, the NEM is undergoing a paradigm transformation that has been brought about by significant shifts in energy efficiency, rapidly decreasing costs of wind and solar generation (known as variable renewable energy or VRE), coal power station retirements, increasing coal and gas costs and Australia's participation in global commitments to reduce carbon emissions (ie Paris Agreement).

Amongst the participants of the NEM, NSW is likely to have one of the greatest requirements for energy replacement and capacity, as several coal-fired power plants are confirmed to be retired. As the likelihood of new coal-fired power stations is considered to be low, much of the replacement of coal-powered generation will be from renewable sources and to a lesser extent gas. Figure 3.4 shows the projected evolution of the generation mix in the NEM to 2040, demonstrating both the increase in forecast generating capacity within the NEM and the shift from coal to renewable energy.

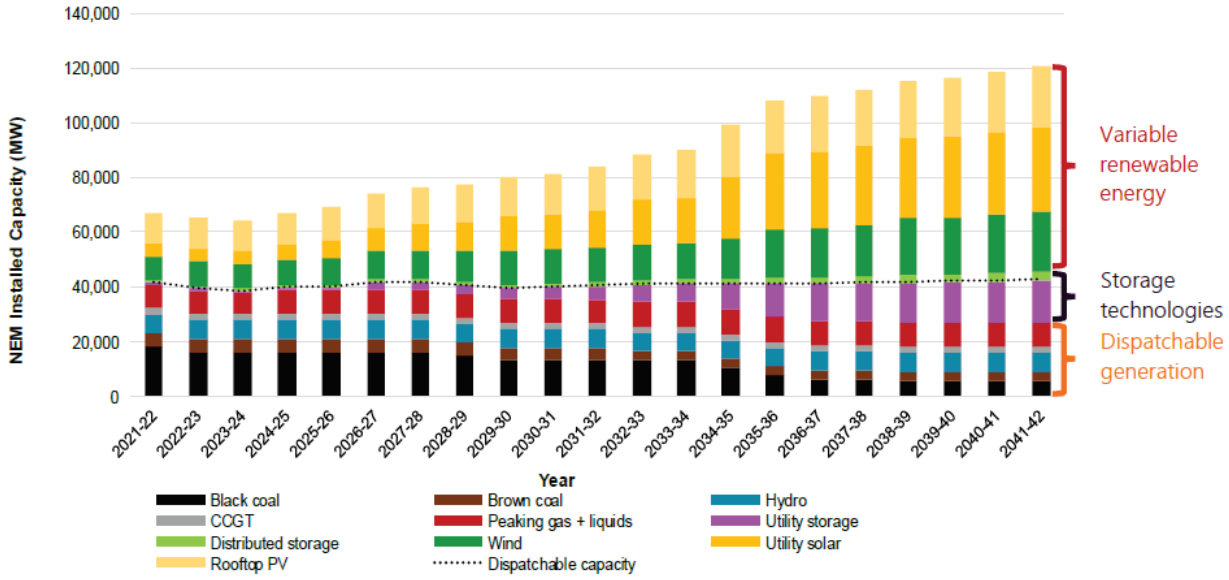


Figure 3.4 Forecast NEM generation capacity (AEMO 2019)

3.1.4 Security, reliability and resilience

In the NEM, changes in technology, costs, policy and customer preferences are occurring at a rapid rate. As energy generation needs to balance with customer demand in real time, the integration of intermittent generation will require increased peaking generation and energy storage solutions to provide a sufficiently fast response capacity and to 'time shift' non-dispatchable renewable generation to those periods when it is needed. The requirements for the NEM include storage that can provide energy for consecutive days (MJA 2018a).

While VRE provide energy during model conditions, the challenge for these sources are during prolonged wind and/or solar droughts when they would not operate. Energy storage helps build power system resilience to weather events (including wind, solar, and hydro droughts) by storing surplus renewable generation for use at times when these resources are scarce and allowing more constant operation of less flexible existing generation. This, in turn, creates a more dispatchable and reliable power system, while helping to keep prices down for consumers. This concept is shown in Figure 3.5.

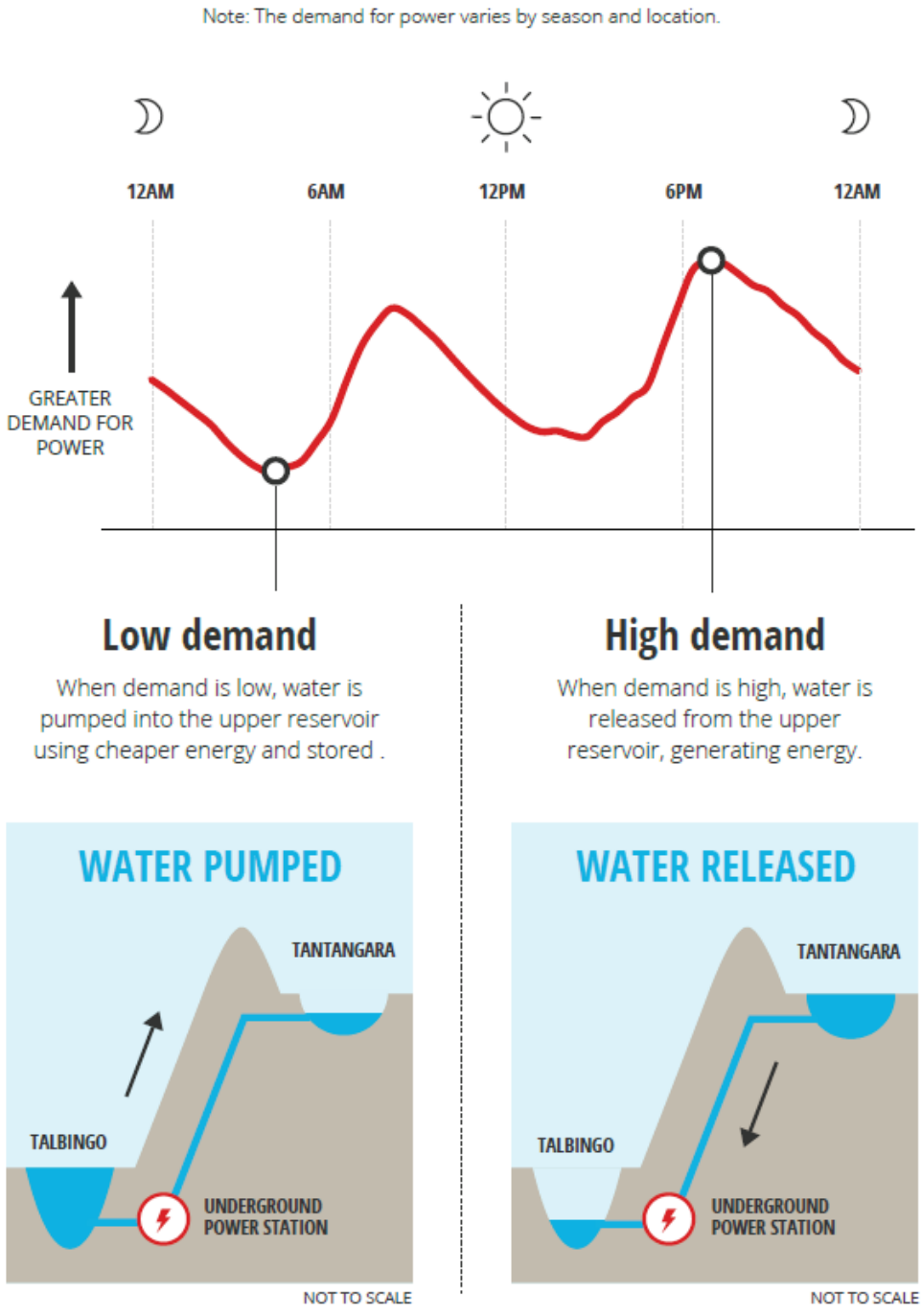


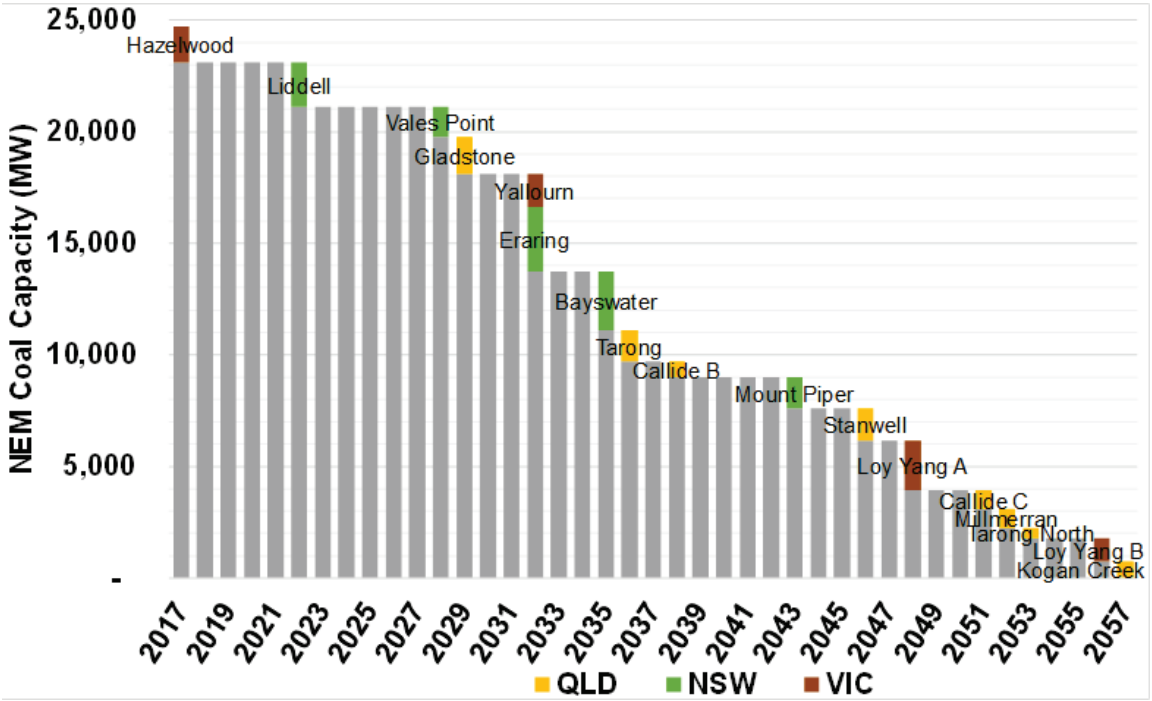
Figure 3.5 Snowy 2.0 operational phases responding to daily power demand

A large pumped hydro system such as Snowy 2.0 (with approximately 350,000 MWh of energy storage) can provide significant energy storage capable of delivering large-scale generation within minutes in times when VRE and / or other generation output is low.

3.2 Need and benefits of Snowy 2.0

As Australia decarbonises, Snowy 2.0 is required to support an orderly transition, prevent blackouts and put downward pressure on energy prices. Snowy 2.0 provides new dispatchable energy generation with large-scale storage to provide secure and reliable energy to the NEM at the lowest cost, which ultimately benefits consumers.

Snowy 2.0 will play a crucial role in providing long term storage and dispatchable generation that can fill and firm the energy void left from the exit of fossil fuel generation. As recognised by the NSW Government in its submission to AEMO (NSW Government 2018), the expected retirement of ageing coal-fired power stations over the next 10 to 15 years combined with increasing demand for energy at peak times will put pressure on the future energy system and require development of replacement firming energy capacity and dispatchable generation. Figure 3.6 shows the current assumptions regarding the closure of these coal-fired generators, with NSW, one of the NEM regions with the greatest scale of age-driven retirements (AEMO 2018). However, as previously discussed, the market has continued to change at a fast pace with an increasing risk that coal-fired generating assets retiring earlier than previously anticipated, placing further pressure on the need to develop replacement firming capacity and dispatchable generation.



Source: MJA S2.0 FID Modelling; technical life basis

Figure 3.6 NEM coal-fired power station operating life (AEMO 2018)

3.2.1 Need for Snowy 2.0 in the NEM

An independent study was carried out by MJA on the operation of Snowy 2.0 in the NEM. The study involved modelling of the NEM with and without Snowy 2.0 for a number of future market scenarios. A detailed account of the methodology and the findings of the study are documented in a detailed report (MJA 2018).

The study included the modelling of the NEM over the period 2018/19 to 2074/75. Further, the modelling was required to properly represent the hourly/daily/weekly/seasonal variations that are fundamental to the operation of generators in the NEM. For each scenario modelled, the impact on the NEM was determined by considering a case where Snowy 2.0 is developed and where Snowy 2.0 is not developed.

As previously discussed, the MJA modelling, whilst carried out in 2017 and 2018, is still very relevant – however, the energy market is evolving and changing much more quickly than originally anticipated even just a year ago. The likelihood of coal-fired generators closing earlier than previously anticipated is increasing (Aurora Energy Research 2019) and concurrently, the rapid uptake of intermittent renewables due to favourable economics is changing the energy market landscape, further underpinning the need for Snowy 2.0.

i The NEM without Snowy 2.0

In the absence of Snowy 2.0, the study concluded the replacement of coal power stations with VRE, gas generation and storage would result in:

- using VRE to replace the lost energy production from the closed coal generators;
- using dispatchable generation (most notably gas) to fill in the gaps when VRE is not generating; and
- using battery storage to capture excess VRE generation that would spill and using it when needed.

Batteries will have a role to play in the future of NEM, but within this scenario, the economics and limited hours of batteries mean that they can only capture part of the variation in VRE and, on their own, do not provide sufficiently for firm capacity. The outlook of this case is that even with the projected reduced costs of batteries, the level of storage required means that more expensive gas generation will be required for firm capacity and to address the majority of the variations in VRE output.

ii The NEM with Snowy 2.0

The MJA study concluded that Snowy 2.0 would influence the operation of and asset mix that replaces the closing coal power stations as follows:

- Significantly more VRE output would be captured thereby improving the economics of VRE entry. Additional VRE generation would be developed. The diversity of VRE output means that Snowy 2.0 would provide for significantly more than 2,000 MW of additional VRE to enter.
- The firm capacity provided by Snowy 2.0 would provide for about 2,000 MW less of more expensive gas generation to be developed.
- Less battery storage would also be needed, although the reduction in battery storage would reduce as battery costs become lower late in the study period.

The net result of Snowy 2.0 being developed is improved market efficiency, more reliable market operation, and lower emissions at the lowest cost.

iii Need for the project

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.

