

Christina McNally
Senior Environmental Advisor - Post Approvals

Snowy Hydro Limited
Sent via Major Projects Portal

17/07/2026

Subject: Snowy 2.0 Main Works (SSI-9687) - Water Management Plan

Dear Mrs McNally,

I refer to the revised Water Management Plan submitted in accordance with Schedule 3, Condition 31 of the Infrastructure Approval for the Snowy 2.0 Main Works Project (SSI-9687).

I note the Water Management Plan:

- has been prepared in consultation with the Environment Protection Authority (EPA), National Parks and Wildlife Service (NPWS), NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) - Water Group and NSW Department of Primary Industries (DPI) - Fisheries;
- contains the information required by the conditions of the Infrastructure Approval; and
- the required Surface Water Management Plan and Groundwater Management Plan have been submitted for review and approval as separate tasks in the Major Projects Portal.

The Department has carefully reviewed the document and is satisfied that it generally meets the requirements of the relevant conditions in the Infrastructure Approval (SSI-9687).

Accordingly, as nominee of the Planning Secretary, I approve the Water Management Plan (Revision P dated 23 January 2026). You are reminded that if there are any inconsistencies between the Water Management Plan and the conditions of approval, the conditions prevail.

Please ensure you make the document publicly available on the project website at the earliest convenience.

If you wish to discuss the matter further, please contact Katie Weekes on 4927 3223.

Yours sincerely,

A handwritten signature in blue ink, appearing to read "Nicole Brewer".

Nicole Brewer
Director
Energy Assessments
As nominee of the Planning Secretary



webuild | clough | lane

MANAGEMENT PLAN

SNOWY 2.0 MAIN WORKS – WATER MANAGEMENT PLAN

S2-FGJV-ENV-PLN-0010

REV P

JANUARY, 2026

ABSTRACT

The objectives underpinning this Plan are to detail management measures and inform site procedures to mitigate potential impacts to water within the scope permitted by the Infrastructure Approval.

Revision Record

P	23.01.2026	Updated to include Water Group comments	S. Lang	E. Porter	F. Lazzarin D. Drummond
Rev.	Date	Reason for Issue	Responsible	Accountable	Endorsed

Document Verification

RACIE Record

R esponsible:	Name: Scott Lang Job Title: Environmental Coordinator Signed:  p.p Carolina Pedraza Hernandez Date: 05.02.2026
A ccountable:	Name: Ellen Porter Job Title: Environmental Manager Signed:  Signed by: E Porter Date: 05 February 2026
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E ndorsed:	Name: Fabrizio Lazzarin Job Title: Project Director Signed:  Signed by: F Lazzarin Date: 06 February 2026 Name: David Drummond Job Title: QHSE Director Signed:  Signed by: JUSTIN TANNOCK Date: 05 February 2026

RACIE Terms

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A	Accountable The person who has the answer for success or failure of the quality and timeliness of the document.
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Revision Tracking

Rev.	Date	Description of Revision
A	27.11.2019	Initial draft for SHL review
B	22.5.2020	Update to reflect conditions of approval and revised environmental management measures
C	15.6.2020	For consultation
D	25.06.2020	Update to address Commonwealth conditions of approval
E	06.08.2020	Revised to address stakeholder comments
F	19.09.2020	Revised to address DAWE and DPIE comments
G	15.10.2020	Revised to address NRAR clarification
H	08.09.2022	Revised to address annual audit findings and update and reviewed for currency and to update prior to in-reservoir placement of spoil.
I	21.10.2022	Updated to reflect Snowy Hydro comments on Rev H
J	25.10.2024	Updated to include Modification 3 details.
K	30.12.2024	Updated to include SHL and agency comments
L	08.08.2025	Updated to include SHL comments
M	04.10.1025	Updated to include Agencies comments
N	23.10.2025	Updated to include DCCEEW comments
O	17.12.2025	Updated to include SHL comments
P	23.01.2026	Updated to include Water Group comments

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ABBREVIATIONS AND DEFINITIONS

Acronym	Definition
AFL	Agreement for Lease
AHD	Australian Height Datum
AIP	Aquifer Interference Policy
CoA	Infrastructure Conditions of Approval (SSI 9687)
Construction envelope	The maximum extent within which the disturbance area corridor can move to allow the final siting of infrastructure through the detailed design process
CPHR	Conservation Programs, Heritage and Regulation
Disturbance footprint	The disturbance footprint as described in the PIR-RTS is the indicative corridor inside the larger construction envelope, where construction works required to build Snowy 2.0 can be carried out.
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DCEEW	Department of Climate Change, Energy, the Environment and Water
DPHI	NSW Department of Planning, Housing and Infrastructure
EIS	Environmental Impact Statement
Exploratory Works	The development of an exploratory tunnel and associated infrastructure described in the Environmental Impact Statement for the <i>Snowy 2.0 Exploratory Works</i> (CSSI 9208) dated July 2018, and modified by the: • <i>Submissions Report</i> dated October 2018 and additional information provided to the Department on 17 October 2018, 19 November 2018 and 23 January 2019; • <i>Modification Report</i> dated 6 June 2019 and associated <i>Submissions Report</i> dated 2 September 2019 and amendment letter date 4 October 2019; and • <i>Modification Report</i> dated 17 October 2019 and associated <i>Submissions Report</i> dated 10 January 2020
EMS	Environmental Management Strategy
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EP&A Regulation	<i>Environmental Planning and Assessment Regulation 2000</i>
EPA	NSW Environment Protection Authority
EPL	Environmental Protection License
ESCP	Erosion and Sediment Control Plan
FGJV	Future Generation Joint Venture
Future Generation-PMS	Project Management System
GMP	Groundwater Management Plan (S2-FGJV-ENV-PLN-0012) (Appendix B)
Incident	An occurrence or set of circumstances that causes or threatens to cause material harm and which may or may not be or cause a non-compliance
KNP	Kosciuszko National Park
Lobs Hole site	The development in the vicinity of Lobs Hole, including the GFO1 emplacement area; construction facilities (Main Yard), including workers' accommodation camp and temporary spoil emplacement areas; Main Access Tunnel and Emergency Cable and Ventilation Tunnel portals; and ancillary infrastructure including access roads, substation, cableyard and utilities.

Acronym	Definition
Main Works	The development of an underground power station and associated infrastructure described in the Environmental Impact Statement for the <i>Snowy 2.0 Main Works</i> (CSSI 9687) dated September 2019, and modified by the: • <i>Preferred Infrastructure Report and Response to Submissions – Snowy 2.0 Main Works</i>, dated February 2020; and • Additional information provided to the Department by EMM on 24 March 2020 and 7 April 2020
Marica site	The development in the vicinity of Marica, including the headrace surge shaft; ventilation shaft; construction facility workers' camp; and ancillary infrastructure including access roads and utilities.
Material harm	Is unauthorised harm that: • involves actual or potential harm to the health or safety of human beings or to the environment that is not trivial; or • results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding \$10,000, (such loss includes the reasonable costs and expenses that would be incurred in taking all reasonable and practicable measures to prevent, mitigate or make good harm to the environment)
NPWS	National Park and Wildlife Services
DPHI	The NSW Department of Primary Industries within Regional NSW
Plateau site	The development in the vicinity of the Plateau, including the instream barrier in Tantangara Creek and ancillary infrastructure including access roads and utilities.
Plateau area	The plateau area; located to the east of the Snowy Mountains Highway and spanning the area between the highway and Tantangara Reservoir, is typical of elevated alpine environments, dominated by low energy streams, gentle rolling hills and mostly flat floodplains. The plateau area includes the Plateau and Tantangara work sites.
PMF	Probable Maximum Flood
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
POEO Regulation	<i>Protection of the Environment (General) Regulation 2009</i>
Project	Snowy 2.0 Main Works
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. The project area does not represent a footprint for the construction works, but rather indicates an area that was investigated during environmental assessments.
Ravine zone	The ravine area; located mostly to the west of the Snowy Mountains Highway, is characterised by deep gorges and steep sloping ridges, the product of incision from river flow, historic glaciation and structural movement. The ravine area includes the Talbingo, Lobs Hole and Marica work sites.
REMM	Revised Environmental Management Measures
Rock Forest site	The development on the Rock Forest property, including the Rock Forest emplacement area, logistics laydown area and ancillary infrastructure including access roads.
Submissions Report or RTS	Response to Submissions Main Works for Snowy 2.0
SHC Act	<i>Snowy Hydro Corporatisation Act 1997</i>
SHL	Snowy Hydro Limited
SSI	State Significant Infrastructure under EP&A Act (Infrastructure Approval 9687)
Talbingo Reservoir site	The development in and around the Talbingo Reservoir, including the Ravine Bay emplacement area; development at Middle Bay, including the water intake and associated

Acronym	Definition
	structures, barge launch ramp, and construction facilities; and ancillary infrastructure, including access roads and utilities.
Tantangara Reservoir site	The development in and around the Tantangara Reservoir, including the Tantangara emplacement area; water intake and associated infrastructure; barge launch infrastructure; construction and laydown facilities, including workers' camp; fish screens; and ancillary infrastructure, including access roads and utilities.
SWMP	Surface Water Management Plan (S2-FGJV-ENV-PLN-0011) (Appendix A)
WAL	Water Access License
Water Group	The Water Group within the Department of Planning Industry and Environment
WM Act	<i>Water Management Act 2000</i>
WM Regulation	<i>Water Management (General) Regulation 2018</i>
WMP	Water Management Plan (S2-FGJV-ENV-PLN-0010) (this Plan)
WSP	Water Sharing Plan
WTP	Water Treatment Plant

1. INTRODUCTION

1.1. Context

1.1.1. Overview

Snowy Hydro Limited (SHL) is constructing a pumped hydro-electric expansion of the Snowy Mountains Hydro-electric Scheme (Snowy Scheme), called Snowy 2.0. Snowy 2.0 is being built by the delivery of two projects: Exploratory Works and Snowy 2.0 Main Works, which commenced in May 2020.

Snowy 2.0 is a pumped hydro-electric project that will link the existing Tantangara and Talbingo reservoirs through a series of new underground tunnels and a hydro-electric power station. Most of the project's facilities will be built underground, with approximately 27 kilometres of concrete-lined tunnels constructed to link the two reservoirs and a further 20 kilometres of tunnels required to support the facility. Intake and outlet structures will be built at both Tantangara and Talbingo Reservoirs.

Snowy 2.0 will increase the generation capacity of the Snowy Scheme by an additional 2,000 MW, and at full capacity will provide approximately 350,000 MWh of large-scale energy storage to the National Electricity Market (NEM). This will be enough to ensure the stability and reliability of the NEM, even during prolonged periods of adverse weather conditions.

Webuild (formerly Salini Impregilo), Clough and Lane have formed the Future Generation Joint Venture (FGJV) and have been engaged to deliver both Stage 2 of Exploratory Works and Snowy 2.0 Main Works.

The Snowy 2.0 Main Works Project includes five primary work sites, displayed in Figure 2. The individual site names are listed below:

- Lobs Hole Ravine Road;
- Lobs Hole;
- Marica;
- Polo Flat;
- Rock Forest;
- Talbingo; and
- Tantangara.

1.1.2. Construction Activities and Program

The Snowy 2.0 Main Works Project includes, but is not limited to, construction of the following:

- Pre-construction preparatory activities including dilapidation studies, survey, investigations, access etc;
- Accommodation camps;
- Construction pads;
- Barge access infrastructure;
- An underground pumped hydro-electric power station complex;
- Water intake structures at Tantangara and Talbingo reservoirs;
- Power waterway tunnels, chambers and shafts;
- Access tunnels;

- New and upgraded roads to allow ongoing access and maintenance;
- 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;
 - permanent water supply to the underground power station; and
- Post-construction revegetation and rehabilitation.

The Snowy 2.0 construction program is summarised in Figure 1-1: Timing of Snowy 2.0.

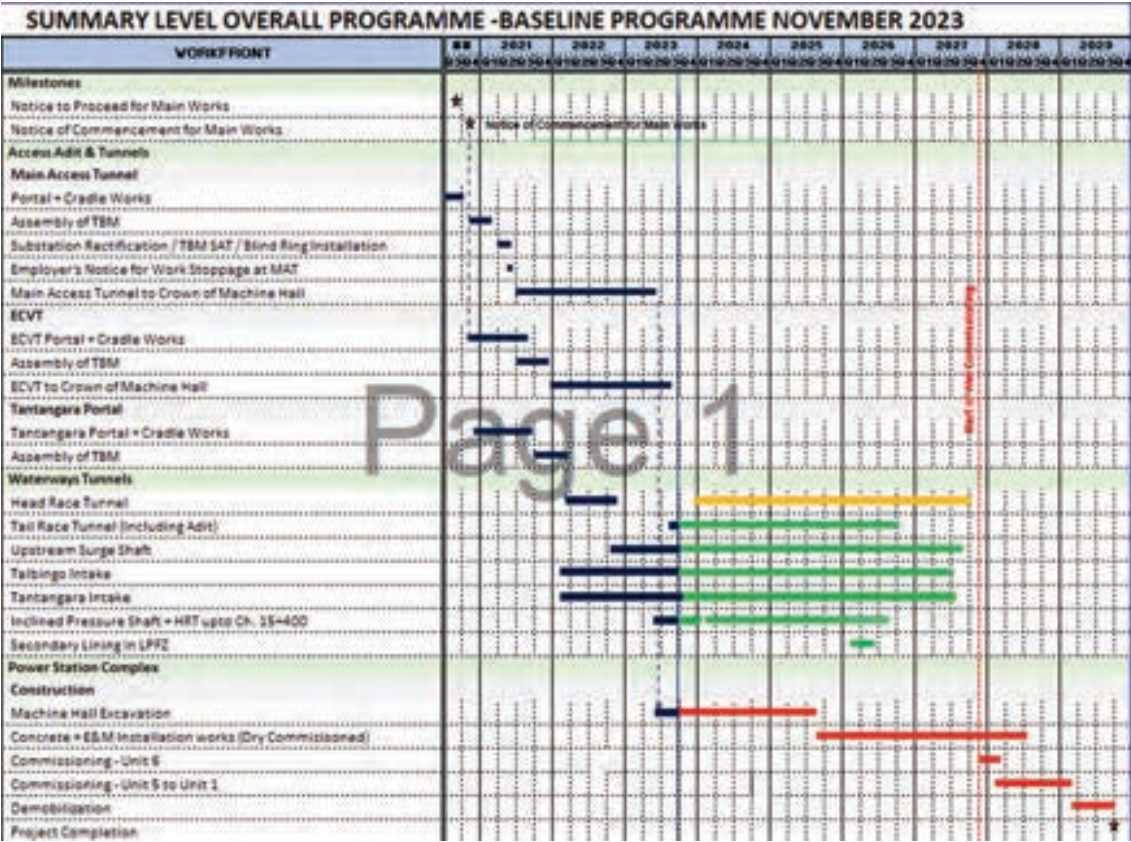


Figure 1-1: Timing of Snowy 2.0

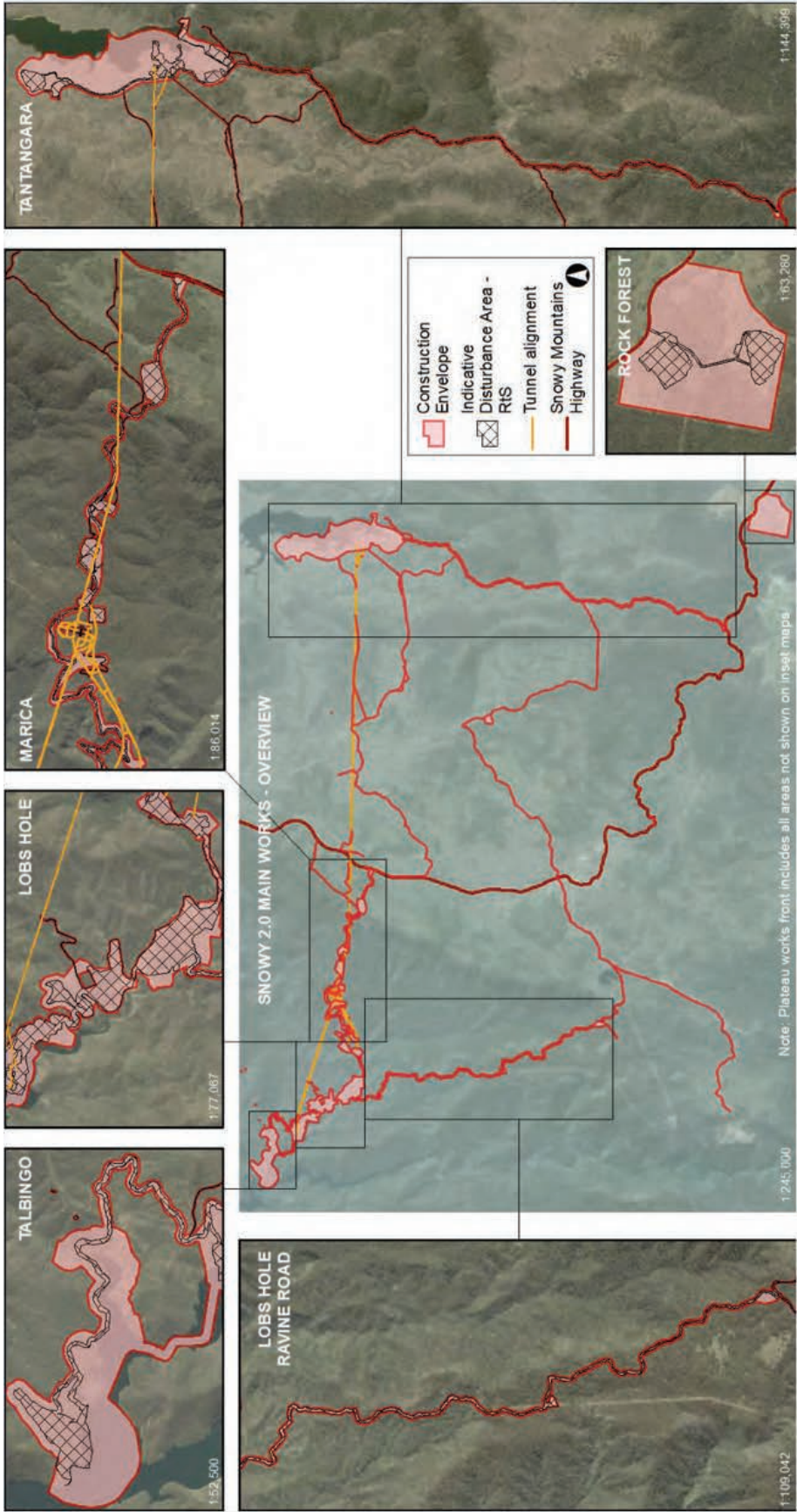


Figure 2: Snowy 2.0 Work Sites

1.2. Project Approval

On 7 March 2018 the NSW Minister for Planning declared Snowy 2.0 to be State significant infrastructure (SSI) and critical State significant infrastructure (CSSI) under the Environmental Planning and Assessment Act 1979 (EP&A Act, 1979) on the basis that it is critical to the State for environmental, economic or social reasons.