In recognition of the need to manage the transition and future energy mix in the NEM, Snowy 2.0 was declared CSSI by the former NSW Minister for Planning under the NSW EP&A Act in March 2018. When announcing the CSSI declaration, the Minister stated that Snowy 2.0 was 'essential for the future security of our energy system, the economy and our environment' with project declared as critical for the energy security and reliability needs of NSW. The declaration signifies the critical role that Snowy 2.0, together with the upgrades to the NSW transmission network, will play in providing reliable energy and large-scale storage to NSW as it transitions to a low emissions economy.

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. Snowy 2.0's 350,000 MWh or 175 hours of energy storage is enough to underpin the stability and reliability of the NEM especially during prolonged weather events, such as wind or solar 'droughts'.

3.2.2 Key benefits of Snowy 2.0

Snowy 2.0 is the largest committed renewable energy project in Australia. By expanding the current Snowy Scheme's renewable energy capacity by almost 50%, the NEM will be served with an additional 2,000 MW generating capacity. In terms of the future energy market, the key benefits of Snowy 2.0 are summarised as follows:

- Snowy 2.0 makes a significant contribution to the continued decarbonisation of the economy;
- Snowy 2.0 provides large-scale energy storages at the least cost to allow more flexibility to respond to seasonal variability when compared to other VRE and batteries;
- Snowy 2.0 will improve the overall efficiency of the NEM by absorbing and storing excess energy from the system at times of excess demand (through pumping) and generate at the critical times of peak times;
- Snowy 2.0, being a closed system, can move water between reservoirs and not rely on natural inflows that may vary seasonally, offering valuable seasonal storage and insurance against drought risk;
- Snowy 2.0 will have the capability to run for over seven days continuously before it needs to be 'recharged'. By comparison, small and large-scale batteries have limited storage (typically one to four hours) and their already high prices increase significantly when used for more than one charge/discharge cycle per day; and
- Snowy 2.0 has a 100 year design life and will operate for generations to come.

The following sections provide further detail on the benefits of Snowy 2.0 within the NEM.

i Supports trilemma of issues of reliability, price and emissions reduction

On a NEM wide basis the above relationships would provide for Snowy 2.0 to directly and substantially contribute to the trilemma issues of reliability (firm capacity), price (least-cost new entry solution), and emissions reduction (optimises VRE storage over time) as the existing fleet of coal-fired generators closes and replacement firm capacity and energy production is required. Lithium ion technology is economically marginal as the reliability (up to 4 hours only) and price (along the learning curve) are not sufficiently profitable in the short to medium term.

ii Avoids excess supply

Snowy 2.0 would utilise otherwise unused low-cost generation (unused coal and VRE) and provide dispatchable and firm capacity that can operate for days if required, with the effect that the NEM would operate more efficiently and with lower emissions.

iii Emissions reduction

Before the closure of NSW Eraring power station, the lowest cost option for reducing emissions is replacing coal generation with VRE generation, together with the level of firming required (with most firming being available from the existing dispatchable generation).

Once Eraring power station and other coal-fired generators close, increasing levels of VRE would require increasing amounts of new firming assets, with economics having this increasingly composed of gas generation. This limits the level of emissions reduction to about a 65% level of abatement (compared to the 2005 level).

A constraint on emissions when coal plant has substantially closed would involve VRE with substantial storage and a reduced reliance on gas generation. The value of large storage is magnified under such conditions.

iv Green energy economy supported by Snowy 2.0

As shown in Figure 3.7, Snowy 2.0, the least-cost economic entrant, displaces both gas (grey bar) and battery (green bar) new entry requirements. In addition, it economically supports wind (black bar) and solar (yellow bar) new entry by converting intermittent dispatchable energy into firm energy using it's unique storage and capacity value capabilities.

Snowy 2.0 provides support and firming for VRE generation. It results in about 3,000 MW of additional VRE generation and a reduction of about 2,000 MW of gas generation (mainly combined gas cycle turbine (CCGT)). Snowy 2.0 results in a reduction of about 1,000 MW of Lithium ion batteries in the initial years of Snowy 2.0 operation, with this reduction diminishing due to the additional VRE that enters in the medium term.

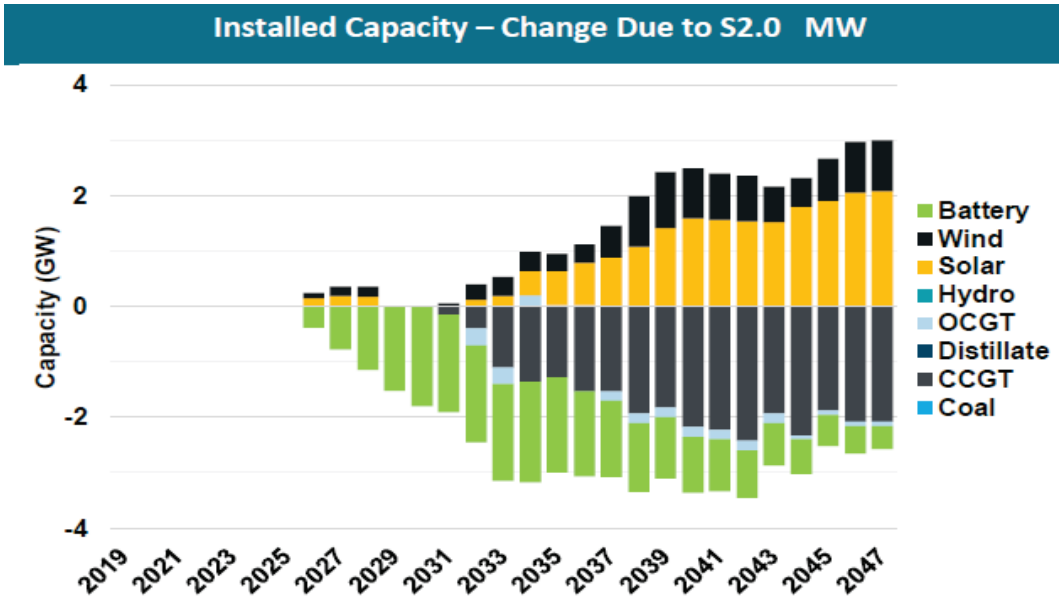


Figure 3.7 MJA modelling – installed capacity changes due to Snowy 2.0 over time

The chart in Figure 3.8, is largely consistent with the ISP (AEMO 2018) decarbonisation prediction shows the benefits Snowy 2.0's unique capabilities can provide to enable the transition to a reliable green energy economy. There is very significant coal-fired generation capacity out to 2047. It is replaced with wind and solar energy, battery value (from Lithium ion and Snowy 2.0) as well as capacity / value from open cycle gas turbines (OCGT) and CCGT.

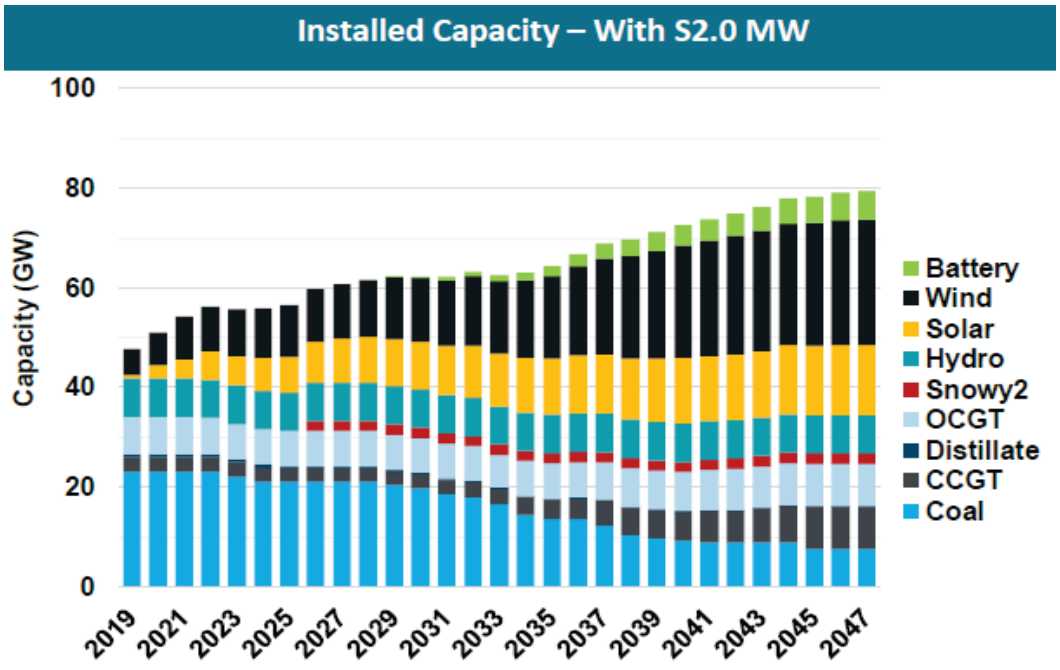


Figure 3.8 MJA modelling – installed capacity due to Snowy 2.0 over time

v Supply side options and costs considered in MJA modelling

Lithium ion battery and gas plants were both considered the two possible next best alternatives to Snowy 2.0's capabilities. The full list of generator options considered in the MJA modelling were as follow:

- high efficiency low emission coal plant;
- gas plant – CCGT;
- gas plant – OCGT;
- gas plant – reciprocating;
- solar generation; and
- wind generation.

The main storage providers in the NEM that were considered in the modelling were as follows:

- Large scale pumped hydro schemes. There were only two:
  - Snowy 2.0 which includes the potential further development of Snowy 3.0;

- Battery of the Nation – Basslink II plus potential developments to the hydro systems in Tasmania. This is supported by the Australian and Tasmanian governments and has economics that requires Riverlink to be developed (which is near being financially committed) and increased VRE development. Battery of the Nation was not costed and has unknown economics;

- Lithium Ion Batteries. Batteries were the principal storage technology developed in the AEMO ISP modelling, and possibly are the most direct competitor to pumped hydro storage in the NEM. However, on the current cost curves, batteries with storage hours of over 4 hours will not be economic from spot price revenues until past 2040;

- Small scale pumped hydro schemes. The geography of Australia limits the number of sizeable and economic sites. Two that were considered included:

  - Kidston in northern Queensland (200 MW and 8 hours of storage); and

  - Cultana in South Australia (up to 250 MW). The Kidston project was assumed to be developed in the MJA modelling.

vi Lithium ion battery as the next best alternative

Not all value that a battery or storage can provide will be translated into a corresponding revenue stream. For example, reducing the costs of coal-fired generator ramping does not appear as a revenue stream.

However, the potential value and revenue streams for batteries that can be modelled and the approach to this assessment of the respective revenue streams includes:

- spot price arbitrage;

- risk value through sustainable operation (associated with storage availability); and

- risk value through the sale (or avoided purchase) of 5-minute cap response products.

The first two of the above increase in value through increased energy in storage.

Another economic factor has been noted:

- batteries can be developed in conjunction with a solar / wind facility. This can have a battery charge directly from the solar plant and discharge when economic. This can have benefits to transmission use of system charges. (if applicable).

The following Lithium ion battery cost curve shown in Figure 3.9 was employed across time on best available, current information on wholesale battery costs.

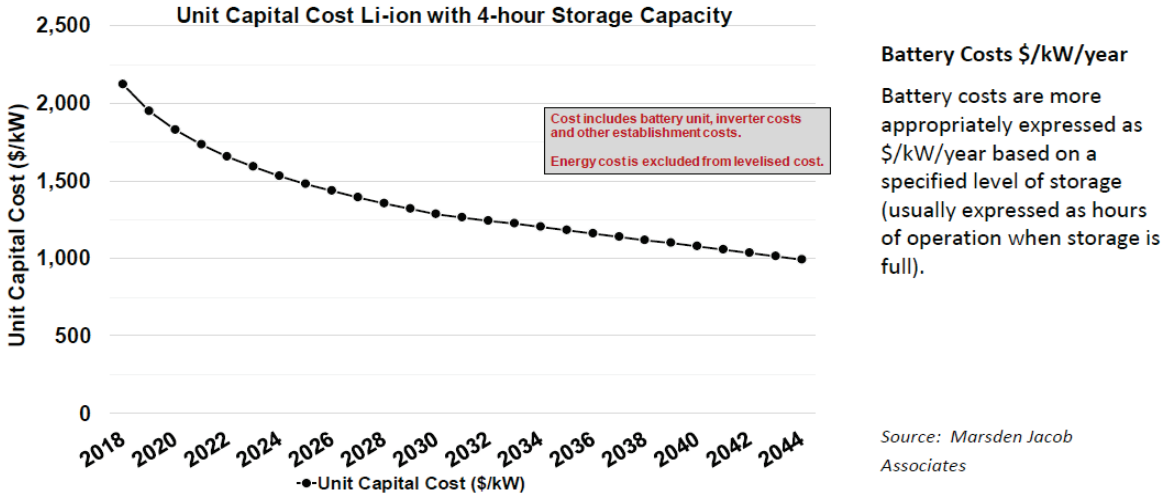


Figure 3.9 MJA modelling – Lithium ion learning cost curve

The development of battery storage is complex. The issue with battery storage is that battery storage (with limited hours of storage) is and will likely continue to enter despite batteries currently not being economic and an outlook (based on the forward cost curves) that batteries will not be economic until past 2040 (for storage with hours of storage over about four hours).

On the basis that batteries will be required to support VRE entry, the analysis concluded batteries will likely enter through the following means:

- limited storage with a solar or wind generator to smooth the VRE profile;
- government-sponsored for reliability and security;
- by regulation. This would require VRE enter to be with a battery for daily smoothing (such as to address minimum load issues) and security post 2030. This would be influenced by other storage such as Snowy 2.0.

The economics of batteries would require very high arbitrage revenues and it is unlikely that there would be a surplus of battery storage competing for VRE charging energy. Consequently, gas generation would form an important component of firming and price setting.

vii OCGT and CCGT gas as the next best alternative

OCGT and CCGT gas generation will likely be needed to provide the firm capacity shortage resulting from the closure of coal plant and the limited expected battery development. MJA economic modelling shows that gas generation is the next best alternative under most scenarios rather than Lithium Ion battery technology due to the latter's constrained energy duration.

viii Summary of key benefits

Snowy 2.0 would result in benefits distributed to the wholesale market, retailers, and consumers. The scale and centralised location of Snowy 2.0 in the NEM enables the system stability, energy reliability and firming capability benefits to be enjoyed by all segments of the NEM as summarised in Figure 3.10.

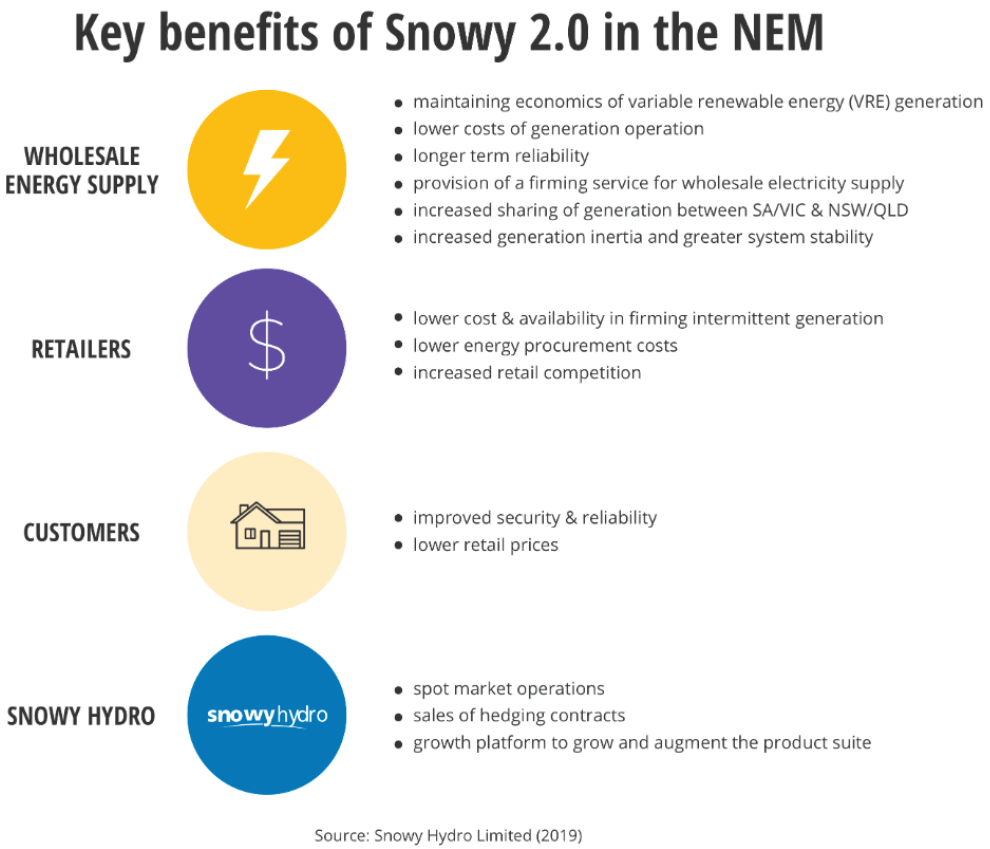


Figure 3.10 Benefits of Snowy 2.0 by market segment

3.2.3 Support for Snowy 2.0

There is strong support for Snowy 2.0 in the community. As part of the stakeholder engagement and community consultation formal surveys were undertaken. Responses identified the areas considered most important by the community, they include:

- the reliability of the electricity network;
- lower energy prices;
- increasing and expanding sources of reliable, renewable energy and minimising reliance on traditional fossil fuels (cleaner energy);
- minimising potential environmental impacts of Snowy 2.0 construction ; and
- the economic benefits of Snowy 2.0 for the local communities.

Snowy Hydro's Independent Board of Directors made its FID on 12 December 2018 to proceed with Snowy 2.0, again confirming the project is economic, technically feasible and financeable. As the sole shareholder, the Australian Government provided shareholder approval for Snowy Hydro to proceed with Snowy 2.0 and committed up to $1.38 billion by way of an equity injection in Snowy Hydro.

3.3 Land use context

3.3.1 Snowy 2.0 and Kosciuszko National Park

The KNP PoM (NPWS 2006) recognises the Snowy Scheme with various references including to 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 categories of Natural Values, Cultural Values and Recreational Values;
- optimise opportunities for a wide range of recreational activities and visitor experiences; and
- minimise land use conflict between participants in different recreational activities, and between visitors, management operations and other authorised users.

The KNP PoM incorporates the Snowy Management Plan. Both plans will be reviewed and amended as required under a transitional program explained in detail in Chapter 4. Chapter 4 also explains the current arrangements for Snowy Hydro's existing and ongoing occupation and use of land within KNP.

One site is beyond the boundaries of KNP and on land zoned for rural uses (RU1 Primary Production) under the *Snowy River Local Environmental Plan 2013*. The Rock Forest site has been secured by Snowy Hydro under a private lease agreement with the landowner.

3.3.2 Elements of the site that could be impacted

The existing environment of the project area has been generally summarised in Table 3.1. Each of the key features are further described in the relevant section in Chapter 6 of this EIS, including how they might be impacted by the project. The project interacts with a number of environmental and social values of the project area which include:

- landscape and natural heritage values of KNP, including its management by NPWS and use by the public;
- terrestrial and aquatic biodiversity, including endangered and critically endangered species identified throughout the project area;
- surface and groundwater features and their interaction, including groundwater levels and overlying watercourses and respective water quality of these resources;
- Aboriginal cultural heritage values and sites and historic heritage items; and
- recreational uses of Lobs Hole, Talbingo and Tantangara reservoirs.

Snowy 2.0 Main Works through its design has considered the interactions with these environmental and social values and where possible sought to avoid and minimise impacts. This principle of avoidance through design is detailed further in Chapter 6.

Table 3.1 Snowy 2.0 site and surrounds – key features requiring consideration

Attributes	Talbingo Reservoir	Lobs Hole	Marica	Plateau	Tantangara Reservoir	Rock Forest
Natural environment						
Geology	The Ravine area is within a geologic domain referred to as the Tumut Block which extends west of the Long Plain Fault (LPF) (Figure 6.3) to the east of Talbingo Reservoir. The area is dominated by Silurian to Devonian sedimentary and igneous rocks. The Silurian Ravine Beds, composed of stratified altered siltstone, sandstone and limestone, provide the structural framework and topographic control for this area. The Ravine Beds are overlain in areas, typically along the escarpment, by younger volcanic rock (Boraig Group and Byron Range Group) deposited in the Devonian during a period of explosive felsic volcanism.			The plateau area is within a geologic domain referred to as the Tantangara Block which extends from the Tantangara Fault (TF) in the east to the LPF in the west. The geological units within the plateau area generally grade from youngest to oldest in an east to west direction, reflecting the compression and tilt placed on the structural block. Igneous intrusions within the plateau area include the Ordovician Shaw Hill Gabbro, Devonian Boggy Plain Suite and Tertiary basalt.		The Rock Forest area is also within the Tantangara Block. The area, which is largely characterised by the steeply dipping metasediments of the Ordovician Bolton Beds and Kiandra Beds, has been significantly intruded by Devonian undifferentiated granites.
Hydrogeology	In the Ravine area, groundwater levels are monitored in the Ravine Beds and the Boraig Group. Groundwater levels within the Ravine area are influenced by the steep relief that exists across the area. Groundwater levels generally mirror the topography. Groundwater levels within the Ravine Beds vary from approximately 1325 m AHD in the topographically elevated terrain adjacent to the LPF towards the east; to approximately 545 m AHD in the topographically lower terrain adjacent to Talbingo Reservoir towards the west. Overall, groundwater levels indicate that groundwater flow within the Ravine Beds is towards the west from the direction of the LPF.			In the plateau area, groundwater levels are monitored in the Tertiary basalt, Gooandra Volcanics, Tantangara Formation, Temperance Formation, Boraig Group, Kelly Plains Volcanics, Boggy Plains Suite and within several bog and fen areas.		N/A

Table 3.1 Snowy 2.0 site and surrounds – key features requiring consideration

Attributes	Talbingo Reservoir	Lobs Hole	Marica	Plateau	Tantangara Reservoir	Rock Forest
Natural environment						
Watercourses	Watercourses	Tumut River, Middle Creek.	Yarrangobilly River, Wallaces Creek, Lick Hole Gully, Sheep Station Creek.	Eucumbene River, Murrumbidgee River, Tantangara Creek, Gooandra Creek and unnamed tributaries, Nungar Creek, Kellys Plain Creek, Boggy Plain Creek.	Eucumbene River, Murrumbidgee River, Tantangara Creek, Gooandra Creek and unnamed tributaries, Nungar Creek, Kellys Plain Creek, Boggy Plain Creek.	Camerons Creek, unnamed watercourse.
Biodiversity	Aquatic habitat comprises submerged trees and the reservoir is considered habitat for Murray Crayfish (threatened species).	Areas of habitat for threatened species such as Booroolong Frog (recorded and mapped Yarrangobilly River) and Smoky Mouse (recorded and mapped along Lobs Hole Ravine Road).	Areas of habitat for threatened species such as Smoky Mouse (recorded and mapped along Marica Trail), and threatened flora species also recorded.	Bogs and Fens endangered ecological community are located throughout the Plateau area, and threatened flora and herpetofauna species also recorded.	Threatened flora species recorded adjacent to Tantangara Reservoir and Tantangara Road.	Rock Forest is located just outside of the KNP, consisting of predominantly derived grasslands as a result of historical clearing and grazing.
Natural and cultural heritage	Historic Ravine Cemetery near Lobs Hole.	The historic Washington Hotel at Lobs Hole and geodiversity features (periglacial boulder stream and Devonian fossils) along Lobs Hole Ravine Road.	Historic heritage features associated with pastoralism, mining and the Snowy Scheme.	Historic heritage features associated with pastoralism, mining and the Snowy Scheme.	Aboriginal cultural heritage rock shelter near Tantangara Reservoir and geodiversity features (Kellys Plain Volcanics) including a former quarry and an outcrop of agglomeratic porphyry.	Historic heritage items relating to mining, agriculture and pastoralism.

Table 3.1 Snowy 2.0 site and surrounds – key features requiring consideration

Attributes	Talbingo Reservoir	Lobs Hole	Marica	Plateau	Tantangara Reservoir	Rock Forest
Built environment						
Reservoirs	Talbingo Reservoir is a large storage dam (921 GL total, or 239 GL active storage) that operates between 534 m AHD and 543 m AHD. The reservoir is about 25 km long and has a surface area of approximately 19.4 km^2 (at spillway crest).	N/A	N/A	N/A	Tantangara Reservoir is a storage dam (254 GL total, or 240 GL active storage) that operates between 1,206 m AHD and 1,229 m AHD. It is about 14 km long and has a surface area of approximately 21.2 km^2 (at FSL).	N/A
Social infrastructure	No townships or existing social infrastructure present.	No townships or existing social infrastructure present. Former township of Lobs Hole.	No townships or existing social infrastructure present.	No townships or existing social infrastructure present.	No townships or existing social infrastructure present.	No townships or existing social infrastructure present.
Transport infrastructure	N/A	Lobs Hole Ravine Road, Lobs Hole Road, Mine Trail Road.	Marica Trail, Marica West Road, Snowy Mountains Highway.	Snowy Mountains Highway, Gooandra Track.	Snowy Mountains Highway, Tantangara Road, Quarry Trail, Pocket Saddle Road.	Snowy Mountains Highway.
Utility infrastructure	330 kV transmission easement.	330 kV transmission easement.	N/A	330 kV transmission easement.	11 kV transmission easement, 33 kV substation, Tantangara Dam.	N/A
Recreational features	O'Hares boat ramp, informal boat ramp at Middle Bay, boating, water sports, fishing.	Camping at Lobs Hole.	N/A	Camping at Bullocks Hill and 3 Mile Dam and Mt Selwyn ski resort.	Camping on reservoir foreshore, fishing, boating, water sports, horse riding trails, Wares Yard, Currango Homestead.	N/A
Historic heritage	Snowy Scheme.	Washington Hotel, Ravine Cemetery.	N/A	Kiandra courthouse.	Snowy Scheme.	N/A

3.3.3 Offsets strategy

In considering the residual impacts of the Snowy 2.0 project, it is critical to place them in context. A fundamental objective of the project is to provide a large scale storage facility to enable the decarbonisation of the nation's energy system in order to achieve meaningful progress in emissions reductions as a key mitigant of climate change. The project's location within the largest alpine area within NSW gives particular merit to this mission given the potential long term impacts on many of the snow dependent species and communities of the local region.

Further, the configuration of the project takes advantage of existing reservoir infrastructure and is constructed almost entirely underground in order to minimise the surface impacts of the works. It is, however, acknowledged that the sensitive nature of the location of the works with KNP requires careful consideration to ensure the project retains a net beneficial contribution to the environment.

The key principles of the strategy are to ensure that an outcomes based program of management actions is developed to ensure that the residual impacts to key values of KNP, which include terrestrial and aquatic biodiversity, with a particular focus on threatened species and communities, and recreational uses in and around the Project area are proportionately offset.

Actions and outcomes to be achieved will be aligned with the Project's understanding of the key stakeholders objectives for impacted values, and Policies and programs such as Caring for our Australian Alps Catchments (Worboys and Good 2011) and the NSW Save our Species (SOS) Program. In particular Snowy Hydro will work with NPWS, DPIE (formerly OEH), DPI Fisheries and local stakeholders to further develop a suite of fully funded conservation and recreational management projects specifically for the improvement of KNP.

Once agreed, this offsets strategy will be implemented to fulfil Snowy Hydro's obligations under NSW *Biodiversity Conservation Act 2016* (BC Act) and EPBC Act. The key areas to be covered by the strategy are set out in Table 3.2, and further details provided in the Offset Strategy in Appendix M.3.

Specific details for the scope and implementation of the suite of proposed actions and measures will be developed further and agreed in consultation with key stakeholders, including DPIE and DEE.

The offsets strategy is expected to be implemented over time and deliver significant benefits for the natural values of the KNP and the people who use it.

3.3.4 Other developments

As previously described in Section 1.4, in addition to the Snowy 2.0 Main Works, Snowy 2.0 also comprises the Snowy 2.0 Exploratory Works, Snowy 2.0 Transmission Connection Project, and proposed segment factory at Polo Flat. This EIS considers the interactions with these projects, using publicly available information to assess potential impacts.

These projects will overlap construction schedule and location, primarily in the Lobs Hole area. Key issues requiring consideration include:

- traffic and transport, as these projects will share the external road network, in particular Snowy Mountains Highway;
- impacts to KNP values, in particular biodiversity and heritage; and
- social and amenity, as workforce enter the region and may influence local towns.