An environmental impact statement for the first stage of Snowy 2.0, the Exploratory Works for Snowy 2.0 (Exploratory Work EIS) was submitted to the then Department of Planning and Environment in July 2018 and publicly exhibited between 23 July 2018 and 20 August 2018. Approval for the first stage of Snowy 2.0 was granted for Exploratory Works by the Minister for Planning on 7 February 2019. The purpose of Exploratory Works is primarily to gain a greater understanding of the underground geological conditions at the new power station. In accordance with section 5.25 of the EP&A Act 1979, the infrastructure approval for the Exploratory Works was modified on 2 December 2019 and on 27 March 2020.

An environmental impact statement for the second stage of Snowy 2.0, the Main Works for Snowy 2.0 (Main Work EIS) was submitted to Department of Planning, Industry and Environment (DPIE) in September 2019 and was publicly exhibited between 26 September 2019 and 7 November 2019. A total of 222 submissions were received during the public exhibition period, including 10 from government agencies, 30 from special interest groups and 182 from the general public. In February 2020, the response to submissions (RTS or Submissions Report) was issued to DPIE to address the public and agency submissions (Snowy 2.0 Main Works - Preferred Infrastructure Report and Response to Submissions, February 2020).

Following consideration of the Main Works EIS and RTS, approval was granted by the Minister for Planning and Public Spaces on 20 May 2020, through issue of Infrastructure Approval SSI 9687.

Further to the Infrastructure Approval, the Main Works RTS includes revised environmental management measures (REMMs) within Appendix C which will also be implemented for the project.

On 27 January 2022, a modification to SSI-9687 (SSI-9687-Mod-1) was granted under Section 2.22 and clause 20 of Schedule 1 of the EP&A Act, 1979. The scope of the modification included horizontal directional drilling (HDD) to establish water and electricity services between the Lobs Hole and Marica areas of the Project.

On 29 November 2023, a second modification to SSI-9687 (SSI-9687-MOD-2) was granted under Section 5.25 of the EP&A Act 1979, approving the undertaking of sinkhole rectification works near the Tantangara Adit Portal, inclusive of geotechnical investigations and remediation works.

A subsequent planning application (SSI-9687-MOD-3) was approved on 16 December 2024 to permit the construction of an additional adit and launching of a fourth tunnel boring machine at Marica West to facilitate excavation of a section of the headrace tunnel (HRT) through the long plain fault zone (LPFZ). The LPFZ is the most geologically complex section of the HRT and represented a significant risk to the overall project completion date. The application was approved in accordance with Section 5.25 of the EP&A Act, 1979.

In addition to the State approval, a referral (EPBC 2018/8322) was prepared and lodged with the Commonwealth Department of Agriculture, Water and the Environment (DAWE) under the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act, 1999). The Commonwealth Minister's delegate determined on 5 December 2018 that Snowy 2.0 Main Works is a "controlled action" under the EPBC Act, 1999. The EPBC Act referral decision determined that the project will be assessed by accredited assessment under Part 5, Division 5.2 of the EP&A Act, 1979.

2. WATER MANAGEMENT PLAN

2.1. Aims and Objectives

2.1.1. Purpose

The purpose of this Plan is to transfer the requirements identified within the Approval documents into a management plan which can be practically applied on the Project sites. Specifically, this plan refers to the following documents:

- Main Works Snowy 2.0 - Environmental Impact Statement, September 2019;
- Revised Environmental Management Measures within the Main Works RTS, February 2020;
- Infrastructure Approval SSI 9687, May 2020;
- Main Works Snowy 2.0 – Modification 1 Assessment Report, January 2022;
- Main Works Snowy 2.0 – Modification 2 Assessment Report, November 2023;
- Main Works Snowy 2.0 – Modification 3 Assessment Report, December 2024; and
- Environmental Protection Licence 21266, latest variation May 2024.

2.1.2. Objectives

The objectives underpinning this Plan are to detail management measures and inform site procedures to mitigate potential impacts to water within the scope permitted by the Infrastructure Approval. To achieve this, SHL and FGJV will implement:

- Appropriate measures during construction to minimise negative impacts to water;
- Monitoring and assessment programs during construction to assess the performance of adopted control measures; and
- Corrective and contingency actions during construction when triggered.

Specific on-site management measures identified in this plan will be incorporated into site documents where relevant. Construction personnel will be required to undertake works in accordance with the mitigation measures identified in the site-specific documents.

2.2. Plan Preparation

This Snowy 2.0 Main Works Water Management Plan superseded the Stage 1 and Stage 2 Exploratory Works Water Management Plan. It does not address the operational phase of the project.

This Plan forms part of Future Generation's environmental management framework and includes the:

- Surface Water Management Plan (SWMP) (Appendix A) (S2-FGJV-ENV-PLN-0011); and
- Groundwater Management Plan (GMP) (Appendix B) (S2-FGJV-ENV-PLN-0012).

2.2.1. Staging

Some distinct work activities require greater detail prior to commencement. Consequently, this Plan will be updated following consultation with relevant stakeholders and submitted to DPHI prior to the commencement of specific activities as detailed in Table 2-1.

Table 2-1: Activities Requiring WMP Update

Activities	Timing
Dredging, channel extraction or underwater blasting	This WMP will be updated for approval prior to dredging, channel extraction or underwater blasting.
Permanent in-reservoir emplacement areas	This WMP will be updated prior to in-reservoir emplacement.
Operation of Snowy 2.0 Project, including dewatering of the tailrace tunnel during operations.	Operation will be addressed through a separate Snowy Hydro framework or document.

2.2.2. Consultation

In accordance with schedule 3, condition 31 of the Infrastructure Approval, the WMP is to be prepared in consultation with;

- NSW Environment Protection Agency (NSW EPA);
- National Parks and Wildlife Services (NPWS);
- Department of Climate Change, Energy, The Environment and Water (DCCEEW);
- Department of Planning, Housing and Infrastructure (DPHI);
- Department of Planning Industry and Environment– Water (Water Group);
- Natural Resources Access Regulator (NRAR); and
- NSW Department of Primary Industries (NSW DPI).

Where additional monitoring infrastructure is proposed outside the construction envelope, consultation with relevant stakeholders will conducted accordingly.

Table 2-2: Consultation Process

Date	Consultation	Outcomes
30/04/2020	NSW EPA, NPWS, Water Group, DPI Fisheries, CPHR	Agency briefing (online PowerPoint) providing overview of document structure and surface water management approach.
07/05/2020	NSW EPA, NPWS, Water Group, CPHR	Agency briefing (online PowerPoint) providing overview of the development of the surface water monitoring program and groundwater monitoring program.
15/06/2020	NPWS, NSW EPA, Water Group, NRAR, NSW DPI	WMP (revision C) issued to stakeholders for review and comment.
26/06/2020	DCCEEW	WMP (revision D) issued to DCCEEW for review and comment.
08/07/2020	DCCEEW	Agency briefing (online PowerPoint) providing overview of document structure and water management approach.
03/08/2020	NRAR, Water Group	Amendment to groundwater monitoring network.
24/08/2020	DCCEEW	Further rationale for adjustment to surface water monitoring locations, details of bushfire impacts on water quality and general clarifications.
09/09/2020	NSW EPA	Amendment to surface water monitoring program, specifically in relation to discharge outlet verification monitoring.
21/11/2022	DPHI, NSW EPA	Minor amendments.
November 2024	DPHI, NSW EPA, CPHR, DCCEEW, NPWS	Amendments to include Modification works, updated reuse risk assessments.
September 2025	DPHI, NSW EPA, CPHR, DCCEEW, NPWS	Amendments to include Modification 3 works, water balance estimates, volumes, and modelling of the hydrology net expansion.
October 2025	DPHI, NSW EPA, CPHR, DCCEEW, NPWS	Revision N was updated to include DCCEEW comments.
December 2025	DPHI, NSW EPA, CPHR, DCCEEW, NPWS	Revision O was updated to include DCCEEW comments.
December 2025	DPHI, NSW EPA, CPHR, DCCEEW, NPWS, Water Group	Revision P was updated to include Water Group comments.

A separate document is provided to DPHI detailing the consultation process, along with FGJV responses to stakeholder comments and how feedback has been implemented during the action.

2.2.3. Terminology Review

A key refinement following public exhibition of the Main Works EIS was a change to and clarification of disturbance area terminology. The revised disturbance area terminology as per the SSI-9687 Instrument, Main Works RTS and this Plan is outlined in Table 2-3, with an example shown at Lobs Hole Ravine Road in Figure 2-1.

Table 2-3: Disturbance Area Terminology Review

Term	Definition	Reasoning
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.	The project area does not represent a footprint for the construction works, but rather indicates an area that was investigated during environmental assessments.
Construction envelope	The envelope within which the disturbance area of the development may be located	As detailed design continues, final siting of the infrastructure (i.e. the disturbance area) can move within the assessed construction envelope subject to recommended environmental management measures and provided it does not exceed the limits defined by the construction envelope.
Disturbance area	The area within the construction envelope where development may be carried out; the precise location of the disturbance area will be fixed within the construction envelope following final design	



Figure 2-1: Disturbance Area and Construction Envelope

2.3. Environmental Management System

The environmental management system for the Project is described in the Environmental Management Strategy (EMS). The EMS forms part of the Project Management System (Future Generation-PMS) and includes any requirements specified in the contract documents, where appropriate.

Management plans and post-approval documents for the project include those listed within Figure 2-2.

An overview of the Plan structure relative to the elements of water management is shown in 2-3.

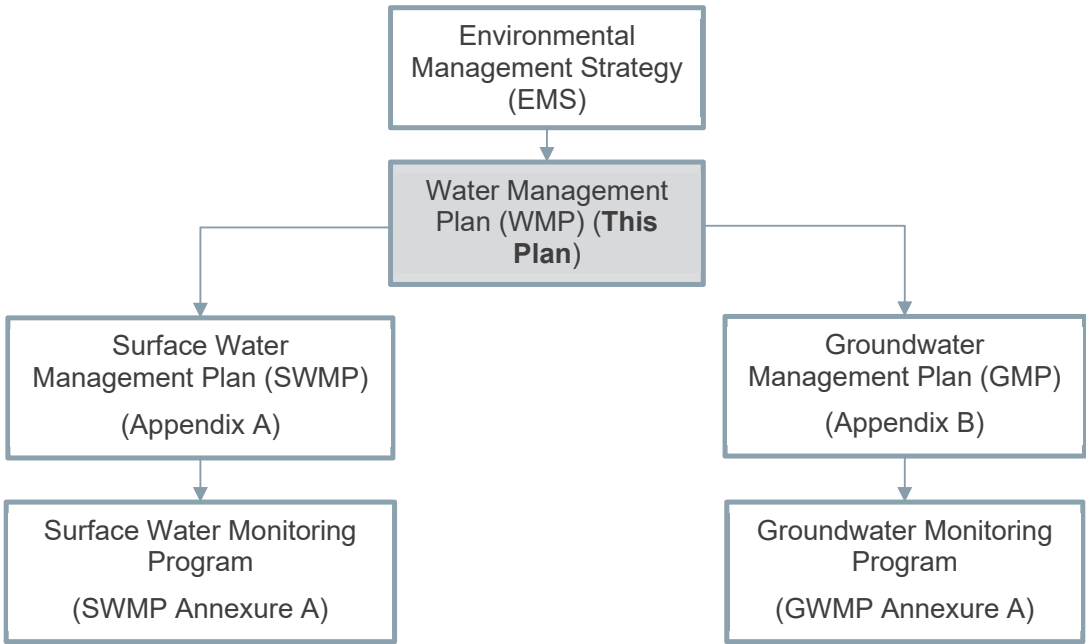


Figure 2-2: Water Management Plan Structure

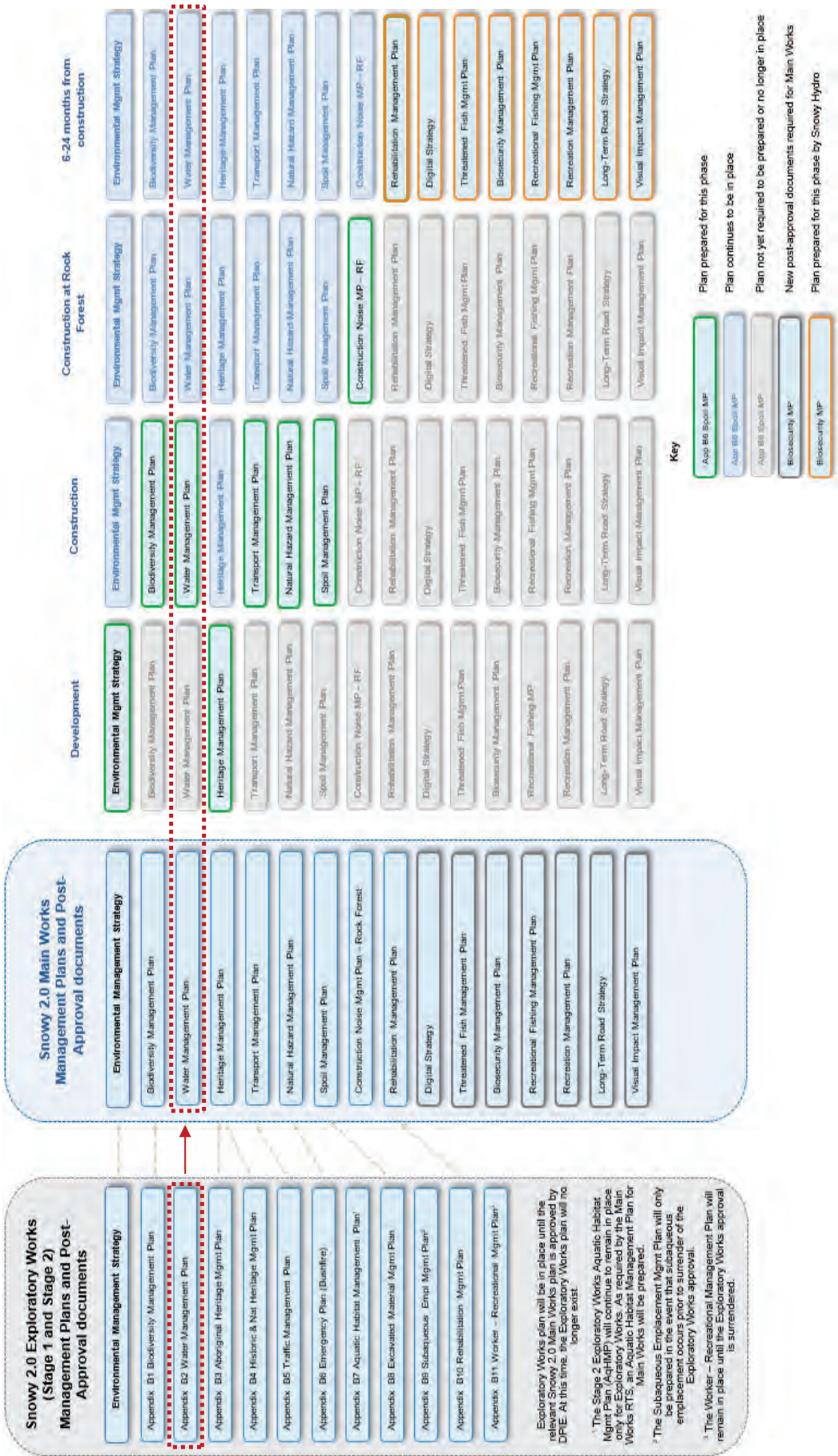


Figure 2-3: Management Plans and Documents

3. ENVIRONMENTAL REQUIREMENTS

3.1. Legislation

Legislation relevant to water management includes:

- Environmental Planning and Assessment Act 1979 (EP&A Act);
- Environmental Planning and Assessment Regulation 2000 (EP&A Regulation);
- Protection of the Environment Operations Act 1997 (POEO Act);
- Protection of the Environment (General) Regulation 2009 (POEO General Regulation);
- Water Management Act 2000 (WM Act);
- Water Management Amendment Act 2014 (WMA Act);
- Water Management (General) Regulation 2018 (WM General Regulation);
- Water Sharing Plan for the Murrumbidgee unregulated and alluvial water sources (2012); and
- Snowy Hydro Corporatisation Act 1997 (SHC Act).