Table 3.2 Potential actions for residual impacts

Key values	Potential actions
Terrestrial biodiversity	Key focus species • Clover Glycine • Kiandra Leek Orchid • Eastern Pygmy-possum • Smoky Mouse • Booroolong Frog • Alpine Tree Frog • Alpine She-oak Skink Key focus communities: • Bogs and Fens Management actions: • Targeted research and monitoring actions to better understand species distribution, abundance and key threats, e.g. systematic camera surveys across KNP and surrounding National Parks and State Forests to document the distribution of Smoky Mouse, or annual systematic surveys of suitable habitat for Clover Glycine to determine the area and extent of populations, the number, size and structure of populations in KNP. • Habitat restoration works for threatened species and communities, eg restoration and dry open Eucalypt forests and woodland. • Management of key threats in particular for predators and invasive competitors eg, weed control programs across KNP etc. • Establishment of SOS sites to ensure good, targeted management of threats for key species and communities.
Aquatic ecology	• Targeted research and monitoring actions to better understand species distribution, abundance and key threats. • Support for local / regional insurance population programs of Macquarie perch. • Habitat protection and enhancement activities for threatened species' with a focus on Murray crayfish and Stocky galaxias.
Recreation	• With stakeholders, develop a program for stocking of large fish (rainbow trout) in Tantangara Reservoir. • Upgrade camping facilities on the Tantangara Reservoir foreshore and Lobs Hole and integrate with the new assets. • Upgrade/ refurbish facilities that have been directly impacted as a consequence of Snowy 2.0.

CHAPTER 4

STATUTORY FRAMEWORK

4 Statutory Framework

4.1 Overview

4.1.1 Snowy 2.0

Snowy Hydro is a company incorporated under the Commonwealth *Corporations Act 2001*, with an independent board of directors and all shareholding held by the Australian Government.

The existing Snowy Scheme is able to operate within land that is reserved as a national park under the provisions of the SHC Act. Snowy Hydro has rights to access and operate the existing Snowy Scheme within the KNP in accordance with the Snowy Park Lease granted by the NSW Minister for the Environment, and the Snowy Management Plan. Snowy Hydro also operates the Snowy Scheme under a water licence administered by DPIE that allows for water collection, storage, diversion and release in order to generate electricity (the Snowy Water Licence).

On 26 October 2017, Snowy Hydro and TransGrid requested that the then NSW Minister for Planning declare Snowy 2.0 and associated transmission upgrade works to be CSSI to which Part 5, Division 5.2 of the EP&A Act applies. On 7 March 2018 the Minister declared 'Snowy 2.0 and Transmission Project' to be CSSI with the declaration coming into effect on 9 March 2018.

As stated in Chapter 1, while the upgrade works to the wider shared transmission network and connection between Snowy 2.0 and the network form part of the CSSI declaration for Snowy 2.0 and the Transmission Project, they do not form part of Snowy Hydro's application. TransGrid is the proponent for the transmission connection which will be subject to separate application and approval processes. However, cumulative impacts have been considered in this EIS where relevant.

i Exploratory Works for Snowy 2.0

Snowy 2.0 is being developed in stages. The first stage, Snowy 2.0 Exploratory Works (SSI 9208), includes an exploratory tunnel and portal and other exploratory and construction activities primarily in the Lobs Hole area of KNP. Approval for Exploratory Works was granted by the then NSW Minister for Planning on 7 February 2019. Construction works commenced in March 2019. Submission of the application and subsequent approval of Exploratory Works ahead of Main Works was critical as it will obtain detailed geological data about the rock types, conditions, ground temperature and stress conditions to inform the detailed design of the underground power station cavern.

The Exploratory Works were referred to the Commonwealth Minister for the Environment under the EPBC Act (Reference 2018/8217) and were determined on 10 July 2018 not to be a controlled action.

An application to modify the Exploratory Works approval to include additional geotechnical drilling and a construction power connection to the existing TransGrid 330 kV line 2 at Lobs Hole (Modification 1) was submitted to DPIE in June 2019 and publicly exhibited between 26 June and 9 July 2019. A response to submissions report was subsequently submitted to DPIE in September 2019 and a determination for Modification 1 is expected in 2019. A second modification to the Exploratory Works that involves changing the tunnelling method for the exploratory tunnel from drill and blast to TBM (Modification 2) is expected to be submitted to DPIE in October 2019.

ii Snowy 2.0 Main Works

The second stage is Snowy 2.0 Main Works (SSI 9687), which includes the full construction and operation of Snowy 2.0. On 15 October 2018, Snowy Hydro submitted to the former Department of Planning and Environment a PEA (also known as a scoping report) for Snowy 2.0 Main Works. It was prepared in accordance with the *draft Environmental Impact Assessment Guidance Series* (June 2017) prepared by DPIE to request and inform the content of the SEARs for Main Works. The project that was described in the PEA was largely a description of the reference design prepared by SMEC on behalf of Snowy Hydro for the purpose of specifying Snowy Hydro's functional and performance requirements for tenders for the detailed design and construction of Snowy 2.0.

In January 2019, Snowy Hydro identified a preferred construction contractor, FGJV, to develop the final design and carry out construction of Snowy 2.0. The contract was formally awarded in April 2019. On 20 June 2019, Snowy Hydro submitted to the former Department of Planning and Environment an amended PEA (in the form of an amended scoping report) to reflect relevant design solutions the contractor was developing for the final design of Snowy 2.0 Main Works. On 31 July 2019 Snowy Hydro was provided with the SEARs for Snowy 2.0 Main Works.

On 30 October 2018, Snowy Hydro submitted a referral to the Commonwealth Minister for the Environment for a proposed action under the EPBC Act for Snowy 2.0 Main Works (EPBC 2018/8322). This referral considered impacts to matters of national environmental significance (MNES) and the environment generally and detailed that Snowy 2.0 Main Works would potentially have a significant impact on MNES, including national heritage places, listed threatened species and ecological communities and listed migratory species. The referral also identified, on a precautionary basis, that Snowy 2.0 Main Works would potentially have a significant impact on the environment, as defined under the EPBC Act.

Due to the potential impacts of Snowy 2.0 Main Works on MNES and the environment, an accredited assessment process was sought under section 87(4) of the EPBC Act, where the Commonwealth accredits the assessment process under Division 5.2 of the EP&A Act. On 5 December 2018, the Assistant Secretary of the DEE provided notification of its referral decision and designated proponent, determining that the Snowy 2.0 Main Works action was a controlled action and is to be assessed by accredited assessment process under Part 5, Division 5.2 of the EP&A Act.

As part of the accredited assessment process, DEE's assessment requirements have been included in the SEARs.

iii Segment factory

The tunnels for Snowy 2.0 Main Works, including the exploratory tunnel for Exploratory Works, would be excavated in part, using TBMs and would be lined using precast concrete tunnel segments. These segments are proposed to be constructed at a factory (the proposed segment factory) on the eastern side of Polo Flat, an industrial estate east of Cooma. The segments would be transported to the construction areas of Snowy 2.0.

In June 2019, Snowy Hydro submitted a Scoping Report to DPIE for the proposed segment factory (SSI-10034). SEARs were issued to Snowy Hydro on 31 July 2019.

The proposed segment factory was referred to the Commonwealth Minister for the Environment under the EPBC Act (Reference 2019/8481) and was determined on 13 August 2019 not to be a controlled action.

Snowy Hydro is preparing the EIS for the proposed segment factory in accordance with the SEARs. Notwithstanding this, potential impacts of the proposed segment factory have been considered in this EIS so that cumulative impacts of the project have been identified and considered.

4.1.2 Transmission connection

Works are required to connect Snowy 2.0 with the existing high voltage transmission network which is owned and managed by TransGrid (the Snowy 2.0 Transmission Connection Project). Principally these works include the construction of:

- a substation to the west of Talbingo Reservoir outside of KNP near an existing transmission line; and
- two transmission lines connecting Snowy 2.0 with the substation.

In November 2018, TransGrid submitted to the former Department of Planning and Environment a PEA (in the form of a scoping report) for the Snowy 2.0 Transmission Connection Project (SSI 9717). SEARs were issued to TransGrid on 4 February 2019.

In February 2019, TransGrid submitted a referral to the Commonwealth Minister for the Environment for its proposed action under the EPBC Act for the Snowy 2.0 Transmission Connection Project (EPBC 2018/8363). This referral considered impacts to matters of MNES and concluded that the Snowy 2.0 Transmission Connection Project would potentially have a significant impact on MNES, including national heritage places, listed threatened species and ecological communities and listed migratory species.

Due to the potential impacts of the Snowy 2.0 Transmission Connection Project on MNES, an accredited assessment process was sought under section 87(4) of the EPBC Act, where the Commonwealth accredits the assessment process under Part 5, Division 5.2 of the EP&A Act. On 5 April 2019, the Acting Assistant Secretary of the DEE provided notification of its referral decision and designated proponent, determining that the Snowy 2.0 Transmission Connection Project was a controlled action and is to be assessed by accredited assessment process under Part 5, Division 5.2 of the EP&A Act.

As stated above, as part of the accredited assessment process, DEE's assessment requirements for the Snowy 2.0 Transmission Connection Project have been included in the SEARs.

TransGrid will prepare the EIS for the Snowy 2.0 Transmission Connection Project in accordance with the SEARs. Notwithstanding this, potential impacts of the Snowy 2.0 Transmission Connection Project, as identified by TransGrid, have been considered in this EIS so that cumulative impacts of the projects have been identified and considered.

4.2 Snowy Hydro

The former Commonwealth Snowy Mountains Hydro-electric Authority was corporatised under the NSW SHC Act (and corresponding legislation passed in Victoria and by the Commonwealth) as Snowy Hydro Limited on 28 June 2002. Snowy Hydro is now fully owned by the Commonwealth following the acquisition of all remaining shares by the Commonwealth from the States of NSW and Victoria in July 2018.

In addition to providing for the corporatisation of Snowy Hydro Limited, the SHC Act implemented a range of measures to transition the operations of the Snowy Scheme as regulated under NSW environmental laws and other regulatory requirements for the first time. As part of this transition Snowy Hydro was entitled to be granted the Snowy Water Licence and the Snowy Park Lease to enable the continued operation of the existing Snowy Scheme and in addition its operations were recognised as having the necessary approvals and consent for the purposes of the EP&A Act and as authorised under the NSW *National Parks and Wildlife Act 1974* (NPW Act).

4.2.1 Snowy Park Lease

Part 6, section 37(2) of the SHC Act entitled Snowy Hydro to the grant of a lease, licence, easement or right of way over KNP, for the purposes of the existing Snowy Scheme. The Snowy Park Lease was granted to Snowy Hydro by the former NSW Minister for Environment in 2002 and has a term of 75 years. The lease covers land where infrastructure associated with the existing Snowy Scheme 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.

4.2.2 Amending legislation to authorise Snowy 2.0

The NSW *Snowy Hydro Corporatisation Amendment (Snowy 2.0) Act 2018* (the SHC Amendment Act) was passed by the NSW Parliament in November 2018. The SHC Amendment Act authorised further leases and other tenures to be granted over the KNP to facilitate the construction and ongoing operation of Snowy 2.0 including the supporting electricity transmission upgrades.

Section 37A(2) of the SHC Act entitles Snowy Hydro to the grant of a lease, licence, easement or right of way over the KNP, for the purposes of and in connection with, Snowy 2.0 and confers similar entitlements for the transmission assets. Snowy Hydro entered into an Agreement for Lease (AFL) with the NSW Minister for the Environment on 18 December 2018 in respect of Snowy 2.0. Subject to the terms of the AFL, Snowy Hydro (and its contractors) will be granted rights to access the areas required for construction under Works Access Licences and Construction Leases. On practical completion of construction of Snowy 2.0 Main Works, Snowy Hydro will be granted an Operational Lease to allow the ongoing operation of Snowy 2.0. This operational lease will expire at the same time as the Snowy Park Lease issued in 2002. Snowy Hydro must satisfy a number of conditions precedent before it will be granted rights to access and use KNP, including that Snowy 2.0 Main Works must obtain CSSI approval.

Section 38(1) of the SHC Act, provides that a plan of management may deal with the activities of Snowy Hydro within the KNP and impose obligations on the company to comply with the plan of management. This compliance obligation is supported by Part 4 of the *NSW National Parks and Wildlife Regulation 2009* (NPW Regulation).The SHC Amendment Act also provided for a transitional period for the KNP PoM and the Snowy Management Plans to be revised to reflect Snowy 2.0. Clause 7 of Schedule 4 to the SHC Act provides a period of three years from when first planning approval is granted for any part of the Snowy 2.0 project, for the KNP PoM to be amended for the purposes of including the Snowy 2.0 project. A further period until 1 January 2024 is then allowed for the Snowy Management Plan to be updated. During that transitional period, section 81(4) of the NPW Act does not operate to prohibit operations being undertaken in relation to the Snowy 2.0 project that are not in accordance with those plans.

4.2.3 Snowy Water Licence

The Snowy Water Licence is a special purpose statutory approval issued under Part 5 of the SHC Act. It embodies the operating and accounting principles of the Snowy Scheme. The Snowy Water Licence confers several 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 that water from storage.

4.2.4 Deemed planning approvals for existing Snowy scheme

Part 7 of the SHC Act approved the existing Snowy Scheme development as at the date of corporatisation (28 June 2002) under former Parts 4 and 5 of the EP&A Act. Section 41(2) of the SHC Act provides:

> A determining authority is not required to comply with Part 5 of the EPA Act for the purposes of granting an initial approval. However, the determining authority is, for the purposes of any Act or law, taken to have complied with Part 5 of the EPA Act in granting the initial approval (but only to the extent that the determining authority would but for this Act have been required to comply with that Part).

Section 41(3) of the SHC Act provides:

> For the purposes of the application of any Act or law to an activity that is part of the existing Scheme development but that is not the subject of an approval granted by a determining authority or of a development consent, the activity is taken to have been commenced and previously carried out in accordance with Part 5 of the EPA Act.

Section 41(4) of the SHC Act further provides:

> This subsection applies to any development that is part of the existing Scheme development and that, on the corporatisation date, cannot be carried out without development consent. On that date, the Snowy Hydro Company is taken to have been granted that development consent in accordance with Part 4 of the EPA Act by the relevant consent authority under that Part

These deemed arrangements applied to the existing scheme as at the date of corporatisation. Any proposed changes since that time have been developed in accordance with applicable legislation.

4.3 Kosciuszko National Park

The existing Snowy Scheme and assets have long been part of the KNP 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 NPW Act. NSW national parks are the responsibility of the NPWS which is a part of DPIE.

KNP contains unique sub-alpine values and declared wilderness areas and is listed on the Australian National Heritage List. All activities on reserved land must be consistent with the objects and purpose of the NPW Act. Consideration of Main Works against the objects and purpose of the NPW Act is provided in Appendix H.

All activities within KNP must be consistent with the KNP PoM, prepared in accordance with Part 5 of the NPW Act. Various references are made to the existence and continued operation of the Snowy Scheme throughout the KNP PoM, including within park zoning provisions and Chapter 12. The PoM also incorporates the Snowy Management Plan to more specifically deal with the operations of the existing Snowy Scheme within KNP.

As such, should approval be granted for the Main Works, the Snowy Management Plan will be reviewed and updated to incorporate management obligations with respect to the Snowy 2.0 project in accordance with the timetable imposed by the SHC Amendment Act.

4.4 NSW planning approval process

4.4.1 Permissibility of Snowy 2.0 Main Works

The EP&A Act and EP&A Regulation form the statutory framework for environmental assessment and planning approval in NSW. Implementation of the EP&A Act is the responsibility of the Minister for Planning and Public Spaces, statutory authorities and local councils.

As explained in more detail in Section 4.2, the existing Snowy Scheme operates under deemed planning approvals conferred by Part 7 of the SHC Act. Snowy 2.0 is an augmentation to the existing Snowy Scheme, beyond the scope of Snowy Hydro operations currently authorised by the SHC Act. Assessment of those impacts of Snowy 2.0 which have not previously been approved, and approval of Snowy 2.0 Main Works under the EP&A Act are, therefore, required prior to commencing.

Section 5.13 enables the Minister for Planning and Public Spaces to declare SSI to be CSSI if 'it is of a category that, in the opinion of the Minister, is essential for the State for economic, environmental or social reasons'. On 26 October 2017 Snowy Hydro requested that the former NSW Minister for Planning declare Snowy 2.0 to be CSSI. On 7 March 2018 the former NSW Minister for Planning declared Snowy 2.0 and the Transmission Project to be CSSI.

This declaration came into effect on 9 March 2018 and is included in Clause 9 of Schedule 5 of the SRD SEPP, 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

(b) the construction and operation of new electricity transmission lines between the new substation at Nurenmerenmong and an existing substation at Bannaby, north of Marulan, and

(c) the construction and operation of new transmission lines between an existing substation at Khancoban and a location on the NSW-Victorian border generally south-west of Khancoban, and

(d) the augmentation of the existing substation at Bannaby.

(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 Main Works is development of the kind specified in Schedule 5, clause 9, subclause (3) and (6) of the SRD SEPP. Clause 16 of the SRD SEPP states that development specified in Schedule 5 of the SRD SEPP:

(a) may be carried out without development consent under Part 4 of the EP&A Act; and

(b) is declared to be SSI for the purposes of the EP&A Act if it is not otherwise so declared; and

(c) is declared to be CSSI for the purposes of the EP&A Act.

Accordingly, Snowy 2.0 (including Snowy 2.0 Main Works) has been declared to be SSI and CSSI and may be carried out without obtaining development consent under Part 4 of the EP&A Act. Therefore, the project requires assessment and approval under Part 5, Division 5.2 of the EP&A Act.

As previously stated, the Transmission Connection Project and proposed segment factory are being considered under separate applications and EISs under Part 5, Division 5.2 of the EP&A Act. Notwithstanding this, potential impacts of the Transmission Connection Project and the proposed segment factory have been identified within this EIS so that potential cumulative impacts of Snowy 2.0 can be considered.

The Transmission Connection Project is for the connection of Snowy 2.0 with the shared transmission network. As the CSSI declaration indicates, the deep augmentation of the shared transmission network is for the broader NEM, and not just Snowy 2.0.

The Minister for Planning and Public Spaces is the determining authority for Snowy 2.0 Main Works, the proposed segment factory and the Snowy 2.0 Transmission Connection Project given their status as CSSI. Whilst section 2.4 of the EP&A Act allows the Minister to delegate his function of determining an application for approval under Part 4 or Part 5 of the EP&A Act, section 2.4(3)(b) prevents this for the determination of an approval for CSSI.

4.4.2 Environmental Planning and Assessment Regulation 2000

The EP&A Regulation was made under the EP&A Act and provides details of the requirements set out in the Act. Requirements of the EP&A Regulation relevant to Snowy 2.0 Main Works include how the EIS is to be prepared and how the application is to be notified.

An EIS for SSI and CSSI is to be prepared in accordance with Part 3 of Schedule 2 of the EP&A Regulation (as per Section 5.16 of the EP&A Act). The requirements for preparation of an EIS are set out in clause 6 and 7 of Schedule 2 of the EP&A Regulation. A summary of these requirements and where they are addressed in the EIS is provided in Table 4.1.

Table 4.1 Schedule 2 requirements for an EIS

Requirement	Where contained in the EIS
Clause 6 - Form of environmental impact statement	
(a) the name, address and professional qualifications of the person(s) by whom the statement is prepared,	Certification page at the front of this EIS
(b) the name and address of the responsible person (the applicant),	Certification page at the front of this EIS
(c) the address of the land: (i) in respect of which the development application is to be made, or (ii) on which the activity or infrastructure to which the statement relates is to be carried out,	Certification page at the front of this EIS
(d) a description of the development, activity or infrastructure to which the statement relates,	Chapter 2
(e) an assessment by the person by whom the statement is prepared of the environmental impact of the development, activity or infrastructure to which the statement relates, dealing with the matters referred to in this Schedule,	Certification page at the front of this EIS and the technical papers within the EIS
(f) a declaration by the person by whom the statement is prepared to the effect that: (i) the statement has been prepared in accordance with this Schedule, and (ii) the statement contains all available information that is relevant to the environmental assessment of the development, activity or infrastructure to which the statement relates, and (iii) that the information contained in the statement is neither false nor misleading.	Certification page at the front of this EIS
Clause 7 - Content of environmental impact statement	
(a) a summary of the EIS,	Executive summary
(b) a statement of the objectives of the development, activity or infrastructure,	Chapter 1 and Chapter 2
(c) an analysis of feasible alternatives to the carrying out the development, activity or infrastructure, having regard to its objectives, including the consequences of not carrying out the development, activity or infrastructure,	Chapter 1 and Chapter 3
(d) an analysis of the development, activity or infrastructure, including:	
(i) a full description of the development, activity or infrastructure, and	Chapter 2
(ii) a general description of the environment likely to be affected by the development, activity or infrastructure, and	Chapter 6
(iii) the likely impact on the environment of the development, activity or infrastructure, and	Chapter 6
(iv) a full description of the measures proposed to mitigate any adverse effects of the development, activity or infrastructure, and	Chapter 6 and Appendix G
(v) a list of any approvals that must be obtained under any other Act or law before the development, activity or infrastructure may lawfully be carried out,	Section 4.4

Table 4.1 Schedule 2 requirements for an EIS

Requirement	Where contained in the EIS
(e) a compilation (in a single section of the EIS) of the measures referred to in item (d)(iv),	Appendix G
(f) the reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development.	Chapter 7

Landowners consent is not required for a CSSI application under clause 193(1) of the EP&A Regulation. However, under clause 193(4), the proponent is required to give notice of the application or request:

(a) by written notice to the owner of the land before, or no later than 14 days after, the application or request is made, or

(b) by advertisement published in a newspaper circulating in the area in which the infrastructure is to be carried out:

(i) in the case of an infrastructure application—at least 14 days before the environmental impact statement that relates to the infrastructure is placed on public exhibition,

An advertisement will be published in local papers in accordance with clause 193(4)(b) of the EP&A Regulation. Notwithstanding this, while landowners consent is not required for a CSSI application, Snowy Hydro has been in regular consultation with all stakeholders in the project area, including landowners.

4.4.3 Other regulatory requirements

Although EPIs do not apply to SSI or CSSI by virtue of section 5.22(2) of the EP&A Act, consideration of the instruments that would have applied to the Snowy 2.0 Main Works project area is also given.

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

4.4.4 Summary of approvals required for the project

A summary of the licences, approvals and permits that are likely to be required for the project is provided in Table 4.2.

Table 4.2 Required licences, approvals and permits summary

Legislation	Authorisation	Consent of approval authority
EP&A Act	CSSI approval for Snowy 2.0 Main Works	NSW Minister for Planning and Public Spaces
	Construction certificate required for construction of relevant structures in the surface infrastructure area	Snowy Valleys Council (SVC) and/or Snowy Monaro Regional Council (SMRC) or private certifier
	Occupation certificate required prior to use of certain buildings in the surface infrastructure area	SVC and/or SMRC or private certifier
SHC Act	*Grant of Construction Lease and Licences in accordance with the Deed of Agreement for Lease*	NSW Minister for Energy and Environment

Table 4.2 Required licences, approvals and permits summary

Legislation	Authorisation	Consent of approval authority
NSW *Protection of the Environment Operations Act 1997* (POEO Act)	Environment protection licence (EPL) for the following premises based scheduled activities: • scheduled development work to enable electricity generation • sewage treatment plant and water treatment plants • disposal of excavated rock • chemical storage	NSW Environment Protection Authority (EPA)
NSW *Roads Act 1993*	Section 138 permits for works involving a public road	SVC, SMRC, NPWS and RMS
NSW *Water Management Act 2000* (WM Act)	Water access licences	DPIE
NSW *Water Act 1912*	Licensing of monitoring bores	DPIE
NSW *Local Government Act 1993* (LG Act)	Approval for carrying out sewerage work	EPA
NSW *Work Health and Safety Act 2011*	Licensing of dangerous goods	NSW WorkCover Authority
NSW *Biosecurity Act 2015*	Exemption required under s402 of the Act from compliance with the mandatory measures for relevant listed aquatic pests and diseases	DPIE

Under sections 5.23 and 5.24 of the EP&A Act, certain separate approvals and licenses would not be required for Snowy 2.0 Main Works or would be required to be issued consistent with any planning approval granted.

4.4.5 Consistency with State and regional policies

The provisions of 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 4.3, together with an assessment of the consistency of Snowy 2.0 Main Works with those policies.

Table 4.3 Consideration of relevant State policies and plans

Policy/plan	Relevant project elements	Consistency of Snowy 2.0 Main Works
State Environmental Planning Policy No. 33 – Hazardous and Offensive Development (SEPP 33)	Storage and transport of dangerous goods.	Consideration of DPIE's guideline *Applying SEPP 33* (2011) and, if required, preparation of a Preliminary Hazard Assessment (PHA) has been carried out and is provided in Appendix U.
State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44)	Clearance of potential Koala habitat.	A biodiversity assessment including surveys for Koalas to determine whether Koala habitat would be impacted is provided in Appendix M.1 of this EIS.
State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55)	Historic mining and agricultural activities have potential for land contamination.	A contamination assessment is provided in Appendix N.1 of this EIS.

4.5 Commonwealth approvals

4.5.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is the primary piece of Commonwealth legislation that governs the protection of the environment.

Relevantly, under the Commonwealth EPBC Act:

- a person is prohibited from taking an action that has, will have or is likely to have a significant impact on certain aspects of the environment (being MNES); and
- the Commonwealth or a Commonwealth agency must not take inside or outside the Australian jurisdiction an action that has, will have or is likely to have a significant impact on the environment inside or outside the Australian jurisdiction;

  without the Commonwealth Minister for the Environment having given approval under the EPBC Act or decided that approval is not needed.

Snowy Hydro became a 'Commonwealth agency' only for the purposes of the EPBC Act on 2 July 2018, following the acquisition of all remaining shares by the Commonwealth from the States of NSW and Victoria.

Under the EPBC Act, a person proposing to take an action may refer the proposal to the Commonwealth Minister for a decision as to:

- whether approval is needed to take the action; and
- how to assess the impacts of the action to be able to make an informed decision whether or not to approve the action.

As previously noted, Snowy 2.0 Main Works action is a controlled action and will be assessed by accredited assessment process under Part 5, Division 5.2 of the EP&A Act.

The proposed action was described in the referral decision notice as follows:

> To construct and operate the Snowy 2.0 project in the Snowy Mountains, NSW, to increase the pumped hydro-electric capacity within the existing Snowy Hydro Scheme, including construction of a pipeline between Tantangara reservoir and Talbingo reservoir and an underground power station [See EPBC Act referral 2018/8322].

The referral decision notice also confirmed the relevant controlling provisions under the EPBC Act relevant to Snowy 2.0 Main Works:

- National Heritage places (sections 15B and 15C);
- Listed threatened species and communities (sections 18 and 18A);
- Listed migratory species (sections 20 and 20A); and
- Commonwealth action (section 28).

Potential impacts to National Heritage places are addressed in Section 6.6 and Appendix P.2. Potential impacts to listed threatened species and communities, and migratory species are addressed in Section Figure 6.3 and

Appendix M.1. Potential impacts of the Commonwealth action on the environment generally are considered throughout this EIS.

CHAPTER 5

ENGAGEMENT

5 Engagement

5.1 Overview of engagement activities

Over many decades Snowy Hydro has lived, worked and invested in the communities it operates in. The company is a sponsor and supporter of community groups, events and activities. Snowy Hydro's high level of local activity, transparent, timely and regular interaction with stakeholder groups, and participation on emergency management groups, ensures the community and stakeholders have ample regular opportunities to engage with the business.

Snowy Hydro has established stakeholder goodwill and a reputation as a trusted and respected corporate and community 'citizen'. This has been reflected in the high results in previous community perception research and is the sentiment felt and expressed during engagement activities.

At the very start of the project Snowy Hydro identified key stakeholders, many with already established and strong relationships. This has meant that engagement this time around for the Snowy 2.0 Main Works EIS is the continuation of a conversation that builds on the Exploratory Works consultation. Snowy Hydro's engagement approach is two-way with Snowy Hydro sharing information and then listening to and taking onboard stakeholder feedback. This EIS addresses how stakeholder feedback has been considered and incorporated into the project plans and activities.

Snowy Hydro's engagement approach is open and transparent, with public and community events open to everyone to attend, including the media. To share information about Snowy 2.0, educate and consult with stakeholders Snowy Hydro utilise multiple communications channels, a suite of hardcopy and digital information materials and attend a wide range of forums and meetings.