Relevant provisions of the above legislation are explained in the register of legal and other requirements included in Appendix A1 of the EMS.

3.2. Guidelines

3.2.1. Guidelines, Specifications and Policies

The main guidelines, specifications and policy documents relevant to this Plan include:

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000);
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2018);
- Managing Urban Stormwater: Soils and Construction (Landcom, 4th Edition March 2004 (reprinted 2006) (the “Blue Book”)) Volume 1 and Volume 2; and
- Approved Methods for the Sampling and Analysis of Water Pollutants in NSW – March 2004.

The management plans appended to this Plan contain additional guidelines applicable to their respective aspects. Other reference documents include:

- Snowy 2.0 Environmental Impact Statement Volume 3, Appendix J, Water Assessment Annexure A, September 2019;
- Snowy 2.0 Main Works - Preferred Infrastructure Report and Response to Submissions, Appendix I, Revised Water Modelling Report, February 2020; and
- Snowy 2.0 Main Works - Preferred Infrastructure Report and Response to Submissions, Appendix J, Revised Water Management Report, February 2020.

3.2.2. Nitrogen Management Plan

On the 23 July 2025 a variation to EPL21266 was issued to SHL from the NSW EPA. The license variation included the addition of Condition E5 which required the Project to implement a Nitrogen Management Plan across the Project sites. In response, the Project developed the Main Works Nitrogen Management Plan (S2-FGJV-ENV-PLN-0367) which provides a governance framework for nitrogen generating aspects of the Main Works construction phase. A key objective of the Nitrogen Management Plan is the implementation and constant refinement of environmental monitoring programs which are critical for informing management pathways.

3.3. Conditions of Approval

Table 3-1 details the CoA that are relevant to water management and demonstrates where these conditions are addressed.

Table 3-1: Relevant Conditions of Approval

Condition	Requirement	Where addressed
SCHEDULE 3		
Spoil Management – Spoil Management Requirements		
Schedule 3, Condition 4 (h)	The Proponent must: (h) minimise the water quality impacts of the temporary and permanent emplacement areas.	Spoil Management Plan Project Leachate Detection Procedures
Spoil Management – Design Objectives for Permanent Spoil Emplacement Areas		
Schedule 3, Condition 6	The Proponent must ensure the permanent spoil emplacement areas comply with the design objectives in Table 2. Water Management: - Integrate the drainage of the emplacement area with the surrounding drainage network, including any upstream flows and residual run-on water - Minimise downstream water flows and velocities with any changes to be quantified and addressed through suitable design - Minimise valley infill - Create natural drainage lines that are long-term sustainable having regard to the selection of suitable underlying materials, including rock sizing and grading - Minimise the use of large rocks in drainage lines - Minimise the concentration of water on landforms unless this is consistent with accepted drainage density and geomorphic design practices - Minimise the generation and dispersion of sediment in the Talbingo Reservoir, Tantangara Reservoir or other waterways	Spoil Management Plan Project Leachate Detection Procedures
Flora and Fauna - Potential Additional Offsets - Alpine Sphagnum Bogs and Associated Fens		
Schedule 3, Condition 15	The Proponent must ensure that the development does not cause any exceedances of the following performance measures in the Alpine Sphagnum Bogs and Associated Fens above the Gooandra Volcanics and Kelly's Plains Volcanics: (a) negligible change to the shallow groundwater regime supporting the bogs and associated fens when compared to a suitable control site; and (b) negligible change in the ecosystem functionality of the bogs and associated fens.	GMP

Condition	Requirement	Where addressed
Schedule 3, Condition 16	If the Planning Secretary determines that the development has caused exceedances of the performance measures in condition 15 above, the Proponent must pay additional funds to the NPWS within 3 months of the determination to offset the groundwater-related impacts of the development on the Alpine Sphagnum Bogs and Associated Fens. The Planning Secretary will determine the amount of funds the proponent must pay following consultation with the NPWS, DCCEW and the Proponent; and having regard to: (a) The significance of the impacts on the bogs and associated fens; (b) The relevant values from the Biodiversity Offset Payment calculator; and (c) The likely cost of carrying out the conservation actions required to offset these impacts on the bogs and associate fens.	Biodiversity Management Plan
Flora and Fauna - Biodiversity Management Requirements		
Schedule 3, Condition 17 (j)	The Proponent must: (j) minimise the generation and dispersion of sediment to watercourses, particularly Yarrangobilly River and Wallace Creek.	ERSED Procedure SWMP
Water – Water Supply		
Schedule 3, Condition 28	The Proponent must ensure it has sufficient water for each stage of the development; and if necessary, adjust the scale of development on site to match its available water supply.	WMP SWMP GMP
Water – Water Pollution		
Schedule 3, Condition 29	Unless an environment protection licence authorises otherwise, the Proponent must comply with Section 120 of the POEO Act.	SWMP GMP
Water – Water Management Requirements		
Schedule 3, Condition 30	The Proponent must:	
	(a) maximise the recycling and reuse of water on site;	WMP SWMP
	(b) maximise the diversion of clean water runoff around the disturbance areas;	SWMP ERSED Procedure
	(c) minimise the flow rates and velocities of any clean water runoff diversions to adjoining watercourses;	SWMP
	(d) minimise the flooding impacts of the development;	SWMP Natural Hazard Management Plan Spoil Management Plan
	(e) minimise groundwater take from the Gooandra Volcanics and Kelly's Plain Volcanics using pre and post grouting of the tunnel, to minimise the loss of stream flows in the waterways above these geological formations, including Gooandra Creek and the headwaters of the Eucumbene River;	GMP
	(f) minimise erosion and the generation and dispersion of sediment using suitable controls in accordance with the relevant requirements in the <i>Managing Urban Stormwater: Soils and Construction</i> guidance series;	SWMP
	(g) design all instream works, particularly the inlet and outlet works, to minimise scour and erosion;	SWMP
	(h) unless permitted by this approval, avoid carrying out of any development within 40 metres of any watercourse;	SWMP

Condition	Requirement	Where addressed
	(i) carry out all instream works or development within 40 metres of any watercourse generally in accordance with the requirements in the <i>Guidelines for Controlled Activities on Waterfront Land</i> ;	SWMP
	(j) treat all wastewater and surplus process water prior to discharging it at the approved discharge points at the Talbingo Reservoir or Tantangara Reservoir;	SWMP
	(k) reduce the number of diffuser points for low velocity discharges to the Talbingo Reservoir or Tantangara Reservoir;	SWMP
	(l) not discharge any surplus process water to the stormwater basins on site;	SWMP
	(m) minimise the surface water quality impacts associated with the development, including: - the development carried out in the vicinity of waterways, particularly in the Talbingo Reservoir, Tantangara Reservoir and Yarrangobilly River; - all instream works, including dredging, channel excavations, underwater blasting, barge infrastructure, fish barriers and screens, culverts and bridges, and service crossings; - the temporary and permanent spoil emplacement areas; - development at the Marica, Plateau and Rock Forest sites; - road works; - the operation of the power station and associated infrastructure, including the operation of the inlets and outlet to minimise sediment disturbance risks and the dewatering of the tailrace tunnel.	SWMP Spoil Management Plan Project Leachate Detections Procedures Talbingo Rock Platform MP (in Draft)
	(n) minimise the risk of spills or leaks on site, and clean up any spills or leaks as quickly as possible;	SWMP Spill Response Procedure
	(o) minimise the groundwater quality impacts of the development, particularly through the design of the temporary and permanent spoil emplacement areas and all water storages on site;	GMP Spoil Management Plan
	(p) store chemicals and hydrocarbon products in bunded areas in accordance with the relevant Australian Standards.	SWMP Spill Response Procedure
Water - Water Management Plan		
Schedule 3, Condition 31	Prior to the commencement of construction, the Proponent must prepare a Water Management Plan for the development to the satisfaction of the Planning Secretary. This plan must: (a) be prepared by a suitably qualified and experienced person in consultation with the EPA, NPWS, the Water Group, NRAR and NSW DPI;	WMP
	(b) include a Site Water Balance for the development and a program to review and update this water balance each calendar year;	WMP
	(c) include a Surface Water Management Plan, containing detailed plans for the Talbingo Reservoir, Lobs Hole, Marica, Plateau, Tantangara Reservoir, and Rock Forest sites with: - detailed baseline data on surface water flows and quality in the watercourses that could be affected by the development, and a program to augment this baseline data over time; - detailed criteria for determining the surface water impacts of the development (flows, quality and flooding), including criteria for triggering remedial action (if necessary); - description of the measures that would be implemented to minimise the surface water impacts of the development and comply with the relevant water management requirements in conditions 4,6 and 30 above, including specific plans covering: - the temporary or permanent emplacement of spoil;	SWMP Water Monitoring Procedure Dewatering Agreement – Project Wide

Condition	Requirement	Where addressed
	– dredging, channel extraction and underwater blasting in the Talbingo Reservoir and Tantangara Reservoir – operation of the discharge points – the design of the inlets and outlets; and – dewatering of the tailrace tunnel during operations; • identify the key risks to the successful implementation of these measures, and describe the contingency measures that would be implemented to address these risks; • a program to monitor and publicly report on the surface water impacts of the development.	
	(d) include a Groundwater Management Plan with: • detailed baseline data of groundwater levels, yield and quality on the aquifers that could be affected by the development, and a program to augment this baseline data over time; • a program to validate and calibrate the groundwater model for the development as new information is collected; • detailed criteria for determining the groundwater impacts of the development, including criteria for triggering remedial action (if necessary) • a description of the measures that would be implemented to comply with the management requirements in condition 30 above; • a program to monitor and report on: – groundwater inflows to the tunnel; – water take from the groundwater bores and connected water sources; – the impacts of the development on: ○ regional and local (including alluvial) aquifers; ○ base flow to surface water sources.	GMP
Schedule 3, Condition 38	The Proponent must implement the approved Water Management Plan for the development.	WMP
Subsistence - Performance Measures – Natural and Heritage Features		
Schedule 3, Condition 63	The Proponent must ensure that any project related subsidence impacts do not cause greater than negligible environmental consequences on the National Park Estate, including but not limited to water, biodiversity and heritage values.	SHL Surface Depression documentation
SCHEDULE 4		
Environmental Management - Monitoring		
Schedule 4, Condition 21	The Proponent may undertake monitoring outside the construction envelope of the development provided this monitoring is required under the conditions of this approval and authorised under an approved management plan.	WMP

3.4. Revised Environmental Management Measures

During preparation of the Main Works Submissions, REMMs were developed and included in Appendix C of the Main Works RTS, February 2020.

Table 3-2 contains a list of Water relevant REMMs along with references to the appropriate management plans or procedures for reference.

Table 3-2: Water Relevant Revised Environmental Management Measures

Impact	Reference	Environmental Management Measures	Where addressed
General	WM01	A Water Management Plan will be developed for Snowy 2.0 Main Works that includes:	This Plan
		proposed mitigation and management measures for all construction water management categories;	WMP – Section 5.1 SWMP - Table 5-3 (All measures) GMP - Table 5-1 (All measures)
		spill management and response;	SWMP - Annexure C (Spill Response Procedure)
		a surface and groundwater monitoring program;	Water Monitoring Procedure SWMP - Annexure A GMP – Annexure A
		water quality trigger action response plan;	SWMP – Section 6.4, Annexure B GMP – Section 7, Annexure B, Annexure C, Annexure D
		reporting requirements;	WMP - Section 7.6 SWMP - Section 6.7 GMP – Section 6.8
		corrective actions;	SWMP – Section 6 GMP – Section 7
		contingencies; and	SWMP - Section 5.3.1, Section 5.14 and Section 6.4 GMP – Table 5-1: GW13
		responsibilities for all management measures.	Water Monitoring Procedure SWMP – Table 5-3 GMP – Table 5-1
		The WMP will be prepared in consultation with DPIE, EPA, Water NSW and key local stakeholders, and would consider concerns raised during the exhibition and approvals process for the project.	WMP Section 2.2
General	WM02	A water monitoring program will be developed as part of the water management plan to monitor quality and quantity impacts to surface water, groundwater and reservoirs. The water monitoring program will incorporate and update the existing monitoring network and detail monitoring frequencies and water quality constituents.	Water Monitoring Procedure SWMP - Annexure A GMP – Annexure A
Water quality impacts from stormwater runoff	WM03	Where practical, clean water will be diverted around or through construction areas. Runoff from clean water areas that cannot be diverted will be accounted for in the design of water management systems.	ERSED Procedure SMWP – Section 5.1, Table 5-3: SW07
Water quality impacts from stormwater runoff	WM04	An Erosion and Sediment Control Plan (ESCP) will be prepared for each construction area that will include relevant information presented in the water management report.	ERSED Procedure SMWP – Section 5.1, Table 5-3: SW04

Impact	Reference	Environmental Management Measures	Where addressed
Water quality impacts from stormwater runoff	WM05	A suitably qualified erosion and sediment control professional(s) will be engaged to: • oversee the development of ESCPs; • inspect and audit controls; • train relevant staff; and • provide advice regarding erosion and sediment control	ERSED Procedure SMWP – Section 5.1, Table 5-3: SW05
Groundwater modelling	WM06	The groundwater model developed for Snowy 2.0 Main Works will be validated and, if necessary, recalibrated to new groundwater monitoring data as the monitoring record increases throughout construction. It is recommended that assessment of the monitoring record and groundwater affecting activities, along with model updates, be undertaken at least annually throughout construction and into operation until it is evident that the update frequency can be reduced.	GMP – Section 8.2
Groundwater inflow / drawdown	WM07	Where discrete high flow features are intercepted, pre-grouting and secondary grouting from the TBM may be undertaken to enable tunnel construction.	GMP – Section 5.1.4, Section 5.1.5 and Table 5 1: GW05
Water supply	WM08	A water supply system will be established to supply water for potable water use and construction activities. The system will most likely source water from regional groundwater resources, but may also source water from either Tantangara or Talbingo Reservoirs provided licences are available. Extraction from watercourses will be avoided where practicable. The most suitable extraction locations and water sources will be established during detailed design.	WMP – Section 3.6.3, Section 6
Reservoir water quality (wastewater management)	WM09	A wastewater management system will be established to manage effluent from construction compounds and accommodation camps. All wastewater will be treated to meet the water quality specifications provided in the water management report and will be discharged to reservoirs. Wastewater discharges to watercourses will be avoided.	SWMP - Section 5.3.2, Table 5-3: SW30
Reservoir water quality (process water management)	WM10	A process water management system will be established to manage water during construction; and to supply water to construction activities. All surplus process water will be treated to meet the water quality specifications provided in the water management report and will be discharged to reservoirs. Process water discharges to watercourses will be avoided.	SWMP - Section 5.3.1, Table 5-3: SW22
Changes to reservoir water quality due to plug removal within the reservoirs	WM11	The specifications and locations of the proposed environmental measures will be determined as part of detailed design, including the installation of silt curtains. They will be designed such that water quality criteria is agreed with the regulators, with the application of a mixing zone if required.	SWMP - Section 5.9, Table 5-3: SW66
Reservoir bed sediments are disturbed by commissioning water flows	WM12	Investigations to minimise the disturbance of bed sediments due to water flows during commissioning will be undertaken as part of detailed design. Potential measures to minimise the disturbance of bed sediments include: • investigate mitigated design measures; • dredging sediments from the potential disturbance zones and placing them in another part of the reservoir; and/or • armouring the sediments in the potential disturbance zones. These options are currently being assessed.	SWMP - Section 5.9, Table 5-3: SW67