To address the needs of special interest and industry groups, information is tailored to focus on the areas that matter the most to them and address specific issues. For example, engagement and discussions with Business Chambers tend to focus more on sub-contracting and local business opportunities, whereas meeting with bush-user groups are more tailored towards addressing the potential impacts to recreational use of the KNP.

The level of engagement reflects the needs of each stakeholder group and their proximity and relationship to the project. The most intensive engagement is with groups closest to the sites impacted and with stakeholder groups whose input and involvement with the project is critical, for instance the NPWS , emergency service agencies and regulators.

On the whole the feedback received from the community and industry groups on Snowy 2.0 has been positive. A range of potential impacts on the local community and industry groups, both positive and negative, by Main Works were identified early by Snowy Hydro based on existing relationships with stakeholder groups, and stakeholder engagement undertaken as part of Exploratory Works. Broadly, these were:

- impacts and opportunities on local employment and businesses;
- impacts and benefits to towns and localities in the region;
- impacts and benefits to services in the region;
- impacts and opportunities on recreation and tourism;
- impacts and benefits on roads; and
- impacts on environment and heritage.

As engagement has progressed through Main Works, Snowy Hydro has continued to seek feedback on key issues which is explored further in this chapter. Snowy Hydro has also used engagement around the EIS as an opportunity to ensure local business owners and locals are informed of how they can connect to procurement, contracting and employment opportunities as they arise on the project.

5.1.1 Engagement objectives

Snowy Hydro has a proactive and flexible stakeholder engagement strategy for Snowy 2.0, which is applicable to all phases of Snowy 2.0, including Main Works. It aims to meet the needs of a diverse range of stakeholders who have different levels of involvement in the project and a wide range of interests.

The strategy has been designed to maintain our social licence and support for the project and deliver the following objectives:

- maintain and build stakeholder and community confidence and trust in Snowy Hydro with open, transparent and timely engagement;
- create awareness of Snowy 2.0, what the project will involve, potential impacts on stakeholders and the role the project will play in the NEM among key stakeholder groups;
- retain and build stakeholder support for Snowy 2.0 and encourage positive collaboration between Snowy Hydro and stakeholders;
- build strategic relationships and work in partnership with key stakeholders to ensure the matters impacting Snowy 2.0 can be mitigated or managed;
- identify, listen to and manage emerging issues through effective two-way engagement;
- ensure communication and project information is up-to-date and communicated in a clear and transparent way; and
- be customisable, flexible, and dynamic to ensure engagement strategies meet the needs of stakeholders.

Like Snowy 2.0 Exploratory Works, the specific objectives of stakeholder engagement for Snowy 2.0 Main Works are to ensure identified stakeholders have a sufficient understanding of:

- its scope of Main Works;
- how Main Works may affect them;
- how engagement contributes to the overall approval process for Snowy 2.0 Main Works;
- how they can participate in the approval process and be informed, consulted and provide feedback;
- collect qualitative and quantitative data, evidence and insights for scoping the EIS, in ways that maximise diversity and representativeness;
- understand the interests that stakeholders have in Snowy 2.0 Main Works, and how potential impacts are predicted to be experienced from their perspective;
- consider the views of stakeholders in a meaningful way and using these insights to inform project planning, mitigation and enhancement measures, and monitoring and management frameworks; and
- respect people's privacy, allowing them to communicate their views anonymously if they desire.

Additionally, the stakeholder engagement strategy is aligned to DPIE's community participation objectives, which were developed by DPIE to ensure community participation is inclusive, easy to access, relevant, timely and meaningful.

5.1.2 Stakeholder engagement framework

To ensure all objectives are addressed, Snowy Hydro has developed an end-to-end framework for stakeholder engagement outlined in Figure 5.1. The framework is based on the International Association for Public Participation (IAP2)'s Public Participation Spectrum, 2014 (the Spectrum).

The framework has and will be applied throughout the lifespan of Snowy 2.0, with the ability to adapt as Snowy 2.0 progresses (including transitioning between Exploratory Works and Main Works) and as/when stakeholder requirements change, while remaining consistent with the overarching objectives.

The key phases are summarised below and in Figure 5.1:

1. identify - identification of stakeholders and impacts;

2. 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;

3. engage - commence stakeholder engagement in line with the level identified in the previous phase, and implement relevant methods;

4. provide feedback - create mechanisms for timely two-way feedback on stakeholder needs and concerns; and

5. review - implement a continuous improvement loop to assess the adequacy and effectiveness of engagement, and where required, change the nature of engagement.

1. Identify

Four key stakeholder groups that require engagement have been identified:
- government
- local community
- local industry groups
- media

A range of potential impacts both positive and negative, by Main Works were identified:
- impacts and opportunities on local employment, businesses, recreation, and tourism
- impacts and benefits to towns, localities and services in the region, and roads
- impacts on the environment and heritage

2. Design and prepare

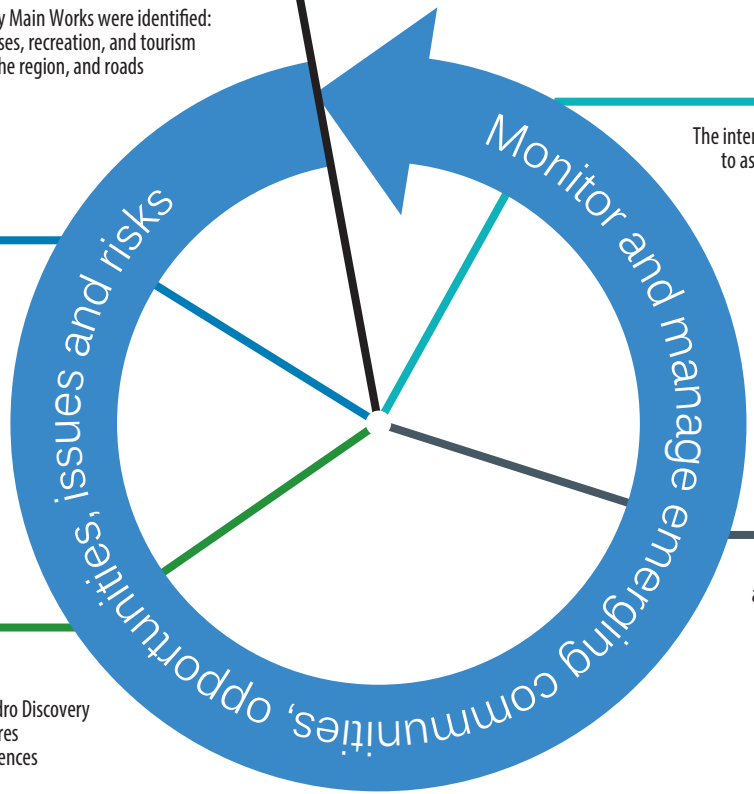
Four levels of engagement were assigned to each stakeholder group; they include:
1. **Inform –**
create awareness amongst stakeholders and communicate progress
2. **Consult –**
proactively seek feedback through formal and informal mechanisms, mitigate potential concerns and establish dialogue
3. **Involve –**
in cases where feedback is provided on direct impacts, consider feedback when designing relevant activities
4. **Collaborate –**
actively seek and incorporate stakeholder input into the design and implementation

3. Engage

The following engagement activities have been undertaken by Snowy Hydro:
- Community consultations in local townships
- The undertaking of surveys
- The provision of information materials through digital channels and in hardcopy
- Regular updates to the company website about the project
- Snowy Hydro's quarterly newsletter
- Media engagement
- Utilising the Snowy Hydro Discovery Centre and Visitor Centres
- Presentations at conferences
- Focus groups
- Ongoing consultation with NPWS, DP&E, local councils (Snowy Valleys & Snowy Monaro Regional Council)
- Ongoing consultation with key stakeholders such as Aboriginal groups, fishing and recreatioal groups
- Briefings and engagement with local communities and community stakeholders obtained through existing relationships with the community; and
- Briefings and engagement with industry groups

A range of permanent engagement channels have been established for Snowy 2.0 to seek input from stakeholders and to support stakeholder engagement on an ongoing basis

A range of tools continue to be used to support communication and engagement for Snowy 2.0 and Main Works, including: publications and information materials, community consultation sessions, presentations, meetings, workshops, media releases, articles, interviews, website updates, Snowy Hydro, FGJV and KNP shop fronts, and surveys



5. Review

The intent of this phase is to implement a continuous improvement loop to assess the adequacy and effectiveness of engagement, and where required, change the nature of engagement

Snowy Hydro has undertaken the following activities:
- research into better practice in community engagement
- validation and testing with key internal stakeholders

4. Feedback

Purpose is to capture feedback during stakeholder engagement and to identify issues by the stakeholders to address throughout Snowy 2.0

Opportunities for future feedback will include the exhibition period for the Main Works EIS

snowy 2.0

EMM

Stakeholder engagement framework
Snowy 2.0
Environmental Impact Statement
Main Works
Figure 5.1

5.1.3 Identified stakeholders – who was engaged

Snowy Hydro identified four key stakeholder groups, being governments, local community, local industry groups and media.

5.1.4 Engagement activities and tools – how and when engagement occurred

i Engagement tools

A range of tools continue to be used to support communication and engagement for Snowy 2.0 Main Works, including:

- publications and information materials;
- community consultation sessions (open to the public);
- stakeholder presentations with audience questions and answers (Q&As);
- meetings, workshops and formal working groups (State and Federal government, SVC and SMRC);
- traditional media (media releases, articles and interviews);
- print and radio advertising
- Snowy Hydro, FGJV and KNP shopfronts - sharing and distributing information;
- Snowy 2.0 project website updates;
- social media;
- surveys; and
- Snowy Hydro staff responding to enquiries and the Snowy Hydro Discovery and Visitor Centres.

Additionally, a range of permanent channels have been established for Snowy 2.0 to seek input from stakeholders and to support stakeholder engagement on an ongoing basis. These channels include:

- Snowy Hydro website (www.snowyhydro.com.au/our-scheme/snowy20/), provides background information, maps, videos, information on approvals, frequently asked questions, and details on how to enquire about the project;
- FGJV website (www.futuregenerationjv.com.au) and site office in Cooma (as of August 2019) to help facilitate stakeholder engagement;
- a dedicated project email address (snowy2.0@snowyhydro.com.au) to facilitate project feedback and comments; and
- a dedicated project freecall number for feedback, questions and complaints.

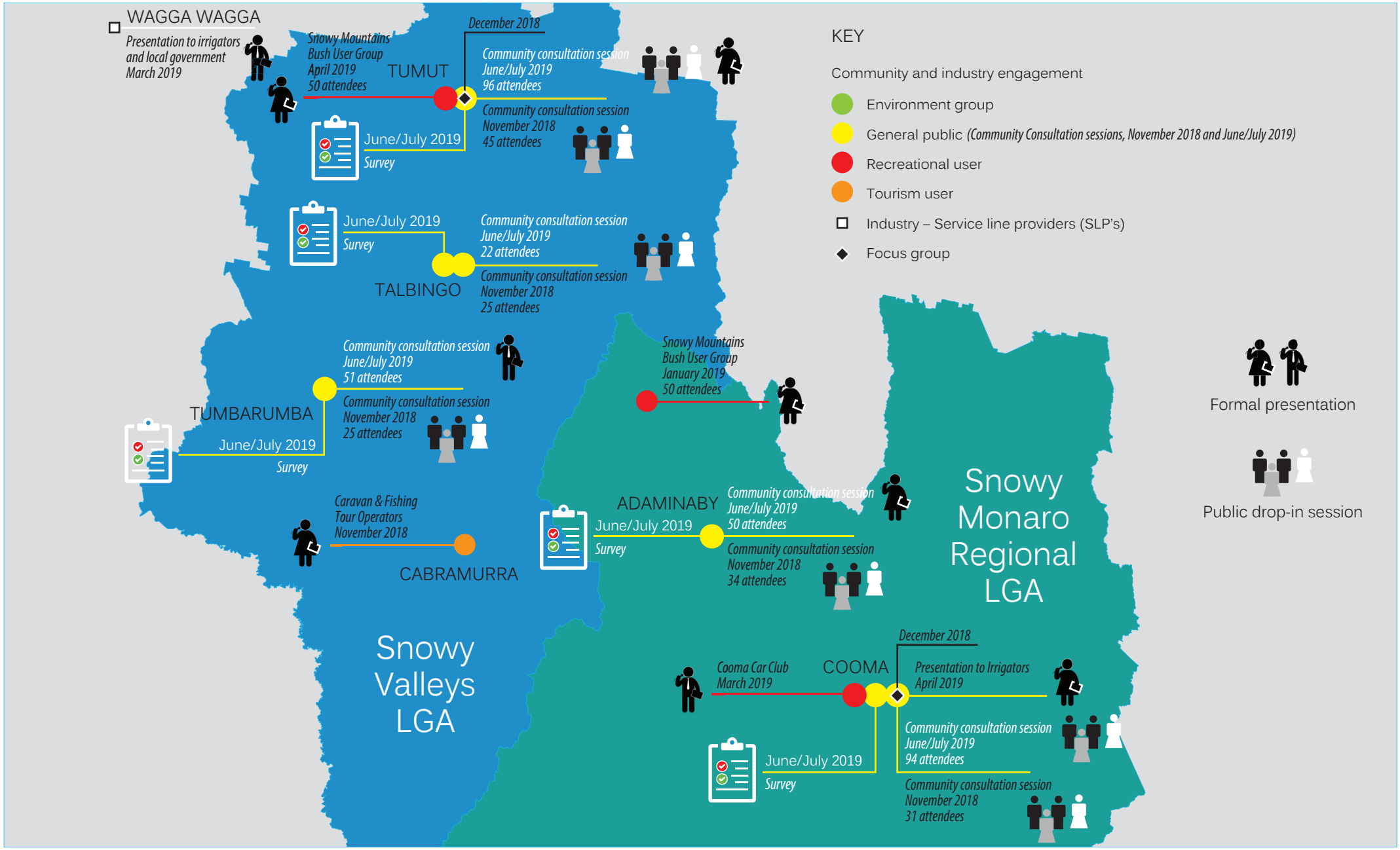
ii Engagement activities

Engagement on Snowy 2.0 commenced in early 2017 as soon as the project was announced and has been regular and ongoing. As the design for Snowy 2.0 developed and the need for Exploratory Works became apparent, stakeholder engagement activities evolved to inform stakeholders about Exploratory Works, as well as the broader Snowy 2.0. Engagement on Exploratory Works was generally undertaken between November 2017 and the end of October 2018. Engagement since the start of November 2018 has largely focused on Snowy 2.0 Main Works.

Further details regarding engagement with the identified stakeholder groups are provided in Appendix I. A summary of engagement activities undertaken by, or on behalf of, Snowy Hydro are below and are also reflected in Figure 5.2 and Figure 5.3:

- community consultations in local townships and discussed the project with over 800 community members;
    - November 2017 – community drop-in sessions held in Adaminaby, Cooma, Talbingo and Tumut;
    - April to June 2018 – community briefings held in Adaminaby, Cooma, Corryong, Jindabyne, Talbingo, Tumbarumba, and Tumut;
    - November 2018 – community drop-in sessions held in Adaminaby, Cooma, Talbingo, Tumbarumba, and Tumut; and
    - June/July 2019 - community briefings and drop-in sessions held in Cooma, Adaminaby, Tumbarumba, Talbingo and Tumut.
- the undertaking of surveys;
    - November 2017 to May 2018 – open online survey (also available in hard copy);
    - December 2018 – telephone survey of a representative sample of residents by target gender, age groups and postcodes in the local area;
    - December 2018 – online surveys completed by a register of interested people on a Snowy Hydro contact list and visiting patrons of the Snowy Hydro Discovery Centre in Cooma;
    - June/July 2019 – open online survey (also available in hard copy through the Snowy Hydro newsletter and at community briefing sessions); and
    - Additional surveys to supplement the Social Impact Assessment and the Recreational User Impact Assessment were also conducted and are discussed further in Appendix X and Appendix Y respectively;
- The provision of information materials through digital channels and in hardcopy including
    - community information booklets;
        - booklet one in November 2017;
        - booklet two in January 2018;
        - booklet three in April 2018;

        - booklet four in December 2018; and
        - booklet five in May 2019.
    - information available on the Snowy Hydro website and social media channels;
    - Snowy Hydro's quarterly community newsletter which is delivered by mailbox drop and provides project updates to communities in the Snowy Valleys and Snowy Monaro Regional LGAs;
- focus groups held in Cooma and Tumut in December 2018 with a representative sample of local residents;
- ongoing consultation and site visits with State and Commonwealth government agencies and local councils (SVC and SMRC), outlined further in Figure 5.3;
- ongoing consultation with key stakeholders such as Aboriginal groups, recreational, and fishing groups;
- briefings and engagement with local communities and community stakeholders obtained through existing relationships with the community;
- briefings and engagement with local industry groups, environment groups, and business chambers, including:
    - National Parks Association;
    - Talbingo Process Association;
    - Snowy Mountains Bush User Group;
    - Snowy Mountains Local Business Chambers of Commerce;
- media engagement through media releases, editorial content, events and responding to media enquiries;
- utilising the Snowy Hydro Discovery Centre and visitor centres to share information about the project and showcase display materials; and
- presentations at conferences and events relevant to stakeholders.



snowy 2.0

EMM

Overview of engagement

Snowy 2.0
Environmental Impact Statement
Main Works
Figure 5.2

iii Engagement with government agencies

The NPWS have been the principal NSW agency engaged through the process of developing the Snowy 2.0 Main Works EIS. This has involved over 10 formal and numerous informal briefings and workshops with representatives from KNP over the last 12 months.

The former OEH (now DPIE) has been engaged comprehensively regarding biodiversity and heritage issues since February 2019. In the first instance ensuring that biodiversity and heritage survey methodology and targets were identified with the best available knowledge in collaboration with OEH was the priority. Thereafter, OEH has been updated on both ecological and heritage findings as surveys progressed and feedback incorporated as work progressed.

There have been at least five workshop/meetings between the project design team and RMS, with a site visit for the RMS team led by Snowy Hydro to help further the understanding of the level of upgrade and maintenance work required, as well as the existing issues that are present with the project region. Engagement with RMS has been very positive throughout the entire consultation process. Both Snowy Hydro and RMS have been working together to achieve the best outcome for the project, whilst taking into account the existing road requirements of the region and ensuring all parties such as local council are equally engaged. Both the Snowy Hydro and RMS teams have been actively sharing information such as model data and proposed designs in order to ensure all issues are raised and that an agreeable solution can be found.

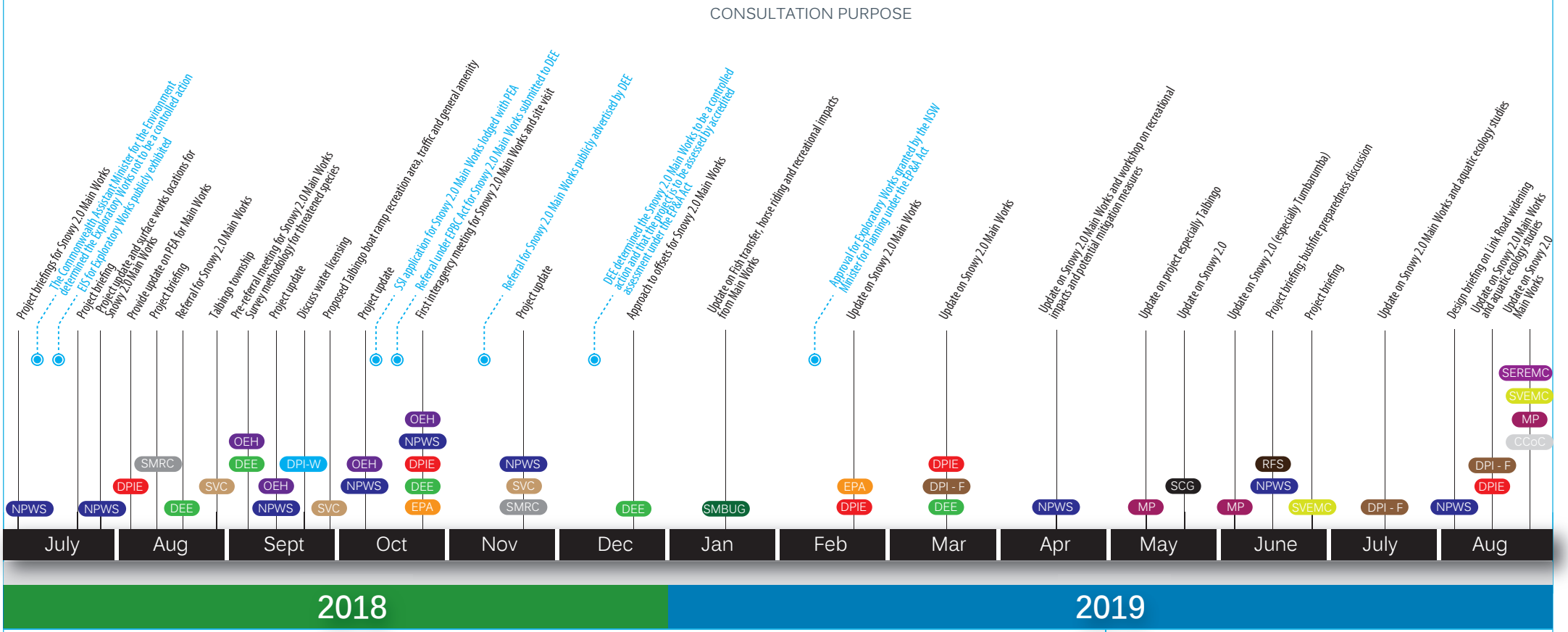
The EPA has been engaged on the Snowy 2.0 Main Works since February 2019 and has involved briefings and workshops with regional officers of the EPA and head office technical assessment teams.

Engagement with DPI Fisheries and Biosecurity during Main Works EIS development have involved face to face briefings and workshops with representatives on at least five occasions and followed on from numerous meetings through the development of the Exploratory Works EIS.

To date Snowy Hydro have met with local representatives of both the Cooma Monaro and Riverina Rural Fire Service (RFS) units on several occasions, in addition to providing regular project updates at the Snowy Monaro and Snowy Valleys Local Emergency Management Committees. RFS representatives have attended for several site familiarisation visits to Project locations and have been extensively consulted in the development of the Project Bushfire Management plans and Emergency Management Plans. Prior to the commencement of the bushfire season each year, Snowy Hydro will attend the local bushfire management committees to obtain the latest information regarding the bushfire outlook.

Throughout the preparation of the technical studies, Snowy Hydro has met with DEE on a regular basis to provide updates on project design, technical study outcomes, principally on ecological and heritage MNES and approval pathway matters (refer to Chapter 4) under the EPBC Act.

Figure 5.3 provides a summary of the engagement undertaken with key government agencies (related predominantly to Snowy 2.0 Main Works). For a full list of government engagement activities please refer to Table 3.1 in Appendix I. Figure 5.3 also contains key dates in the approval process for Snowy 2.0 to provide context to the consultation with the agencies.



KEY

GOVERNMENT AGENCY

DPIE	NSW Department of Planning and Environment
DEE	Commonwealth Department of the Environment &Energy
NPWS	NSW National Parks and Wildlife Service
DPI-W	NSW Department of Primary Industries – Water
DPI - F	NSW Department of Primary Industries – Fisheries
OEH	NSW Office of Environment and Heritage
RFS	Rural Fire Service Riverina
SCG	State Coordination Group
SEREMC	South Eastern Regional Emergency Management Committee
EPA	NSW Environment Protection Authority
SVC	Snowy Valleys Council
SMRC	Snowy Monaro Regional Council
DPI - B	NSW Department of Primary Industries – Biosecurity
MP	Individual MPs
RMS	NSW Roads and Maritime Services
SMBUG	Snowy Mountains Bush User Group
SVEMC	Snowy Valleys Emergency Mgt Committee
CCoC	Cooma Chambers of Commerce

KEY

COMMUNITY AND INDUSTRY ENGAGEMENT

- Environment group
- General public *(Community Consultation sessions, November 2018 and June/July 2019)*
- Recreational user
- Tourism user
- Industry – Service line providers (SLP's)

snowy 2.0

EMM

Overview of engagement with government agencies

Snowy 2.0
Environmental impact statement
Main Works
Figure 5.3

5.2 Key issues raised and how they have been addressed

5.2.1 Local community, local industry and special interest groups

Feedback from the community on Snowy 2.0 has been positive. Some of the issues identified and raised by these stakeholders are specific to a geographic location or an individual. Other issues that are raised at community events (which are all open to anyone to attend) are raised by someone on behalf of a local community group and reflect a special interest group's view. Key matters raised include:

- general interest in business opportunities and work with Snowy 2.0;
- traffic around Cooma and potential disruptions to the main street from trucks;
- the concern that there will be accommodation shortages when workers come into towns, especially in winter, which will impact on ski tourism;
- closures of specific roads, for example Tantangara Road; and
- impacts to recreational fishing spots from partial reservoir closures or restrictions at Talbingo and Tantangara Reservoirs.

Additionally, the most recent survey results undertaken in June and July 2019 indicates that these interests are still very important to the community, with the top four themes identified by the community as the most important being (in order of importance);

1. Economic, employment and business opportunities;
2. Energy reliability;
3. Renewable / greener energy; and
4. Environmental impacts.

Snowy Hydro has specifically engaged with a range of special interest groups. It's also important to note that many of these groups' views are also captured through engagement with the local community and the public information sessions held. Key matters raised by these groups include:

- environment impacts to the KNP;
- impacts to recreational activities including fishing and horse riding in the KNP;
- potential for fish transfer;
- excavated rock placement in the Tantangara Reservoir;
- road closures and increased traffic during construction; and
- opportunities for local businesses to get work on Snowy 2.0.

5.2.2 Government agencies

As discussed in Section 5.1.4 engagement with government agencies during the Snowy 2.0 Main Works EIS development has been in concurrence with Exploratory Works and Snowy 2.0 in general and remains a priority to Snowy Hydro. Primary matters raised during these engagement sessions include:

- potential impacts of the proposed works on the amenity and recreational facilities in KNP;
- potential impacts to local water quality during construction;
- potential impacts on reservoir water quality from the excavated material placement;
- impacts on native aquatic species and recreation as a result of potential pest fish transfer between Talbingo and Tantangara and related impacts (such as potential transfer of pathogens);
- potential impacts to threatened species as a result of excavated material placement in Talbingo; and
- traffic impacts across the project and on the main haul routes to site.

These matters are outlined in further detail in Table 5.1.

5.2.3 Summary of matters raised

Table 5.1 provides a summary of the matters raised through the engagement carried out by Snowy Hydro for Snowy 2.0 Main Works.