Impact	Reference	Environmental Management Measures	Where addressed
Flooding	WM13	Further consideration of flooding conditions and impacts, including flood modelling where necessary, will be undertaken to support future detailed design of both temporary and permanent works.	SWMP - Section 5.2, Table 5-3: SW18
Flooding	WM14	Flood emergency response plans will be developed for both construction and operational phases	Natural Hazard Management Plan
Impacts to GDE's	ECO3	A GDE monitoring program will be implemented to assess actual impacts against predicted. If actual impacts are greater than predicted, adaptive management will be implemented.	
Impacts to aquatic Habitat	AE01	An Aquatic Habitat Management Plan will be prepared and implemented to guide management of impacts to aquatic habitat. The Plan will: - be prepared in consultation with NPWS and DPI Fisheries - include a description of measures that would be implemented to: - minimise impacts to aquatic habitat outside the approved disturbance areas; - minimise the loss of key aquatic habitat; - minimise the impacts of the development on threatened fauna species; - minimise the impact of the development on fish habitat; - relocate Murray crayfish from the shallower parts of the approved disturbance area in Talbingo Reservoir prior to disturbing these areas; - notify DPI-Fisheries of any fish kills; - include a trigger action and response plan for the Murray crayfish, which would be implemented if monitoring shows the development is adversely affecting the species; - include a program to restore and enhance the aquatic habitat of the approved disturbance area except for the intakes and their approach areas as soon as practicable following the completion of development in these areas; - include a program to monitor and report on the effectiveness of these measures.	Aquatic Habitat Management Plan
Impacts to aquatic habitats	AE02	Bridges or culverts would be designed and constructed in accordance with NSW DPI fish passage requirements for waterway crossings (Fairfull & Witheridge 2003) where practicable.	Aquatic Habitat Management Plan
Impacts to aquatic habitats	AE03	Construction works within the channel of a permanent waterway with type 1 or 2 key fish habitat would allow some flow to maintain fish passage at all times and be staged to minimise the total disturbance at any given time.	Aquatic Habitat Management Plan
Soil erosion and sedimentation	SOIL03	Site-based Erosion and Sediment Control Plans (ESCPs) will be prepared or reviewed by a Certified Professional in Erosion and Sediment Control (CPESC) for the construction works.	ERSED Procedure SWMP – Section 5.1, Table 5-3: SW04
Water Supply	HAZ06	Water supply requirements for firefighting, including the provision of hydrants and hose reels, is designed, constructed in accordance with the relevant Standards and PBP 2018.	WMP Section 3.6.3, SWMP Section 3.6.3 and GMP Section 3.6.3. Natural Hazard Management Plan

3.5. EPBC Approval

The EPBC Act approval for Snowy 2.0 Main Works was granted by DCCEEW in 2020. This approval was provided for the impact of the Snowy 2.0 Main Works Project on national heritage values of a national heritage place (Sections 15B and 15C of the EPBC Act), listed threatened species and communities (Section 18, Section 18A of the EPBC Act) and listed migratory species (Section 20, Section 20A of the EPBC Act).

Table 3-3 details the EPBC Act Approval conditions which are relevant to water and demonstrates where these conditions are addressed.

Table 3-3: Commonwealth Conditions of Approval

Condition	Requirement	Where addressed
17	To minimise impacts on water resources, the approval holder must comply with conditions 30 – 32 of the NSW approval relating to water management	Refer to WMP - Table 3-1
18	The approval holder must prepare the Water Management Plan required by condition 31 of the NSW approval in consultation with the Department, before it is approved by the NSW Planning Secretary	WMP – Section 2.2
19	The Water Management Plan must include provisions to make monitoring data (excluding sensitive ecological data) available as part of the monitoring, evaluation and reporting programs required by condition 31c and 31d of the NSW approval	WMP - Appendix A (SWMP) WMP - Appendix B (GMP)
20	Once the Water Management Plan is approved by the NSW Planning Secretary, the approval holder must implement the plan for the duration of the approval, unless otherwise agreed by the Minister in writing.	This WMP will be implemented for the development.

3.6. Licences and Permits

3.6.1. Environment Protection Licence

Environment Protection Licence 21266 (EPL21266) was issued as part of the Exploratory Works phase for extractive activities. The premise boundary for the Exploratory Works EPL was expanded to encompass both Exploratory Works and Main Works activities and the governing schedule activity was updated to Electricity Generation.

The license provides a roadmap of key Conditions (and corresponding frequencies where applicable) the Proponent must complete to continue constructing the Main Works whilst mitigating potential risk to offsite environmental receptors. With regards to water management, EPL21266 defines clear monitoring, reporting and (a degree of) acceptability criteria for the various water sources interacting with and managed by the Project

At times, water monitoring requirements prescribed by EPL21266 may differ to that detailed within this Plan, particularly in the event of variations to the License. Differences may include changes to the monitoring locations; changes to the frequency of monitoring; or changes to the parameters which are required to be monitored.

Should differences arise, the monitoring requirements of the EPL will take precedence. This will occur until such time that the revised WMP is updated and approved.

NSW EPA has issued variations to EPL21266 on numerous occasions. A list of EPL 21266 variations is provided below:

- March 2020: Variation of EPL monitoring locations and location descriptions and removal of requested analytes;
- April 2020: Variation of EPL monitoring locations and change to sampling requirements;

- October 2020: Varied to reflect the commencement of Main Works, including change to the premises boundary, primary fee-based scheduled activity, ancillary activities, scheduled development works and a range of administrative, limit, monitoring, reporting and special conditions;
- November 2020: Removal of groundwater monitoring bore EPL 3 and amendment of the frequency of groundwater monitoring from monthly to quarterly;
- December 2020: Variation to surface water monitoring locations and amended to include approved scheduled development works;
- April 2021: Variation to allow the discharge of treated effluent from the Lobs Hole sewage treatment plant and process water treatment plant;
- August 2021: Variation to move the diffuser location to avoid environmental impact;
- January 2022: Variation to increase discharge volume limit at point 43 from 1.66 ML/day to 4.32 ML/day and to include a discharge flow rate limit of 50 L/s, and the inclusion of a correlation assessment in order to monitor faecal coliforms.
- February 2022: Inclusion of a The EPA considers it appropriate to capture a Pollution Reduction Program (PRP) to facilitate improved water and contaminant management at the MAT spoil stockpile area.
- May 2022: Variation to allow for the discharge of treated sewerage and processed water at Tantangara with additional new water discharge and monitoring points within the Tantangara Reservoir.
- 31 May 2022: Variation to remove the PRP following project commitments.
- July 2022: Approval of updated Spoil Management Plan and inclusion of O5.1 – O5.8 operational conditions relating to spoil characterisation, treatment, emplacement, leachate management and contingencies.
- October 2022: Variation to scheduled development works, updated surface and groundwater water monitoring points, updated sampling methodology for select locations, inclusion of the Diffuse Source Water Pollution Management PRP and the addition of the Generator Emission Improvements Program.
- June 2023: Variation to include updated monitoring locations, include Spoil Contingency Plan details, updated Environmental Monitoring Report requirements, updated Quarterly Spoil Monitoring Report requirements and updates to both the Diffuse Source Water Pollution Management and Generator Emissions Improvement Plan.
- March 2024: Variation to include updated monitoring locations and analytical requirements, volume monitoring requirements, the removal of the Diffuse Source Water Pollution Management and the Generator Emissions Improvement Plan, addition of Process Water Treatment Plant Pollution Study, addition of lining and capping of Ravine Bay and Tantangara Permanent Spoil Emplacement Areas.
- December 2024: Variation to include reference to works associated with the Marica Adit and the spoil emplacement areas Ravine Bay and Rock Forest, update the location description for all monitoring points and inclusion of additional monitoring points, the revision of 90 percentile limit for biological oxygen demand from 1mg/L to 2mg/L as 1mg/L is below the limit of detection, amend the sampling method for several pollutants from grab sample to in-situ due to limitations in the transportation of samples, addition of conditions relating to the development of and compliance with a Nitrogen Management Plan.
- July 2025: Variation to include updated monitoring locations and analytical requirements, volume monitoring requirements, addition of Pollution Studies and Reduction Programs, addition of lining and capping of Rock Forest Permanent Spoil Emplacement Area.

- September 2025: Condition L2.4 was amended to include revised 90th and 100th percentile concentration limits for Total Nitrogen, Ammonia, Total Phosphorus, and Biochemical Oxygen Demand (BOD). These revised limits will be implemented on a trial basis, remaining valid only until December 31, 2026. Additionally, the regulatory framework was modified with the addition of Condition E5. This new condition formally integrates the Reservoir Discharge Limit Validation Monitoring Program and the Nutrient Loading Monitoring Program, ensuring robust data collection to assess the effectiveness and impact of the new trial limits.

3.6.2. Agreement for Lease

Snowy Hydro Limited have established an Agreement for Lease (AFL) with NPWS. Following this establishment, a Construction Lease and Works Access Licence were issued through NPWS for the construction of works listed in the Snowy 2.0 Main Works SSI 9687.

3.6.3. Water Access Licence

Section 60A of the Water Management Act 2000 requires that a water access licence be obtained to extract water from a water source.

Water required for construction purposes that require a water access licence includes the Project activities below:

- Interception activities (i.e. intercepted groundwater during tunnelling);
- Human consumption associated with the accommodation camp and other daily tasks; and
- Process water via the services pipeline from Talbingo and Tantangara Reservoirs for tunnelling and construction activities.

Snowy Hydro secured two groundwater access licences (WAL42408, WAL42960) and a surface water specific purpose access licences (WAL42407) during the Exploratory Works Project. These three licences allow for direct and indirect take of water from the Lachlan Fold Belt (LFB) Murray Darling Basin (MDB) Groundwater Source and direct take from the Upper Tumut water source (i.e. from Talbingo Reservoir).

Snowy Hydro have secured groundwater licences via Controlled Allocation Order for additional share entitlement from the LFB MDB groundwater source (RO13-19-093), the LFB South Coast groundwater source (RO13-19-192) and a surface water specific purpose access licence (to take water from Tantangara Reservoir) for the Main Works Project. The additional allocation covers the peak predicted annual take modelled for both Main Works and Exploratory Works.

These Water Access Licences were processed by the Natural Resources Access Regulator (NRAR) and registered with NSW Land Registry Services (LRS). Actual take will be reported to NRAR on an annual basis in accordance with licence conditions.

Modification 3 includes the requirement to install an additional potable water bore at Marica to accommodate the increased user demands. Appendix C of the Modification Submission Report 3 further identifies the requirement for SHL to seek an additional 41 megalitres per year of entitlements to account for the anticipated groundwater ingress during tunnelling works. These are expected to be obtained through trading schemes. It is noted the additional potable supply bore will not be constructed until an Environmental Impact Assessment is reviewed and granted by DCCEW Water Group.

Table 3-4: Water Licences

Water Access Licence	Project	Water source	Share per Year
WAL42407– Specific Purpose Access Licence	Exploratory Works	Upper Tumut water source	227 ML
WAL42408 – Groundwater Licence	Exploratory Works	Lachlan Fold Belt MDB	0
WAL42960 – Groundwater Licence	Exploratory Works	Lachlan Fold Belt MDB	354 units
WAL43328 – Groundwater Licence	Main Works	Lachlan Fold Belt MDB	3,375 units
WAL43329 – Groundwater Licence	Main Works	Lachlan Fold Belt South Coast	1,722 units
WAL43544 - Specific Purpose Access Licence	Main Works	Tantangara Water Source	532 ML

4. EXISTING ENVIRONMENT

4.1. Topography and Landscape

The Snowy 2.0 Project is mostly located within the KNP and spans the NSW Western Slopes, South Eastern Highlands and Australian Alps Interim Biogeographic Regionalisation for Australia (IBRA) regions. The geomorphic history of the project area is complex and has resulted in a landscape of disrupted drainage patterns, swampy basins and erosion surfaces (Snowy Hydro 2017). This complexity is seen in the diverse landforms present in the area, ranging from valleys to mountain ranges. For the most part, the project area can be broken into two distinctive terrains the incised ravine area and the plateau area.

The Ravine area; located mostly to the west of the Snowy Mountains Highway, is characterised by deep gorges and steep sloping ridges, the product of incision from river flow, historic glaciation and structural movement. The ravine area includes the Talbingo, Lobs Hole and Marica work zones.

The plateau area; located to the east of the Snowy Mountains Highway and spanning the area between the highway and Tantangara Reservoir, is typical of elevated alpine environments, dominated by low energy streams, gentle rolling hills and mostly flat floodplains. The plateau area includes the Plateau and Tantangara work zones.

The landscape varies from 545 m AHD in the Ravine Area (Lobs Hole) leading up the valleys (Marica/ Plateau zones) to the plateau topped Tantangara zone at 1,524 m AHD.

The Rock Forest work zone is located on farmland southeast of the KNP.

4.2. Geology

The Project area is located within the south-eastern portion of the Lachlan Fold Belt (LFB) of NSW. The LFB comprises a suite of Ordovician to Devonian sedimentary, igneous and metamorphic rocks that have developed during multiple orogenic periods.

The geology between Talbingo and Tantangara reservoirs (Table 4-1) is structurally deformed with numerous folds and several major faults associated with the north-south trending Long Plain Fault (LPF) zone.

The Project intercepts two major structural blocks. These two structural blocks form distinct geological terrains; the dominantly Silurian Tumut Block in the west (the Ravine Area), and the dominantly Ordovician Tantangara Block in the east (the Plateau). The terrains are separated by an escarpment caused by movement on the LPF.

The key geological formations for each block are shown in Table 4-1 and Figure 4-1.

Table 4-1 Key Geological Formations

Plateau	Ravine
Tertiary Basalt, Kelly's Plain Volcanics, Boggy Plain Suite, Peppercorn Formation, Tantangara Formation, Temperance Formation, Shaw Hill Gabro and the Gooandra Volcanics	Boraig Group, Byron Range Group, Ravine Beds and Yarrangobilly Limestone.

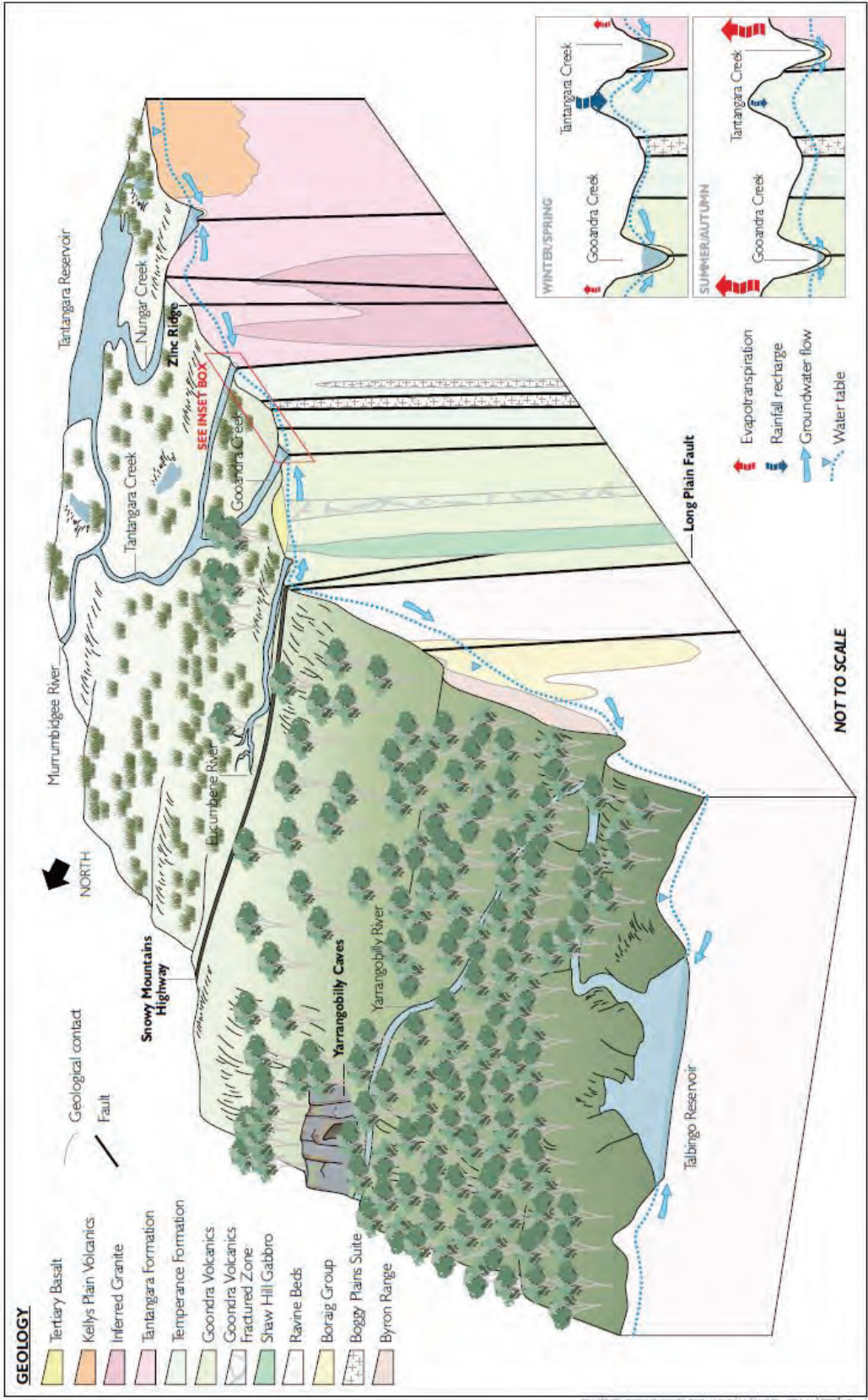


Figure 4-1: Conceptual Geological Block Diagram (EMM, 2019)

4.3. Climate

The Project area has an alpine climate that is characterised by cool summers and cold, damp, and snowy winters. The highest and most consistent precipitation occurs in winter to early spring, with precipitation amounts increasing with elevation. Summer and autumn are generally drier and experience greater variation in monthly rainfall. Summer rainfall is generally of higher intensity and of shorter duration than in winter. Climate data for the project area has been sourced from regional Bureau of Meteorology (BoM) and Snowy Hydro rainfall gauges, as well as climate maps produced by BoM. A summary of climate data for the ravine and plateau areas is provided in the Surface Water Management Plan.