Table 5.1 Key issues raised during the preparation of the EIS

Theme	Key issue raised	How has the issue been addressed	Where addressed in this EIS
Strategic context	• Renewable energy • The transitioning NEM • Energy prices • Viability of project/cost of pumping • Concerns that alternative sites for pumped-hydro were not considered • Economic viability • impact of the transmission corridor • Staging of the approval process	This EIS has provided a detailed options report (refer to Appendix C) which provides information on the alternatives to Snowy 2.0. A key reference document is 1991 study carried out by Snowy Mountains Scheme which considered the Yarrangobilly Pumped Storage Scheme, a precursor to Snowy 2.0. With the NEM continuing to evolve and at a rapid pace, Snowy 2.0 be a significant contributor to the continued decarbonisation of the NEM. The EIS provides further contextual information (Appendix H). Each technical study has considered the cumulative impacts of the Snowy 2.0 Transmission Connection Project where relevant to do so. Snowy Hydro and TransGrid have been working together during the design development to maximise an efficient and optimised integration of the two projects. Community consultation activities for Snowy 2.0 Main Works have included materials providing information on the Snowy 2.0 Transmission Connection Project with some TransGrid personnel available at some sessions.	Chapter 3 of the EIS

Table 5.1 Key issues raised during the preparation of the EIS

Theme	Key issue raised	How has the issue been addressed	Where addressed in this EIS
KNP	• Environment impacts to the KNP and potential long-term damage • Long term impacts on the KNP of 2.0 operations	Through the design process significant effort has been put into mitigating impacts to amenity, natural and cultural values of the KNP by: • minimising physical disturbance areas as much as possible; • using existing and limiting new access points; and • committing to land-forming and rehabilitation programs. Concerns about long term impacts to KNP will be addressed through the program of rehabilitation and land forming impacted areas. It has also been agreed with KNP that a recreation plan be developed collaboratively, that identifies any permanently affected recreation facilities requiring relocation, or new or augmented visitor facilities. Lastly, the long term tenure arrangements for operation of Snowy 2.0 within KNP, will contain provisions for maintenance of areas, roads and other assets to ensure costs are apportioned and borne by the appropriate party. Where these measures have not fully avoided or minimised impacts, offsets are proposed that will see management actions implemented, that achieve direct recreation and conservation outcomes within KNP, proportionate with the impacts.	Chapter 6 of the EIS

Table 5.1 Key issues raised during the preparation of the EIS

Theme	Key issue raised	How has the issue been addressed	Where addressed in this EIS
Biodiversity	• Impacts on native aquatic species and recreation as a result of potential pest fish (Redfin) transfer between Talbingo and Tantangara reservoirs, and further impacts from distribution upstream and downstream • Impacts on recreational fish (trout) as a result of potential Redfin transfer • Potential transfer of pathogens and in particular the EHN virus through the power waterway • Transfer of invasive weed species from vehicle movement • Concerns for wildlife on the roads and increased roadkill; • Potential impacts to threatened species (Murray crayfish) as a result of excavated material placement in Talbingo Reservoir • Potential impacts to threatened species and communities • Where impacts to threatened species and communities cannot be avoided, developing a strategy for offsets	The project has committed to fish barrier controls on the Eucumbene - Murrumbidgee tunnel and on the Tantangara dam wall and upstream on Tantangara Creek The project has committed to augmenting the recreational fishing resource through stocking of larger trout in Tantangara Reservoir that can survive predation from Redfin, should the pest species be transferred. The aquatic ecology assessment (Appendix M.2) considers the risks of the EHN virus. There is no history of outbreaks in Talbingo Reservoir. The assessment also found that the number of outbreaks and virulence of them, has been in decline and there has been no outbreak detected since 2011. The potential for use of UV to mitigate this risk is being assessed and discussions with DPI about the value of installing this is ongoing. The direct impacts to Murray crayfish from placement of excavated material is being mitigated through reductions in the overall placement area, pre-clearance surveys, and translocation. Where these do not adequately mitigate the impacts to Murray crayfish, offsets will be necessary and proportionate with the impacts.	Section 6.4 of the EIS

Table 5.1 Key issues raised during the preparation of the EIS

Theme	Key issue raised	How has the issue been addressed	Where addressed in this EIS
Heritage	• Potential impacts to Aboriginal cultural heritage	Snowy Hydro has committed to the avoidance of Ravine cemetery and Washington Hotel at Lobs Hole, the main construction area. Further, Importantly a highly significant Aboriginal heritage rock shelter was identified during the project investigations and has been avoided. Through the Aboriginal cultural heritage assessment process, Snowy Hydro has regularly engaged with RAPs and OEH regularly regarding the heritage investigations, findings and management measures. These matters are addressed in the Aboriginal Cultural Heritage Assessment (Appendix P.1). Should Snowy 2.0 Main Works be approved, management plans addressing potential impacts to Aboriginal heritage will be prepared and implemented.	Sections 6.7 and 6.8 of the EIS
Water	• Impact of subaqueous placement of excavated rock (turbidity and water quality) • Fluctuation of dam levels on Talbingo and Tantangara reservoirs • Closure of the Talbingo spillway • Interest from irrigators about water quality and of downstream water releases or flows will be impacted • Eucumbene lake operators concerned that water will be held in Tantangara and not released into Eucumbene or Providence Portal • Potential impacts to local water quality from surface water runoff from disturbed construction areas • Potential impacts to local water quality from process tunnel and wastewater from accommodation and other construction facilities	For surface water runoff, a range of cultural, physical design and administrative measures are proposed, including: • establishing a strong culture of pollution prevention and providing access to a highly experienced and skilled pollution control expertise; • focusing prevention of pollution through design (eg clean water diversion), site selection and source controls; • minimising disturbance and the amount of time disturbed areas are exposed and closing site prior to weather events that could result in runoff; • monitoring and responding rapidly to any potential pollution causing event and taking corrective action; and • ensuring that discharges meet the water quality objectives for process and wastewater.	Section 6.2 of the EIS

Table 5.1 Key issues raised during the preparation of the EIS

Theme	Key issue raised	How has the issue been addressed	Where addressed in this EIS
Traffic and transport	• Existing road utilisation and known issues within the road network for the Project • Traffic modelling and the comparison between existing baseline and average and peak project loading • Impact of construction traffic on main and local roads • Transport of large equipment and project routes • The ability to use Port Phillip Track as an alternative to Tantangara Road and the seasonal access • Truck parking and places to stop aren't available in some of the towns like Adaminaby • Review and discussions on concept designs for road intersection across the Project site and on the main haul routes to site • Safety concerns with trucks on the roads and accidents • Managing and scheduling Project required works with RMS existing planned maintenance and works • Local road upgrades • Closure of roads due to construction	Snowy Hydro has engaged with road authorities, SMRC, NPWS and RMS, regarding proposed measures to provide for adequate road safety and network performance during the construction period. There have been several workshop/meetings between the Snowy Hydro, SMRC, NPWS and RMS, with a site visit for the RMS team led by Snowy Hydro to help further the understanding of the level of upgrade and maintenance work required, as well as the existing issues present with the region's road network. The teams have been actively sharing information such as model data and proposed designs in order to ensure that appropriate solutions are implemented. A Traffic and Transport Assessment (Appendix Q) has been prepared and Snowy Hydro will continue to engage with RMS and other key road agencies.	Section 6.9 of the EIS

Table 5.1 Key issues raised during the preparation of the EIS

Theme	Key issue raised	How has the issue been addressed	Where addressed in this EIS
Social and economic	**Local employment and business opportunities** • Opportunities for businesses and individuals to participate (including opportunities for apprenticeships) • Access to packages for small operators/businesses • Process for business pre-qualification, project readiness and job applications • Seeking support for the Chambers to assist business get ready and prequalified for work on the project • Concerns from local business owners about losing their existing staff to the project workforce • Training opportunities • Impact on existing local workforce/employee availability	Ongoing engagement with local businesses and Business chambers will assist in ensuring they are aware of business opportunities and contracts available on Snowy 2.0.	Section 6.13, Section 6.14, and Appendix X of this EIS

Table 5.1 Key issues raised during the preparation of the EIS

Theme	Key issue raised	How has the issue been addressed	Where addressed in this EIS
	Recreation and tourism • Access to Talbingo and Tantangara reservoirs, lobs hole • Impacts to recreational activities ie fishing and tourism • Concerns that Lobs Hole won't be the same quiet campsite post-project (access will be opened up with improved road access to the site) • Impacts of the proposed works on the amenity and visitor facilities of KNP and recreational users who value this • Impacts of the proposed works on the natural and cultural heritage values of KNP • Long term impacts on the KNP of 2.0 operations • Tourism operators and towns worried about the perception that the region is 'closed' or impacted by construction and traffic and it could deter visitors to the region • Horse riders - access to recreation sites • Tourism benefits from off-shift workers recreating locally • Desire for some of the funding from the environmental offsets to be invested in improved recreational amenities • Impacts on accommodation shortages, especially in winter which will impact on ski tourism	Engagement with community and stakeholders has been a key part of avoidance and minimisation of impacts throughout the design process. Keeping the community informed of project developments and predicted impacts enables the community to prepare for and predict how the project might result in some changes to recreation in some sections of KNP. In addition to community and stakeholder engagement, the following avoidance and minimisation measures have been considered and adopted for the project: • maintaining some level of access on Tantangara Road; • providing future recreational opportunities through consultation with NPWS; and • incorporating relevant road works to improve safety and access to KNP in the long term. The recreational user assessment involved the collection of qualitative and quantitative data on the use and visitation of KNP, including field (visitor) surveys, email surveys, and visitor counts, as well as consultation with NPWS.	Section 6.13, Section 6.14, and Appendix X of this EIS

Table 5.1 Key issues raised during the preparation of the EIS

Theme	Key issue raised	How has the issue been addressed	Where addressed in this EIS
	Impacts or benefits to towns in the region • Benefits for economies of local towns • Impacts for towns (eg Talbingo, Tumut) not perceived as central to the project • Benefits of families of workers moving to towns • Local towns are seeking ways to market their region to workers on their swing off days • Concerns from land holders about difficulty crossing live-stock on the Snowy Mountains Highway • Impacts on services such as health and schools, tertiary education facilities and childcare • Short and long-term housing availability	In addition to the extensive engagement already undertaken by Snowy Hydro during the preparation of this EIS, a series of targeted social impact-specific engagement activities was undertaken to address issues raised by the community on the impacts or benefits to communities of local towns in the region. These activities utilised a variety of techniques including focus groups, surveys and in-depth interviews with service level providers. Planning is already underway regarding mitigating potential impacts to short and long-term housing availability. Snowy Hydro are pursuing the provision of accommodation for project workers at a site in Cooma (called Pacific Hills) that could provide 120 short term accommodation rooms and 30 long term accommodation cabins. It also allows for potential expansion. This accommodation would support the accommodation needs of the different project components of Snowy 2.0. This process is subject to a separate development application to SMRC.	Section 6.13, Section 6.14, and Appendix X of this EIS
	Workforce • Duration of swings and facilities in the accommodation camps • Where will the workers come from and how will they be mobilised? • Transport to site and FIFO What will happen to construction camps and sites after the project is finished?	Snowy Hydro views the Exploratory Works phase of Snowy 2.0 as a unique opportunity to anticipate degrees of workforce population and movements and potential impacts on the local community. Preparing for and adequately monitoring the degree of population change that arises will be the main way of managing social impacts when the Main Works phase of the Project commences. Depending on the population change scenario that eventuates, appropriate interventions can then be designed by Snowy Hydro that are proportionate to the scale of change being experienced.	Section 6.13, Section 6.14, and Appendix X of this EIS
Emergency services	• potential lack police resources -escort vehicles • Lack of single communication network	Prior to the commencement of the bushfire season each year, Snowy Hydro will attend the local bushfire management committees to obtain the latest information regarding the bushfire outlook.	Section 6.11

5.3 Proposed approach to community engagement if the project is approved

Community and Stakeholder Management Plans (CSMP) have been developed for Snowy 2.0 that provide a framework for the management of community and stakeholder relations and communication related to the project. This plan will be a fluid document that will be updated every year and reviewed regularly following Snowy 2.0 engagement activities. These CSMPs will continue to be updated and implemented should Snowy 2.0 Main Works be approved. These plans will be supported by other plans and procedures as needed to manage engagement with the community during construction.

The proposed approach to community engagement if the project is approved, is to focus on providing engagement activities that provide up to date project information to those likely to be affected during construction and also allow the community to communicate concerns with the project.

A summary of the key engagement activities proposed if the project is approved is provided in Table 5.2, with further detail provided at Appendix I. Table 5.2 also outlines the implementation of the DPIE community participation objectives in relation to the engagement activities.

Table 5.2 Engagement activities during construction

Engagement activities	Description	DPIE community participation objectives to be implemented
Construction management communication	A Snowy 2.0 Main Works Communication Action Plan will be developed three months prior to construction to plan for all upcoming construction activities including traffic and transport movements that may impact the local community and travelling public. This action plan will be a working document and updated regularly as the project progresses. Additionally, some indicative tools and engagement activities that may be used to communicate construction activities during Main Works include: • Targeted communication: – briefings for local councils and emergency services, meetings/briefings with key stakeholders such as directly impacted residents, business owners and the wider community; – construction disruption letters to affected properties and construction notification emails to key stakeholders; – construction information sessions for the community; • Mass-distribution communication: – community consultation sessions; – community announcements/road work alerts; – community and media events at project milestones; – public display materials; – Snowy Hydro Discovery Centre; – project fact sheets and traffic management communications supporting collateral; – e-newsletters, freecall 1800 information line which operated 24/7; and – project website and social media accounts, email addresses for feedback and enquiries. A Crisis Communication Procedure has been developed to ensure an effective and appropriate response to any incident on site.	• Open and inclusive • Easy to access • Relevant • Timely • Meaningful

Table 5.3 Engagement activities during construction

Engagement activities	Description	DPIE community participation objectives to be implemented
Traffic and Transport Communication Working Group	A Snowy 2.0 Traffic and Transport Communication Working Group has been established including communication representatives from Snowy Hydro, Future Generation Joint Venture, NSW Police, Transport NSW, Destination Southern NSW, Snowy Monaro Regional Council and Snowy Valleys Council. The group will continue throughout Main Works. The purpose of this group is to share resources and communication tools to ensure all communication channels and resources are utilised to inform the local community and general public of the project's traffic and transport activity and likely impacts.	• Open and inclusive • Easy to access • Relevant • Timely
Complaints handling	A Complaint Management and Dispute Resolution Procedure has been developed for Snowy 2.0 with an overview of the process and procedures established to manage complaints and disputes. Regular reporting will also occur from within the project in relation to complaints raised, outcomes and process changes arising from such complaints. A register of community inquiries will be maintained through the Snowy 2.0 stakeholder management software and updated as inquiries or complaints are received and resolved. All complaints and actions will be published on the project webpage.	• Open and inclusive • Easy to access • Timely • Meaningful
Online communications	During Exploratory Works, communication has been developed to educate and prepare the community for the likely impacts of construction activity, especially during Main Works. Some communication channels for the project have already been established such as www.futuregenrationjv.com.au and www.snowyhydro.com.au/our-scheme/snowy20/.	• Open and inclusive • Easy to access • Relevant • Timely • Meaningful
Snowy 2.0 information centre	A Snowy 2.0 information centre/project office is being established to provide a one-stop shop for the local community. Due to the isolated nature of the site location and camp accommodation this information centre/project office will be positioned prominently and will be easily accessible within Cooma. A community suggestion box will also be included for the community to offer feedback and suggestions for improvement. The information centre/project office is planned to include interactive displays, photographic installations and a project construction video. Project staff will be available to answer community questions when required.	• Open and inclusive • Easy to access
Media	Media briefings, especially to local media throughout the project's life cycle, will form the cornerstone of a media strategy to deliver key information to the public. To disseminate key project messages into the public domain and to ensure that media are armed with information relating to this project, a series of media briefings will be held throughout the project construction. Other activities to support this strategy may include: • Construction updates in local community newspapers/newsletters; • Onsite media visits; • Inclusion of construction updates in existing project communication materials; and • Production of a promotional video for the lifecycle of the project	• Open and inclusive • Easy to access • Relevant • Timely