4.3.1. La Nina

La Nina is a weather event that causes greater than average rainfalls throughout Spring and Summer. This has been experienced in NSW following the bushfires in 2020/2021, with the Bureau of Meteorology (BOM) recording the 5th highest annual rainfall on record for 2021 (records began in 1900). In 2021 the Project experienced approximately 1287 mm of rainfall.

The prediction of a La Nina weather event does not change the Project's approach to surface water management on the Snowy 2.0 Project. The principles and management measures described in the Surface Water Management Plan remain applicable to La Nina periods, including but not limited to minimising the extent and duration of disturbance, segregating clean and dirty water, controlled stormwater flows, minimising soil erosion and maximising sediments retention.

As described in the SWMP, erosion and sediment controls including sediment basins will be sized at a minimum with a design rainfall depth of 85th percentile 5-day rainfall event, with consideration given to increasing basin size at locations where sufficient space is available and / or topography does not constrain the basin size.

4.4. Bushfire

In January 2020, during the Main Works EIS application, significant bushfires occurred within the Project area and northern section of Kosciuszko National Park. The project site at Lobs Hole was severely impacted with much of the groundcover and trees burned, leaving the catchment area with bare soil and no ground protection. Other parts of the Main Works project area including the Plateau, Marica and Tantangara were also impacted by the bushfire to varying degrees.

The bushfires led to a reduction in ground cover and increase in burnt ash material within and adjacent to the construction envelope. For some time, the existing pre-fire baseline water data that was gathered and discussed in the relevant management plans differed to the post-fire water quality.

4.5. Surface Water Courses

All water courses are defined as receiving baseflow from groundwater (gaining streams). The ravine watercourses generally flow to the Talbingo Reservoir and the Plateau watercourses generally flow into the Tantangara Reservoir. Existing water quality characteristics are discussed in the Surface Water Management Plan (Appendix A).

The key watercourses, the baseline water quality and flood characteristics for the Ravine Area, Plateau Area and Rock Forest are included below.

4.5.1. Ravine Area

Within the Ravine Area, the Yarrangobilly River is the major regional watercourse that flows into Talbingo Reservoir, downstream of Lobs Hole. Its catchment has an area of 271 km² that is wholly within the KNP. The Yarrangobilly River has a number of tributaries within the ravine, including Wallace's Creek, Stable Creek, Sheep Station Creek, and Highground Creek. The majority of annual stream flow occurs in late winter and early spring, which is typical for rivers in the Australian Alps.

4.5.2. The Plateau

The Plateau is within the upper reaches of the Murrumbidgee and Eucumbene River catchments, wholly within KNP. The headwaters of the Eucumbene River are in the western plateau, and the river flows in a southerly direction to Lake Eucumbene. The Murrumbidgee River flows from north of the plateau in a south easterly direction into Tantangara Reservoir.

A number of perennial waterways are present across the Plateau flowing either north into the Murrumbidgee River or directly into Tantangara Reservoir, including Gooandra Creek, Tantangara Creek, Nungar Creek, and Kelly's Plain Creek.

4.5.3. Rock Forest

Rock Forest is in the headwaters of the Goorudee Rivulet Catchment outside of KNP. The site is within the proximity of two watercourses, being Cameron's Creek and an unnamed 3rd order watercourse.

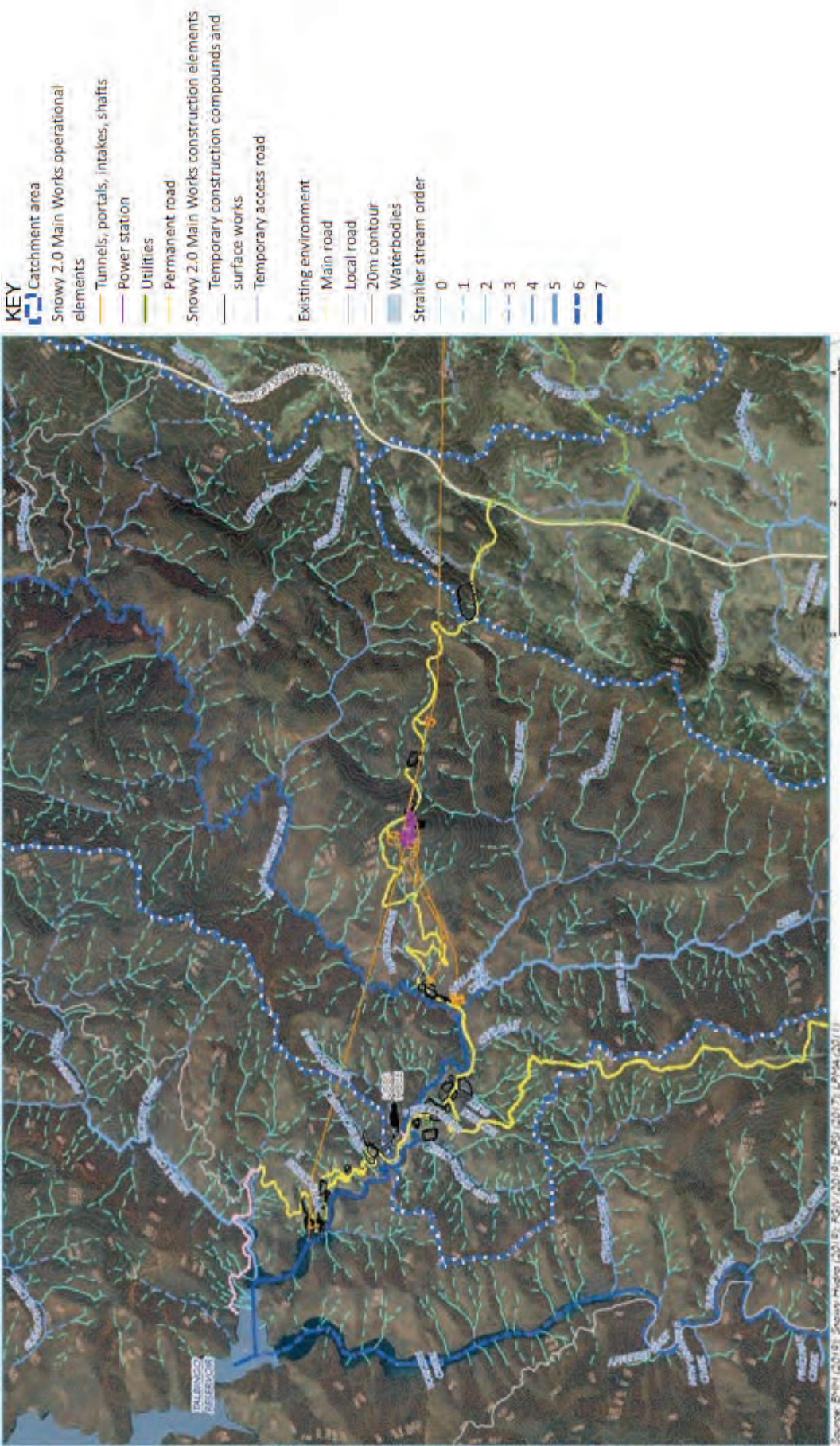


Figure 4-2: Water Courses – Ravine (EMM, 2019)

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Figure 4-3: Water Courses – Plateau (EMM, 2019)

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4.6. Groundwater

The hydrogeological units of the project are:

- Alluvium, colluvium and weathered rock: these shallow units are generally recharged by moderate to high rainfall, flooding for alluvial areas and snow melt;
- Shallow weathered fractured rock: these units have low to moderate permeability and are recharged by moderate to high rainfall and snow melt (occurring when soil moisture conditions are exceeded); and
- Deep fractured rock: recharged by infiltration of rainfall migrating from shallow groundwater systems. Permeability is generally lowest in the central section of the plateau and higher in the east and western areas of the plateau. There is downward flow of groundwater in recharge areas and upward flow in discharge areas.

Measurements from the baseline groundwater monitoring network vary from approximately 1,470 m AHD in the topographically elevated terrain adjacent to the LPF, to approximately 570 m AHD in the topographically lower terrain near Lobs Hole. Groundwater levels may fall outside of this measured range in areas of higher relief and in some of the lower drainage lines, such as the interface between the Yarrangobilly River and Talbingo Reservoir where levels are likely at or close to surface levels of about 545 m AHD.

4.6.1. Ravine Area

Along the proposed tailrace tunnel transect, groundwater levels within the Ravine Beds vary from approximately 1,325 m AHD in the topographically elevated terrain adjacent to the LPF in the east, to approximately 570 m AHD in the topographically lower terrain near Lobs Hole. Groundwater flow direction is generally from east to west, with the LPF area acting as a groundwater divide between the ravine and plateau areas.

Groundwater levels within the ravine do not typically show an obvious response to rainfall events or flow events within the Yarrangobilly River.

4.6.2. The Plateau

Along the proposed headrace tunnel transect, groundwater levels vary from approximately 1,470 m AHD in the elevated areas adjacent to the LPF in the west, to approximately 1,170 m AHD in the lower elevated area near Tantangara Creek. Overall, groundwater levels observed along the proposed tunnel alignment indicate that groundwater flow direction is generally west to east from the LPF.

Groundwater levels within the plateau show a moderate to strong response to rainfall events, indicating a moderate to strong connection between surface and the regional groundwater system.

5. WATER MANAGEMENT APPROACH

5.1. Water Management Streams

The six key water management streams for the Project are described in Table 5-1.

Table 5-1: Water Management Streams

Water management stream	Description	Details of management measures
Stormwater	This refers to surface water runoff from areas disturbed by construction (i.e. water directed to sediment basins) and surface runoff around construction areas (i.e. clean water diversions).	WMP SWMP Basin Dewatering Management Procedure ERSED Procedures
Leachate	This refers to water run-off and infiltration within the permanent and temporary spoil emplacement areas.	SWMP GMP LDP's Basin Dewatering Management Procedure Spoil Management Plan Nitrogen Management Plan
Groundwater	This refers to the groundwater encountered during tunnelling and excavation activities.	GMP LDP's Water Monitoring Procedure
Process water	This refers to the water treatment and supply system used for construction and tunnelling activities and includes the: - Extraction of water from groundwater wells (see Figure 6-1); - Treatment of leachate water; - Extraction of water from reservoirs; - Reuse of intercepted waters; - Reuse of treated process water; - Treatment of other construction generated water; and - Discharge of water to reservoirs.	WMP SWMP GMP Basin Dewatering Management Procedure Discharge Procedure Nitrogen Management Plan
Wastewater	This refers to sewage and grey water generated from the accommodation camps and other amenities.	WMP SWMP
Potable water	This refers to water that has been treated to a potable water standard (i.e. drinking water).	WMP SWMP

5.2. Project Water Reuse

The Project is committed to maximising the reuse and recycling of water. A key mechanism that has been designed is the reuse of treated waste and process water as much as practicable in order to avoid release into the surrounding water environments.

5.2.1. Risk Assessment

In May 2021, an investigation of the opportunities to reuse treated effluent within the Project boundary was undertaken through the engagement of an appropriate third party. The investigation included a risk review of the permissibility of using treated effluent against the Project Approval,

environment and human health legislation and guidelines alongside potential risks to offsite environmental receptors. The third-Party Consultant's Memorandum was prepared to inform treated water effluent reuse from the Exploratory and Fly Camp STP, however results were considered applicable to the Main Camp, Marica and Tantangara systems. As both STP and Process Water are required to meet the same water quality criteria, the reuse recommendations provided in the Memorandum were considered applicable to both.

In May 2023, the third-party consultant issued a revised risk assessment document addressing treated water reuse across the Project. The document contained a range of analytical criteria for water across the project that would be considered acceptable for beneficial reuse avenues.

In September 2025, EPL21266 was subject to an additional license variation whereby Condition U1 – *Assessment of Water Reuse and Basin Maintenance Activities* was included in Schedule 8. Condition U1 requires the Proponent to undertake a Project wide assessment of all referenced activities prior to ultimately redeveloping a Water Reuse Management Plan in 2026. On 16th December 2025, at the time of finalising Revision O of this Plan, the Project had completed several actions required by the Condition, however, note that water reuse activities remained consistent with the third-party Memorandum for the interim period.

5.2.2. Reuse Activities

The reuse of treated Water is restricted to reuse for the following activities:

- Dust suppression within applicable areas;
- Irrigation of approved locations;
- Concrete batching;
- Wheel wash infrastructure;
- Material preparation and other civil works;
- Rock and concrete crushing;
- Fire and emergency water systems;
- Drilling and other auxiliary operations; and
- Tunnelling activities.

Treated water not required for reuse would be discharged to the reservoirs in following compliance with EPL21266.

At the time of this Management Plan Revision, water reuse is governed by criteria derived from the third-party risk assessment.

6. SITE WATER BALANCE

The Project is located in a remote location with no municipal potable water supply available in the area. A water supply system will be established to supply water for potable water use and construction activities. The system is planned to be sourced from licenced groundwater bores until an extraction pipeline is established to extract raw water for construction use from Talbingo and Tantangara Reservoirs. No surface watercourse extraction is proposed (i.e. the only surface water extraction proposed is from the reservoirs). During tunnelling, intercepted groundwater will become the primary water supply source (i.e. process water) for construction activities.

Currently, two extraction bores exist within the Maria site boundary with the decommissioning of Lobs Hole bores EWPB1, EWPB2 and the Tantangara Bore WSB1 due to reservoir supply connections. The bores fall under Access License 40AL417795 and Work Approval 40MW416855.

Process water and wastewater will be treated, recycled and re-used back into the tunnel or on site as non-potable water. Excess treated water that cannot be utilised on site will be discharged via pipe into either the Talbingo or Tantangara Reservoir.

These systems are referred to as the Tantangara and Talbingo systems and will operate independently (i.e. they will not be connected, as delineated in Figure 6-26-3 and 6-4). Discharges from the treatment systems will be licenced under the EPL21266. During construction, wastewater will be produced at all construction camps and facilities that have amenities, these waters will be managed through the onsite STP's including the additional treatment facility planned for Marica.

Modification 3 signalled the installation of additional water treatment facilities at Marica. This capacity upgrade is intended to allow for water to be directed to Lobs Hole for reservoir discharge following treatment at the site's upgraded facilities.

All water extraction will be appropriately licenced and required for the scope of works detailed in this Plan. This includes the additional potable water bore installation planned for Marica's Modification 3 scope. Should watercourse extraction be required in the future, additional approvals under the Water Management Act would be reviewed and sought as required.

Water extraction (i.e. from groundwater bores, reservoirs and tunnel inflows) and water discharge (i.e. surplus treated process and wastewater) metering will comply with the Australian Standard AS 4747: 'Meters for non-urban supply'. The metering equipment will be installed at water source extraction points and prior to discharge points. Readings will be undertaken manually (the Project are investigating opportunities for electronic monitoring) on an ongoing basis throughout construction (i.e. weekly) and recorded in a project water usage register.

Conceptual overviews of the water systems are available in the following Sections of this Plan including the conceptual layout for Modification 3 works. All monitoring will be used to track water take in accordance with water access licence requirements and inform the annual revised site water balance.



Figure 6-1: Marica Extraction Bores MB01 and MB02

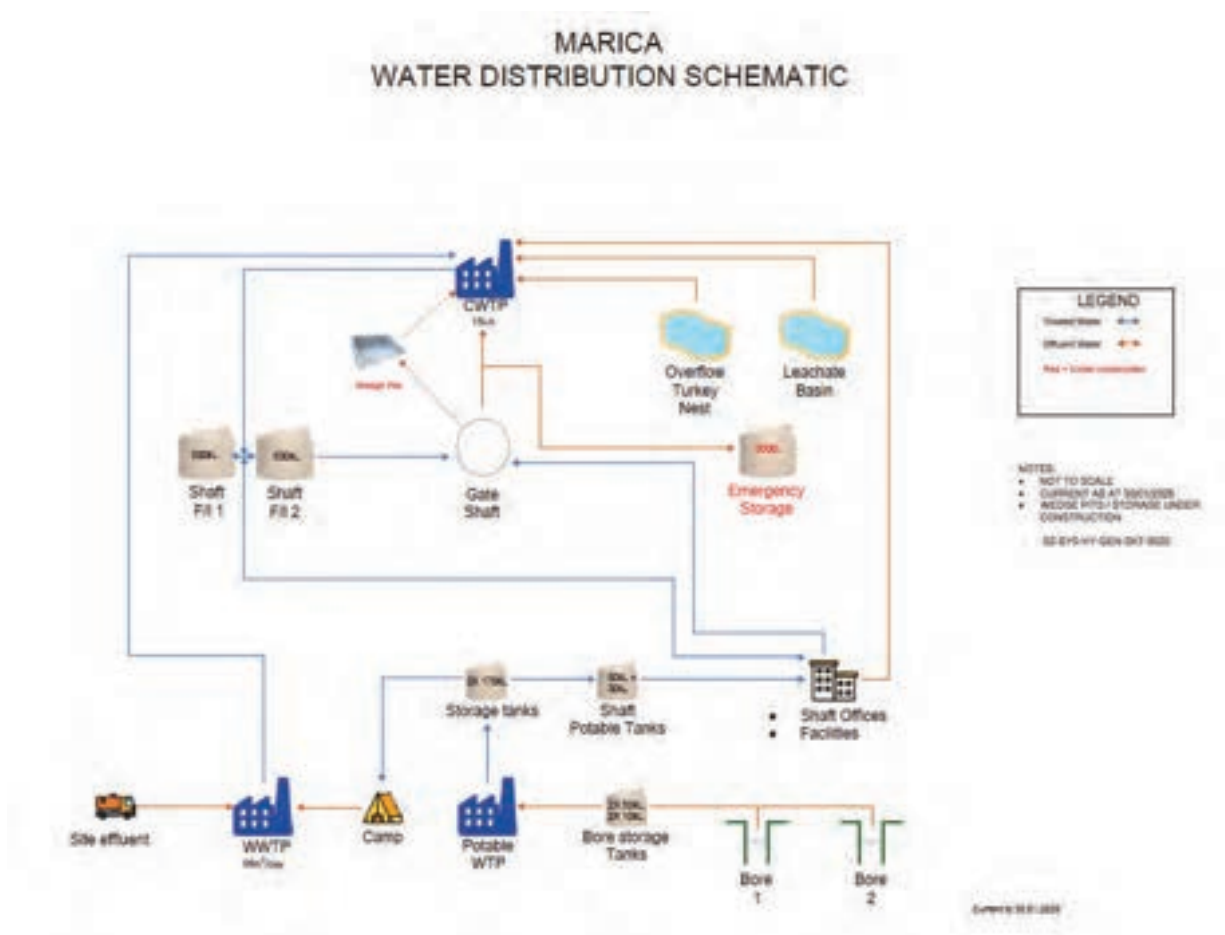


Figure 6-2: Marica Water Treatment System Extent

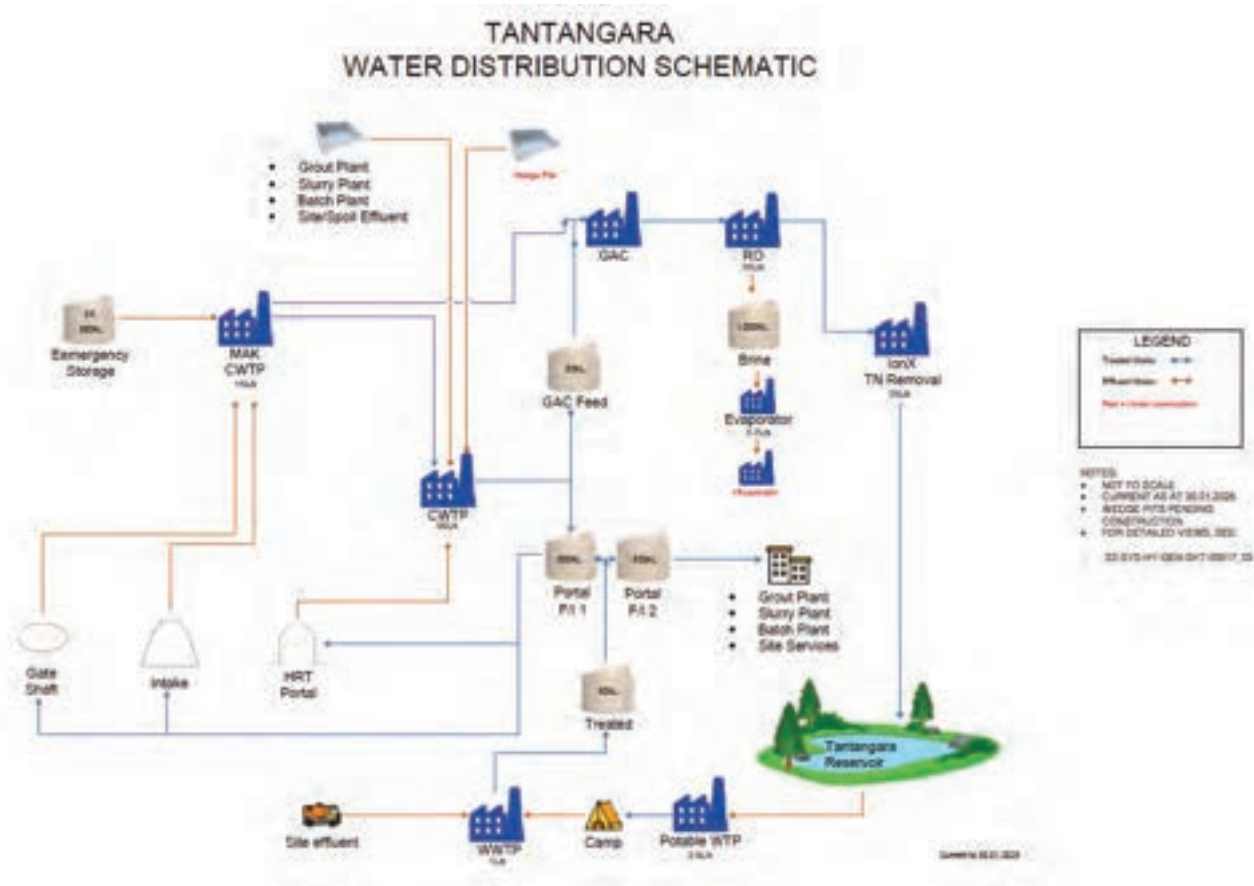
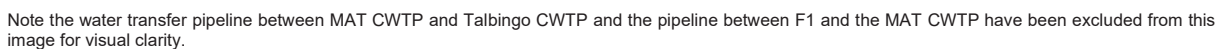


Figure 6-3: Tantangara Water Treatment System Extent



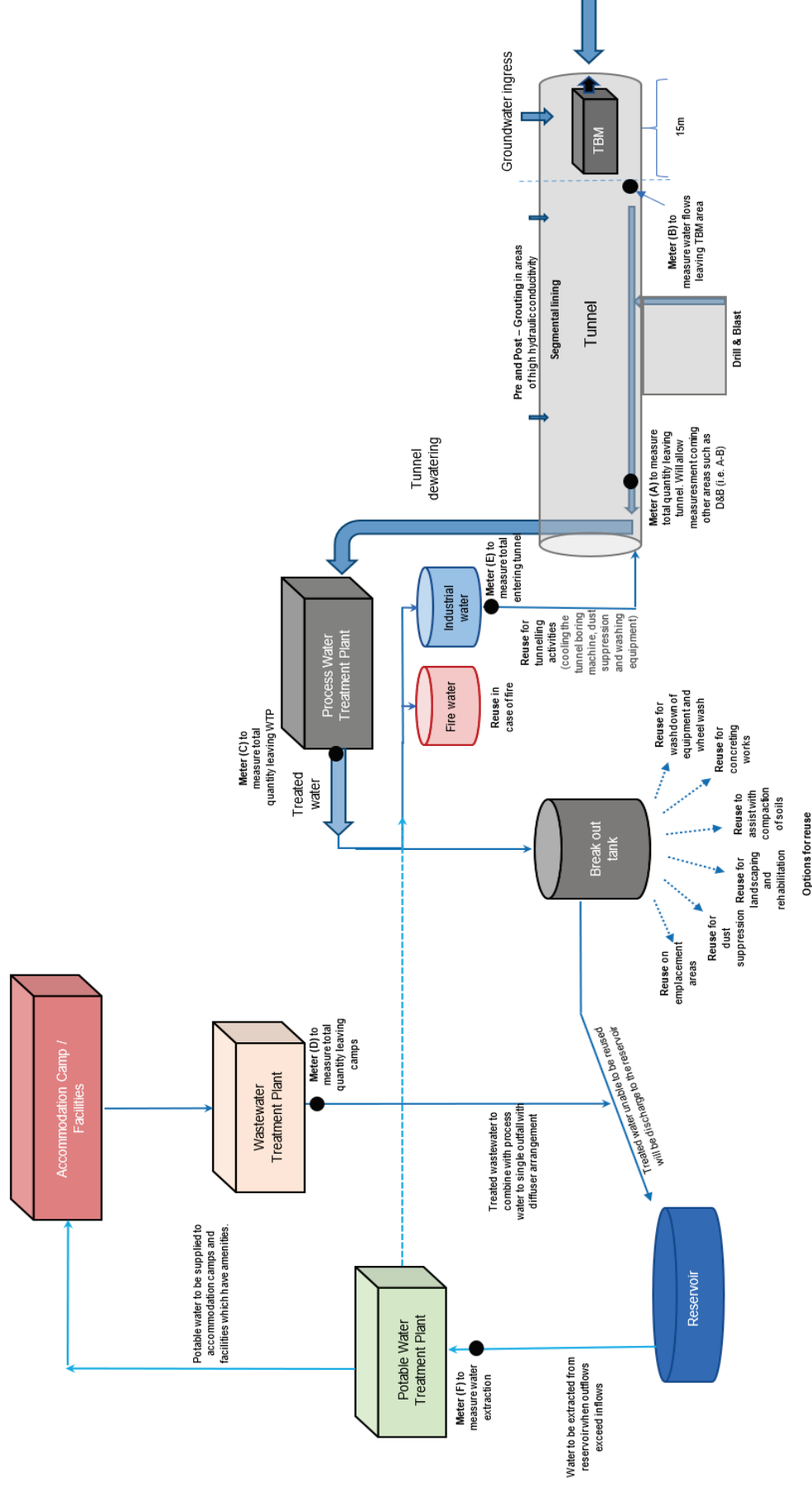


Figure 6-5: Conceptual Water Management Overview

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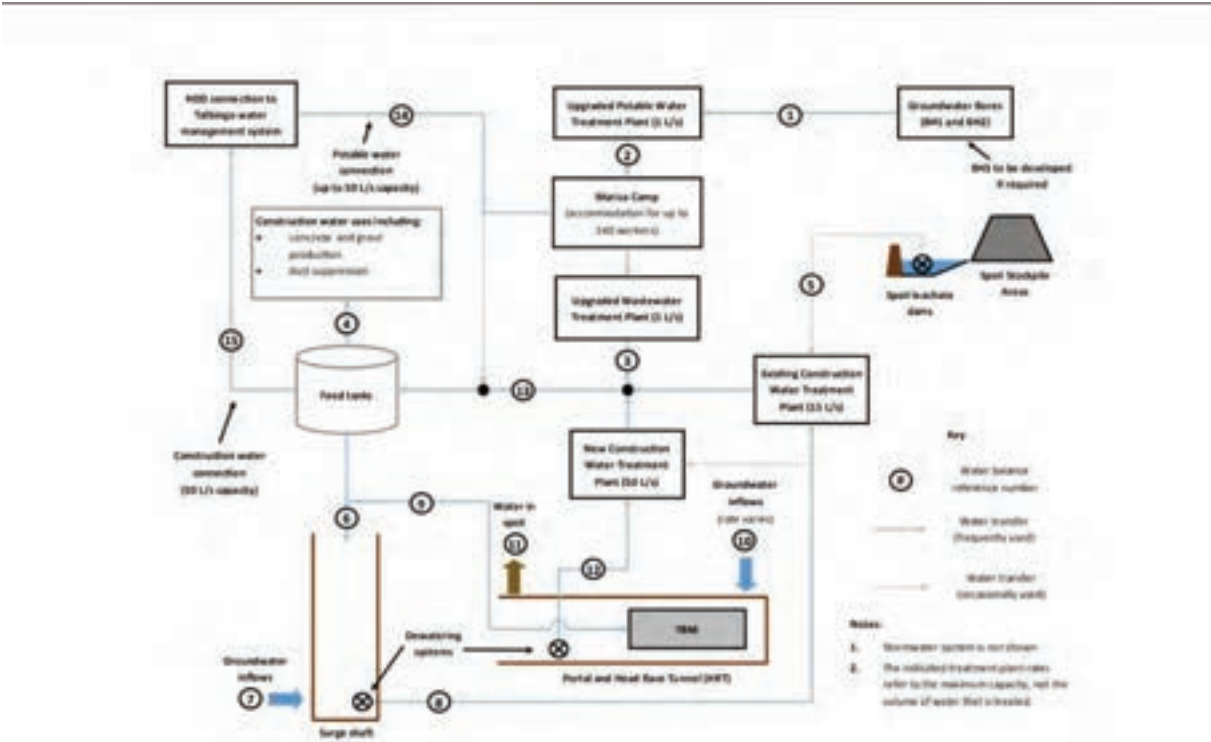


Figure 6-6: Proposed Water Operation System – Modification 3, Marica. (Source: EMM, 2024)

A preliminary Site Water Balance (Balance) was completed in the Revised Water Management Report (RTS Appendix J) to estimate the discharge and top-up profiles from the systems over the construction phase of the project.

A revised assessment of the Balance, informed by the provisions within the Geotechnical Baseline Report (GBR) (Future Generation, 2019) and revised construction program identified an increase in peak discharge from the Talbingo system.

Figure 6-7 and Figure 6-8 illustrate the following site water predictions:

- The peak discharge from the Tantangara system is expected to occur during the latter end of the construction timeline, with a discharge rate of approximately 3.7 ML/day. From approximately mid 2024 until the start of commissioning, which has been extrapolated to include the updated Project timelines. The peak discharge from the Talbingo system is estimated to be in the order of 4.32 ML/day due to combined concurrent excavations (i.e. MAT, ECVT, TRT, USS, DSS);
- The predicted maximum groundwater inflow into the tunnel is 3.9 ML/day in the Tantangara system and 4.1 ML/day in the Talbingo system; and
- System top-ups will only be required when net usage exceeds net inflows and will be at peak of 6 ML/month for Tantangara and 23 ML/month for Talbingo.

Table 6-1: Peak Discharge and Top-up Rates

Process water system	Peak top-up rate	Peak discharge rate
Tantangara	6 ML/month or 0.2 ML/day	114 ML/month or 3.7 ML/day
Talbingo	23 ML/month or 0.7 ML/day	130 ML/month or 4.32 ML/day

The original Balance for month 48 of construction is presented in Section 6 as a snapshot during the construction period.

The Balance is currently a conceptual model. The Project will continue to develop the Balance during construction and the completion of final tunnel design for the purpose of:

- Demonstrating the functionality of the process water system;
- Estimate the probable range in water transfer volumes; and
- Record, update and report on the water transfer volumes each calendar year.

The Water Balance will be reviewed each calendar year with the results of each review prepared in individual assessment reports. The provision of each report can be made available through SHL. Where updates are identified, the revised Balance will be updated and included in future revision of this WMP.

This review will involve using monitored quantities to verify predicted quantities, adjust the Balance where required, and provide explanation of any differences between predicted and actual quantities. Any water infrastructure retrospectively added or changes in water access/extraction licences will be included in the revision.

Further details of the Tantangara and Talbingo systems are contained within in Surface Water Management Plan (Appendix A) and Groundwater Management Plan (Appendix B).

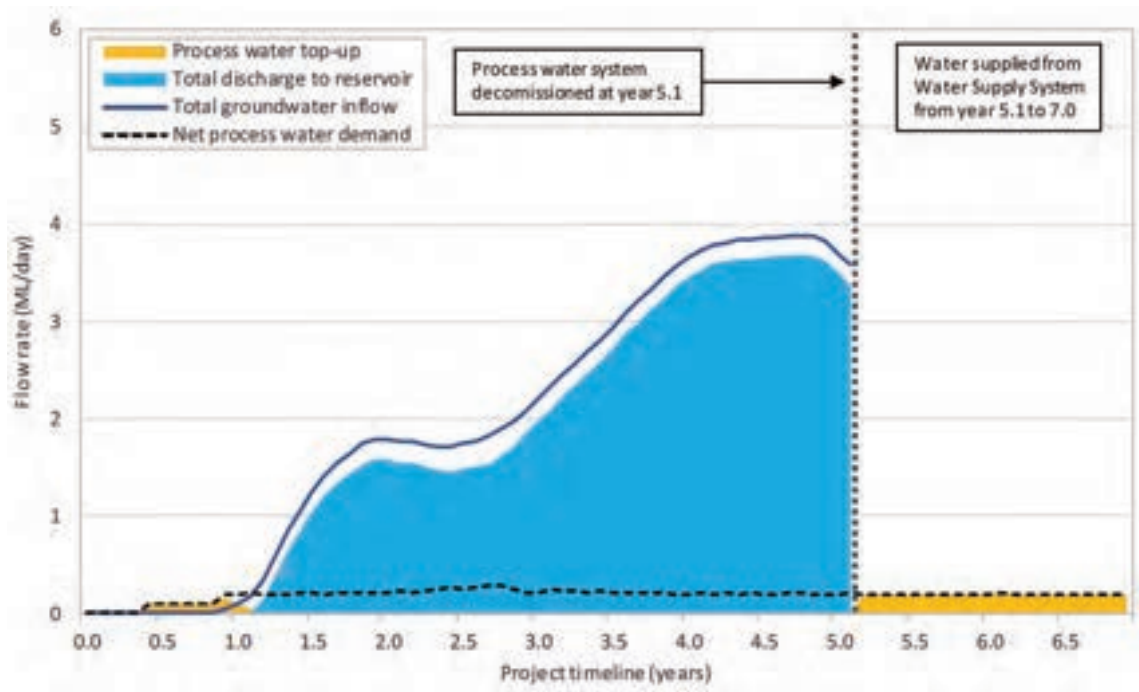


Figure 6-7: Tantangara Process Water Balance (EMM, 2020)

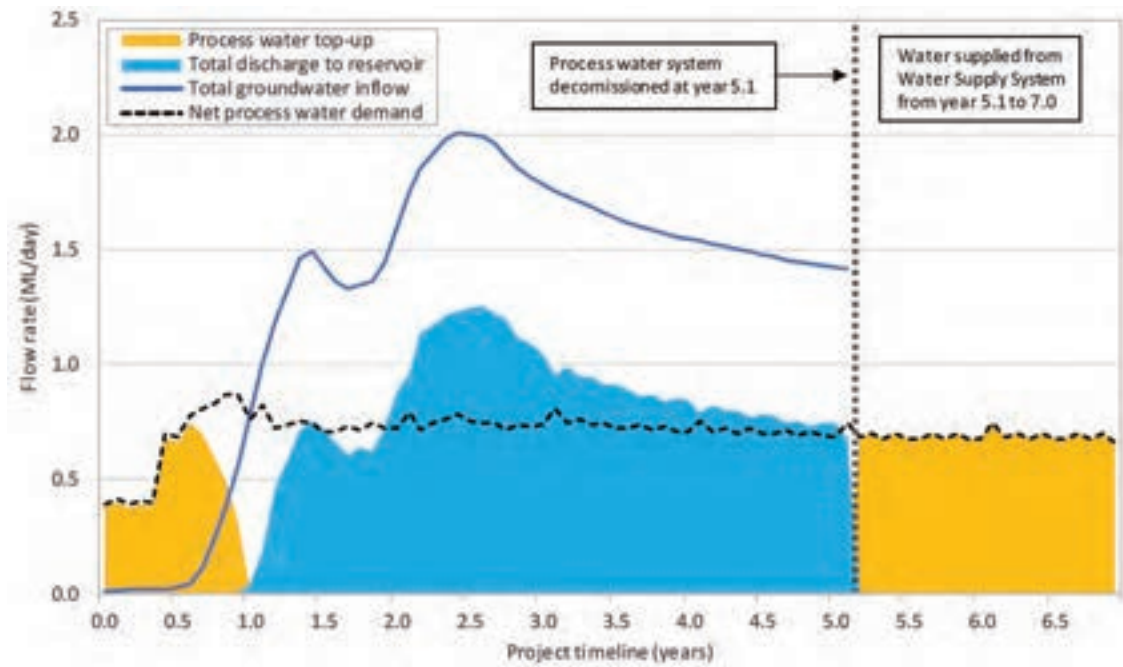


Figure 6-8: Talbingo Process Water Balance (EMM, 2020)

6.1.1. Groundwater Inflows Prior to 2026

The RTS Revised Water Modelling Report (EMM, 2020) included updated inflow volume predictions to peak during construction at 62 L/s before stabilising at 45 L/s during operation. This modelled reduction in groundwater inflow compared to the original EIS report significantly reduced the magnitude and extent of groundwater drawdown and associated impacts.

The RTS Model Report considered potential average, wet and dry climate scenarios and quantified groundwater inflows to all excavations at 1,874 ML (59L/s), 1,952 ML (62L/s) and 1,835 ML (58L/s dry) on an annual basis for the average, wet and dry climate scenarios modelled, as summarised in Table 6-2. These figures were adopted within the Project until the conclusion of the date provided whereby the revised volumes were considered appropriate.

Table 6-2: Predicted Annual Inflows Main Works to 2025

Year ending	Dry climate (ML)	Wet climate (ML)	Average climate (ML)
1 June 2019	0	0	0
1 June 2020	3	3	3
1 June 2021	392	395	393
1 June 2022	1212	1259	1212
1 June 2023	1456	1503	1475
1 June 2024	1835	1952	1874
1 June 2025	1398	1488	1800

The Modification 3 assessment works included a revised Modelling Report (EMM, 2024) which detailed inflow predictions specific to the modification 3 works. This report model focused on the excavations commencing outside the HRT alignment prior to joining the HRT and contributing to inflow volumes throughout the Kellys Plain Volcanics and the Gooandra Volcanics. It is noted the Mod 3 report details annual inflows consistent with previous construction timelines which have since been superseded. Table 6-3 displays predicted groundwater inflow rates for the MOD3 works as provided by EMM in 2024.

Table 6-3: Predicted Annual Inflow - Modification 3 (EMM, 2024)

Prediction	Inflow (ML/ yr)
Construction: Year 1 groundwater inflow (ML)	36.5
Construction: Year 2 groundwater inflow (ML)	40.1
Operation: Steady state groundwater inflow (ML)	0

6.1.1.1. Revised Inflow Predictions to 2028

Tunnel inflow volumes were subject to review during the December 2025 and January 2026 revision of this Management Plan to allow for estimation up to the anticipated conclusion of construction. The primary objective underpinning the review was to improve overall clarity regarding water source takes and establish the maximum inflow volumes expected until December 2028.

The revised maximum annual inflow volumes have been calculated utilising the medium scenario volumes provided in the RTS Revised Water Modelling Report (EMM, 2020) in conjunction with inflow records generated during the 2025 inflow volume reporting period. The medium inflow scenario (equating 5 L/s/km) detailed within Part 2 – 3.4 of the Model Report has been adopted as the maximum inflow volume applied per kilometre of unexcavated and unlined area until construction

is complete. The predicted annual volumes were subsequently applied to the respective water sources on an annual basis.

As such, Table 6-4 quantifies maximum inflow predictions up to the end of 2028 separating the volumes via water sources.

Table 6-4: Predicted Annual Inflows

Year Ending	2026	2027	2028
Lachlan Fold Belt – Murray Darling Basin Groundwater Source (24.5 kms intersection)	1505 ML+50 ML *	2129 ML+50ML *	2939 ML+50ML *
Lachlan Fold Belt – South Coast Groundwater (2.5 kms intersection)	312 ML	339 ML	254 ML

*Shaft volume is conservatively estimated at 50ML, based on a baseline of 30ML recorded in the previous year.

Table 6-5: Additional Usage Estimations – Marica

ID	Description	Minimum Volume ML per day	Assumptions
1	Water supply from groundwater bores	0.075	Estimated value based on average metered supply between November 2023 and March 2024, adjusted for the accommodation camp expansion (from 196 to 340 beds)
2	Potable water supply to accommodation camp and amenities	0.068	Estimated value based on average metered supply between November 2023 and March 2024, adjusted for the accommodation camp expansion (from 196 to 340 beds at 200L per person).
3	Treated Sewerage Wastewater	0.044	Estimated value based on average metered supply between November 2023 and March 2024, adjusted for the accommodation camp expansion (from 196 to 340 beds).
4	Construction water use	0.337	Maximum deficit scenario – estimated value provided by Future Generation Joint Venture (FGJV) based on the following average daily use rates: 0.3 L/s for concrete production, 1.8 L/s for grout production and 1.8 L/s for dust suppression (3.9 L/s total).
5	Water transferred to CWTP from basins	0.920	Maximum surplus scenario assumes basins are dewatered within 5 days and basins are built to design
6	Construction water supply to USS	Nil	Maximum deficit scenario – minor as surge shaft construction receives water in greater volumes than supply. the TBM
8	Water from USS to CWTP	0.192	Estimated value based on average metered dewatering volumed between November 2023 and March 2024.
7	Groundwater inflow USS	0.192	Assumed to be less than ingress.
9	Water supply to TBM	0.691	Maximum deficit scenario – estimated maximum value provided by FGJV.
10	Groundwater inflow into HRT	1.442	Maximum surplus scenario –assumed maximised inflow volumes during TBM 4 mining.

11	Water retained in spoil	0.345	Maximum deficit scenario – assumes 50% of TBM feedwater is retained in spoil
12	Transfer from HRT to CWTP	1.442	Assumes maximum ingress of groundwater per day and CWTP can treat up to 5 L/s.
13	Potable water supply for TBM Grout	0.446	Maximum
14	Discharge to Reservoir	4.3	Assumes connection is installed prior to tunnelling works commence. Assumes 100 L/s discharge modelling is complete.

Source: Snowy 2.0 Main Works- Modification 3 - Appendix B SSI-9687-Mod-3

Table 6-6: Updated Estimated Water Allocation

WAL	Project Stage	Entitlement	Estimated Take 2024	Estimated Take 2025	Maximum Estimated Take 2026	Maximum Estimated Take 2027	Maximum Estimated Take 2028
WAL424 07	Talbingo (Pontoon)	227 ML	127 ML (55.95% of entitlement)	123 ML (53% of entitlement)	170 ML (75% of entitlement)	170 ML (75% of entitlement)	170 ML (75% of entitlement)
WAL424 08	NIL	0	NA	NA	NA	NA	NA
WAL429 60	Marica Potable Bores	354 units	17 ML (5% of entitlement)	17 ML (5% of entitlement)	177 ML (50% of entitlement)	177 ML (50% of entitlement)	141.6 ML (40% of entitlement)
WAL433 28	All Tunnel activities / Shaft	3,375 units	70. ML (2% of entitlement)	405 ML (12% of entitlement)	1,505ML +50ML* (45% of entitlement)	2129ML +50ML* (63% of entitlement)	2939+50ML* (87% of entitlement)
WAL433 29	Yet to be intersected by the Headrace Tunnel	1,722 units	N/A	N/A	312 ML	339 ML	254ML
WAL435 44	Tantangara Surface Extraction (Pontoon)	532 ML	55 ML (10% of entitlement)	81 ML (15% of entitlement)	266 ML (50% of entitlement)	266 ML (50% of entitlement)	266 ML (50% of entitlement)

*Shaft volume is conservatively estimated at 50ML, based on a baseline of 30ML recorded in the previous year.

Note: Marica bores (MB1 and MB2) fall under Access License 40AL417795 and 40MW416855.

Note: These forecasts are subject to change as actual groundwater behaviour is observed and as construction methodologies are refined. Recorded inflows are lower than predictive therefore peak inflows are lower overall than originally expected.

7. COMPLIANCE MANAGEMENT

7.1. Roles and Responsibilities

FGJV's organisational structure and overall roles and responsibilities are outlined in Section 4 of the EMS. Specific responsibilities for the implementation of mitigation measures are detailed in the SWMP and GMP.

7.2. Inspections

Inspection of water management measures will be undertaken regularly during construction in the form of weekly environmental inspections and rainfall inspections. All inspections will be internally recorded.

Any opportunities for improvement identified through the inspection process will be recorded in an inspection report (minor issues) in accordance with Section 8 of the EMS or an incident report completed in accordance with Section 7 of the EMS. Findings from inspection and incident report(s) will be reported to relevant agencies where required.

7.3. Monitoring

Monitoring will be undertaken to confirm the satisfactory water outcomes are achieved during construction. A summary of the monitoring aspects within this WMP is provided in Table 7-1.

Further details, such as the parameters and frequency of monitoring are included in the SWMP and GMP.

Table 7-1: Water Management Plan Monitoring Overview

Aspect	Objective
Surface Water Management Plan	
Routine receiving surface water quality monitoring	- inform and assess the performance of management processes/measures that seek to minimise the Project's impact on surface water quality - help determine source and extent of any water quality changes - collect baseline data to characterise water quality and determine site specific values
Event based wet weather overtopping water quality monitoring	
Beneficial treated and basin water reuse	inform and assess water reuse, site balance and compliance with the infrastructure approval schedule 3, condition 30 (a)
Leachate detection program	- assess if leachate is being generated from the spoil emplacement areas. - inform management processes that seek to minimise the Project's impact on surface and groundwater.
Groundwater Management Plan	
Groundwater level monitoring	inform and assess the performance of management processes/measures that seek to minimise the Project's impact on regional and local (including alluvial) aquifers and GDEs
Groundwater quality monitoring	
Water extraction monitoring	inform and assess water consumption, site water balance and compliance with water access licenses
Leachate detection procedures	- assess if leachate is being generated from the spoil emplacement areas. - inform management processes that seek to minimise the Project's impact on surface and groundwater.

7.3.1. Monitoring Outside Construction Envelope

In accordance with schedule 4, condition 5 of the Infrastructure Approval, monitoring is permitted outside the construction envelope of the development provided the monitoring is required under the conditions of approval and authorised under an approved management plan.

This WMP includes surface water monitoring and groundwater monitoring inside and outside the construction envelope to monitor the surface water and groundwater impacts of the development (to satisfy schedule 3, condition 31(c) and 31(d) of the Infrastructure Approval).

Generally, monitoring will include the use of hand operated monitoring devices, sampling containers for the collection of water and the use of existing monitoring infrastructure (i.e. groundwater bores installed during project characterisation).

Where additional monitoring infrastructure is proposed outside the construction envelope, Future Generation will review environmental constraints and consult with relevant stakeholders (i.e. NPWS for monitoring infrastructure within the KNP) during the update to the Plan. Micro-siting principles will be implemented to minimise disturbance and compliance tracked against conditions of approval.

The ongoing use of monitoring infrastructure post construction will be determined in a SHL operational document or framework. Where monitoring infrastructure is no longer required, rehabilitation will be undertaken in accordance with the Rehabilitation Management Plan.

7.4. Incidents

Water incidents will be managed in accordance with Section 7 of the EMS and the Snowy Hydro Environmental Incident Process included within Appendix A4 of the EMS.

The Secretary and other relevant agencies will be notified of incidents in accordance with Section 7 of the EMS. Depending on the type and severity of the incident this may include notification to the Department and NPWS in writing for incidents defined under the conditions of approval, notification to the NPWS where required under the Deed of Agreement of Lease and notification to the EPA for pollution related incidents. Snowy Hydro would notify DPHI in writing immediately after they become aware of the incident on site.

7.5. Auditing

Annual audits will be undertaken to assess the effectiveness of water management measures and overall compliance with this WMP. Audit requirements are detailed in Section 8.3 of the EMS.

7.6. Reporting

FGJV will report to SHL and other agencies regarding water management aspects related to the Project. During construction, surface water and groundwater monitoring data will be collected, tabulated and assessed against relevant criteria.

Table 7-2: Water Reporting Requirements

Report	Requirement	Recipient
Reporting		
Weekly inspection	<u>EMS Requirement</u> Weekly inspection report undertaken by environmental advisor which includes aspects relevant to the management of water	FGJV Internal Record
Incident Report (related to water)	<u>Infrastructure Approval Schedule 4, CoA 6</u> The Proponent must notify the Department and NPWS via the Major Projects Portal immediately after it becomes aware of an incident on site. This notice must set out the location and nature of the incident.	Depending on the type and severity of the incident this may include notification to the Department and NPWS in writing for incidents defined under the conditions of approval, notification to the NPWS where required under the Deed of Agreement of Lease and notification to the EPA for pollution related incidents. Snowy Hydro will notify DPHI in writing immediately after they become aware of the incident on site.
	<u>EPL 21266</u> Incident reports to be provided to EPA in accordance with EPL notification of environmental harm and written report requirements.	
EPL Monitoring Reports and Annual Return Reports	<u>EPL 21266</u> EPL monitoring reports will be prepared in accordance with the requirements of the EPL. An Annual Return will be prepared in respect of each EPL reporting period (typically 12 months).	EPA
Water Access Licence Report (annual)	<u>Water Access Licence</u> Actual water take will be reported to NRAR on an annual basis in accordance with water access licence conditions.	NRAR
Environmental Water Report (every 6 months)	<u>Infrastructure Approval Schedule 3, CoA 31(c)(d)</u> Commentary on the performance of the monitoring programs within the water management plan will be documented in the biannual environmental water report. Any incidents and key environmental issues will be documented.	Publicly available on project website
Other Aspects		
Site Water Balance	<u>Infrastructure Approval Schedule 3, CoA 31(b)</u> Yearly calendar revision of the Site Water Balance will be undertaken and where updates are identified, the revised Balance will be updated and included in a future revision of this WMP.	Proposed future updates to this WMP will be provided to EPA, NPWS, Water Group, NRAR and NSW DPI.
Groundwater model validation	<u>Infrastructure Approval Schedule 3, CoA 31(d)</u> Yearly calendar groundwater model review, validation and recalibration (as dictated by monitoring results) (undertaken by SHL).	The revised model will be submitted to the relevant agencies on completion.
Updates to this WMP	This WMP will be updated prior to the commencement of the following activities: - Dredging, channel extraction or underwater blasting - In-reservoir emplacement works - Construction works in the third year for the purposes of determining need / location of streamflow monitoring sites - Snowy 2.0 operations (a separate SHL document or framework may be prepared)	Proposed future updates to this WMP will be provided to EPA, NPWS, Water Group, NRAR and NSW DPI.

APPENDIX A – SURFACE WATER MANAGEMENT PLAN

Christina McNally
Senior Environmental Advisor – Post Approvals
Snowy Hydro Limited
Sent via Major Projects Portal

22/07/2026

Subject: Snowy 2.0 Main Works – Surface Water Management Plan

Dear Mrs McNally,

I refer to the Surface Water Management Plan submitted in accordance with Schedule 3, Condition 31 of the Infrastructure Approval for the Snowy 2.0 Main Works project (SSI-9687).

I note the Surface Water Management Plan has been prepared:

- in consultation with the Environment Protection Authority (EPA), National Parks and Wildlife Service (NPWS), NSW Department of Climate Change, Energy, the Environment and Water (DCCEE) - Water Group and NSW Department of Primary Industries (DPI) - Fisheries; and
- contains the information required by the conditions of the Infrastructure Approval.

The Department has carefully reviewed the document and is satisfied that it meets the requirements of the relevant conditions in the Infrastructure Approval (SSI-9687).

Accordingly, as nominee of the Planning Secretary, I approve the Surface Water Management Plan (Revision O dated 3 February 2026).

Please ensure future revisions of the Surface Water Management Plan include:

- a summary of stream flow and baseflow monitoring regimes for creeks and associated trigger action response plans. This information will also be included in an updated numerical groundwater flow model and Groundwater Management Plan; and
- any variations made to the Environment Protection Licence (EPL) and resulting changes to the monitoring program.

You are reminded that if there are any inconsistencies between the Surface Water Management Plan and the conditions of approval, the conditions prevail.

Please ensure you make the document publicly available on the project website at the earliest convenience.

If you wish to discuss the matter further, please contact Katie Weekes on 4927 3223.

Yours sincerely,

A handwritten signature in blue ink, appearing to be 'Nicole Brewer', with a long horizontal flourish extending to the right.

Nicole Brewer
Director
Energy Assessments

As nominee of the Planning Secretary



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MANAGEMENT PLAN

SNOWY 2.0 MAIN WORKS – SURFACE WATER MANAGEMENT PLAN

S2-FGJV-ENV-PLN-0011

REV O

JANUARY 2026

ABSTRACT

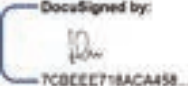
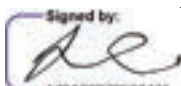
The key objective of this Plan is to detail management measures and inform site procedures for implementation so that surface water impacts are minimised and within the scope permitted by the Infrastructure Approval.

Revision Record

Rev.	Date	Reason for Issue	Responsible	Accountable	Endorsed
O	03/02/2026	Updated to address NPWS and SHL Comments	S. Lang	E. Porter	F. Lazzarin D. Drummond

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RACIE Terms

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A	Accountable The person who has the answer for success or failure of the quality and timeliness of the document.
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Revision Tracking

Rev.	Date	Description of Revision
A	27.11.2019	Initial draft for SHL review
B	22.5.2020	Update to reflect conditions of approval and revised environmental management measures
C	15.6.2020	For consultation
D	25.06.2020	Update to address Commonwealth conditions of approval
E	06.08.2020	Revised to address stakeholder comments
F	19.09.2020	Revised to address DAWE and DPHI comments
G	15.10.2020	Revised to address NRAR clarification
H	09.09.2022	Revised to address annual audit findings and include EPL variations and leachate detection programs
I	14.02.2023	Updated to reflect SHL comments
J	25.10.2024	Updated to include Modification 3 details.
K	15.01.2025	Updated to reflect agency and SHL comments
L	04.02.2025	Updated to address SHL comments
M	28.07.2025	Updated to reflect NPWS comments and incorporate the latest appendices
N	18.12.2025	Updated to address agency comments and incorporate the latest appendices
O	03.02.2026	Updated to address NPWS and SHL comments

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ABBREVIATIONS AND DEFINITIONS

Acronym	Definition
AEP	Annual exceedance probability
AFL	Agreement for Lease
BoM	Bureau of Meteorology
CoA	<i>Infrastructure Conditions of Approval (SSI 9687)</i>
Construction envelope	The maximum extent within which the disturbance area corridor can move to allow the final siting of infrastructure through the detailed design process
CSSI	Critical State significant infrastructure
CPHR	Conservation Programs, Heritage and Regulation
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DCCEEW	Department of Climate Change, Energy, the Environment and Water
Disturbance footprint	The disturbance footprint as described in the PIR-RTS is the indicative corridor inside the larger construction envelope, where construction works required to build Snowy 2.0 can be carried out.
DOI	NSW Department of Industry
DPHI	NSW Department of Planning, Housing and Infrastructure (formerly DPE)
EIS	Environmental Impact Statement
EMS	Environmental Management Strategy
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EP&A Regulation	<i>Environmental Planning and Assessment Regulation 2000</i>
EPA	NSW Environment Protection Authority
EPL	Environmental Protection License
ESCP	Erosion and Sediment Control Plan
Exploratory Works	The development of an exploratory tunnel and associated infrastructure described in the Environmental Impact Statement for the Snowy 2.0 Exploratory Works (CSSI 9208) dated July 2018, and modified by the: • Submissions Report dated October 2018; • Modification Report dated 6 June 2019 and associated Submissions Report dated 2 September 2019; and • Modification Report dated 17 October 2019 and associated Submissions Report dated 10 January 2020
FGJV	Future Generation Joint Venture
Future Generation-PMS	Project Management System
GDE	Groundwater Dependent Ecosystem
GMP	Groundwater Management Plan
Incident	An occurrence or set of circumstances that causes or threatens to cause material harm and which may or may not be or cause a non-compliance
KNP	Kosciusko National Park
LFB	Lachlan Fold Belt
Lobs Hole site	The development in the vicinity of Lobs Hole, including the GFO1 emplacement area; construction facilities (Main Yard), including workers' accommodation camp and temporary

Acronym	Definition
	spoil emplacement areas; Main Access Tunnel and Emergency Cable and Ventilation Tunnel portals; and ancillary infrastructure including access roads, substation, cableyard and utilities
LPF	Long Plain Fault
Main Works	The development of an underground power station and associated infrastructure described in the Environmental Impact Statement for the Snowy 2.0 Main Works (CSSI 9687) dated September 2019, and modified by the: - Preferred Infrastructure Report and Response to Submissions – Snowy 2.0 Main Works, dated February 2020; and - Additional information provided to the Department by EMM on 24 March 2020 and 7 April 2020
Marica site	The development in the vicinity of Marica, including the headrace surge shaft; ventilation shaft; construction facility workers' camp; and ancillary infrastructure including access roads and utilities.
Material harm	Is unauthorised harm that: - involves actual or potential harm to the health or safety of human beings or to the environment that is not trivial; or - results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding \$10,000, (such loss includes the reasonable costs and expenses that would be incurred in taking all reasonable and practicable measures to prevent, mitigate or make good harm to the environment)
NPWS	National Park and Wildlife Services
NSW DPI	The NSW Department of Primary Industries within Regional NSW
Plateau site	The development in the vicinity of the Plateau, including the instream barrier in Tantangara Creek and ancillary infrastructure including access roads and utilities.
Plateau area	The plateau area; located to the east of the Snowy Mountains Highway and spanning the area between the highway and Tantangara Reservoir, is typical of elevated alpine environments, dominated by low energy streams, gentle rolling hills and mostly flat floodplains. The plateau area includes the Plateau and Tantangara work site.
PMF	Probable Maximum Flood
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
POEO Regulation	<i>Protection of the Environment (General) Regulation 2009</i>
Process water	Water produced by and used by construction activities.
Project	Exploratory Works and Main Works
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. The project area does not represent a footprint for the construction works, but rather indicates an area that was investigated during environmental assessments.
Ravine area	The ravine area; located mostly to the west of the Snowy Mountains Highway, is characterised by deep gorges and steep sloping ridges, the product of incision from river flow, historic glaciation and structural movement. The ravine area includes the Talbingo, Lobs Hole and Marica work sites.
REMM	Revised Environmental Management Measures
Submissions Report or RTS	<i>Response to Submissions Main Works for Snowy 2.0</i>
SHC Act	Snowy Hydro Corporatisation Act 1997
SHL	Snowy Hydro Limited

Acronym	Definition
SWMP	Surface Water Management Plan (This plan)
Talbingo Reservoir site	The development in and around the Talbingo Reservoir, including the Ravine Bay emplacement area; development at Middle Bay, including the water intake and associated structures, barge launch ramp, and construction facilities; and ancillary infrastructure, including access roads and utilities.
Tantangara Reservoir site	The development in and around the Tantangara Reservoir, including the Tantangara emplacement area; water intake and associated infrastructure; barge launch infrastructure; construction and laydown facilities, including workers' camp; fish screens; and ancillary infrastructure, including access roads and utilities.
WAL	Water Access License
Water Group	DPIE Water
Wastewater	Domestic sewer water stream (i.e. from showers, kitchens, laundries and toilets)
WM Act	<i>Water Management Act 2000</i>
WMP	Water Management Plan
WM Regulation	<i>Water Management (General) Regulation 2011</i>
WQO	Water Quality Objective
WTP	Water Treatment Plan

1. INTRODUCTION

1.1. Project Description

1.1.1. Overview

Snowy Hydro Limited (SHL) is constructing a pumped hydro-electric expansion of the Snowy Mountains Hydro-electric Scheme (Snowy Scheme), called Snowy 2.0. Snowy 2.0 is being built by the delivery of two project: Exploratory Works and Snowy 2.0 Main Works, which commenced in May 2020.

Snowy 2.0 is a pumped hydro-electric project that will link the existing Tantangara and Talbingo reservoirs through a series of new underground tunnels and a hydro-electric power station. Most of the project's facilities will be built underground, with approximately 27 kilometres of concrete-lined tunnels constructed to link the two reservoirs and a further 20 kilometres of tunnels required to support the facility. Intake and outlet structures will be built at both Tantangara and Talbingo Reservoirs.

Snowy 2.0 will increase the generation capacity of the Snowy Scheme by an additional 2,000 MW, and at full capacity will provide approximately 350,000 MWh of large-scale energy storage to the National Electricity Market (NEM). This will be enough to ensure the stability and reliability of the NEM, even during prolonged periods of adverse weather conditions.

Webuild, Clough and Lane have formed the Future Generation Joint Venture (FGJV) and have been engaged to deliver both Stage 2 of Exploratory Works and Main Works.

1.1.2. Construction Activities and Program

The Snowy 2.0 Main Works Project includes, but is not limited to, construction of the following:

- Pre-construction preparatory activities including dilapidation studies, survey, investigations, access etc;
- Accommodation camps;
- Construction pads;
- Barge access infrastructure;
- An underground pumped hydro-electric power station complex;
- Water intake structures at Tantangara and Talbingo reservoirs;
- Power waterway tunnels, chambers and shafts;
- Access tunnels;
- New and upgraded roads to allow ongoing access and maintenance;
- 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;
 - permanent water supply to the underground power station; and
- post-construction revegetation and rehabilitation.

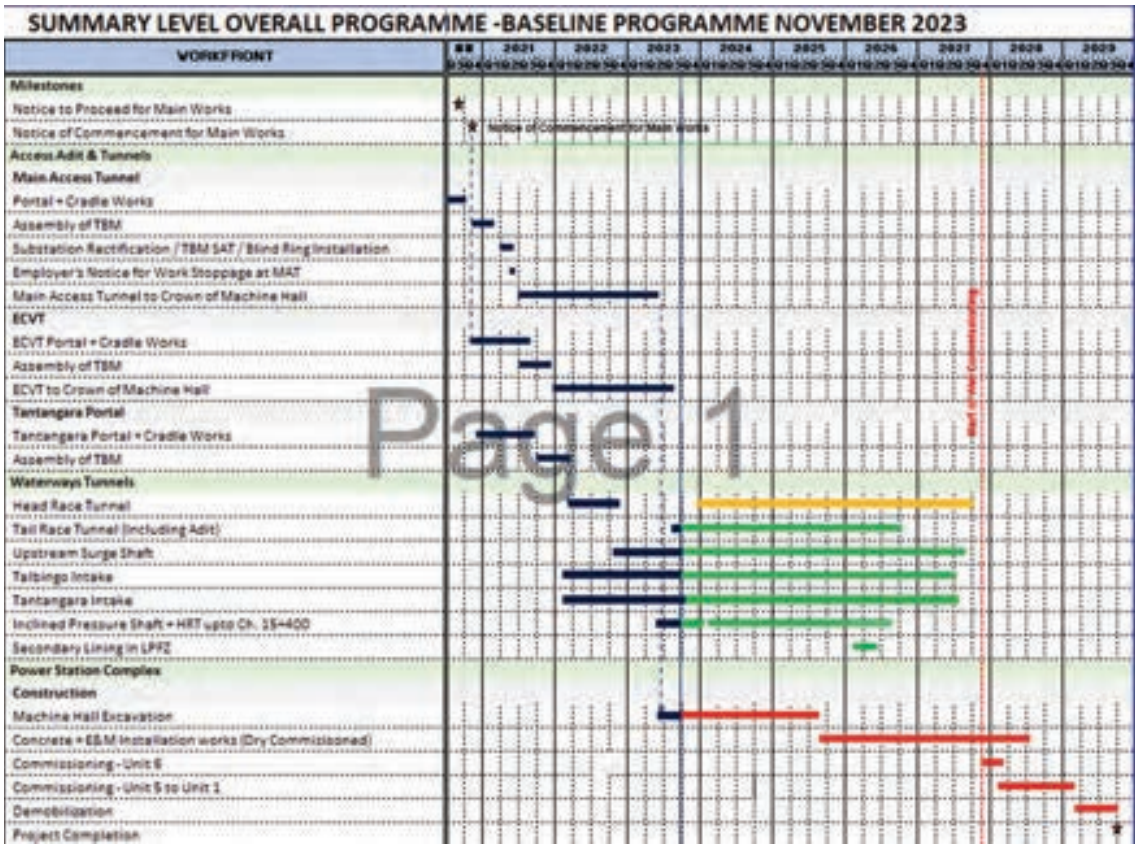


Figure 1-1 Timing of Snowy 2.0

The Snowy 2.0 Main Works Project includes numerous work sites as shown in Figure 1-2.

These work sites include:

- Lobs Hole Ravine Road;
- Lobs Hole;
- Marica;
- Plateau;
- Rock Forest;
- Talbingo; and
- Tantangara.

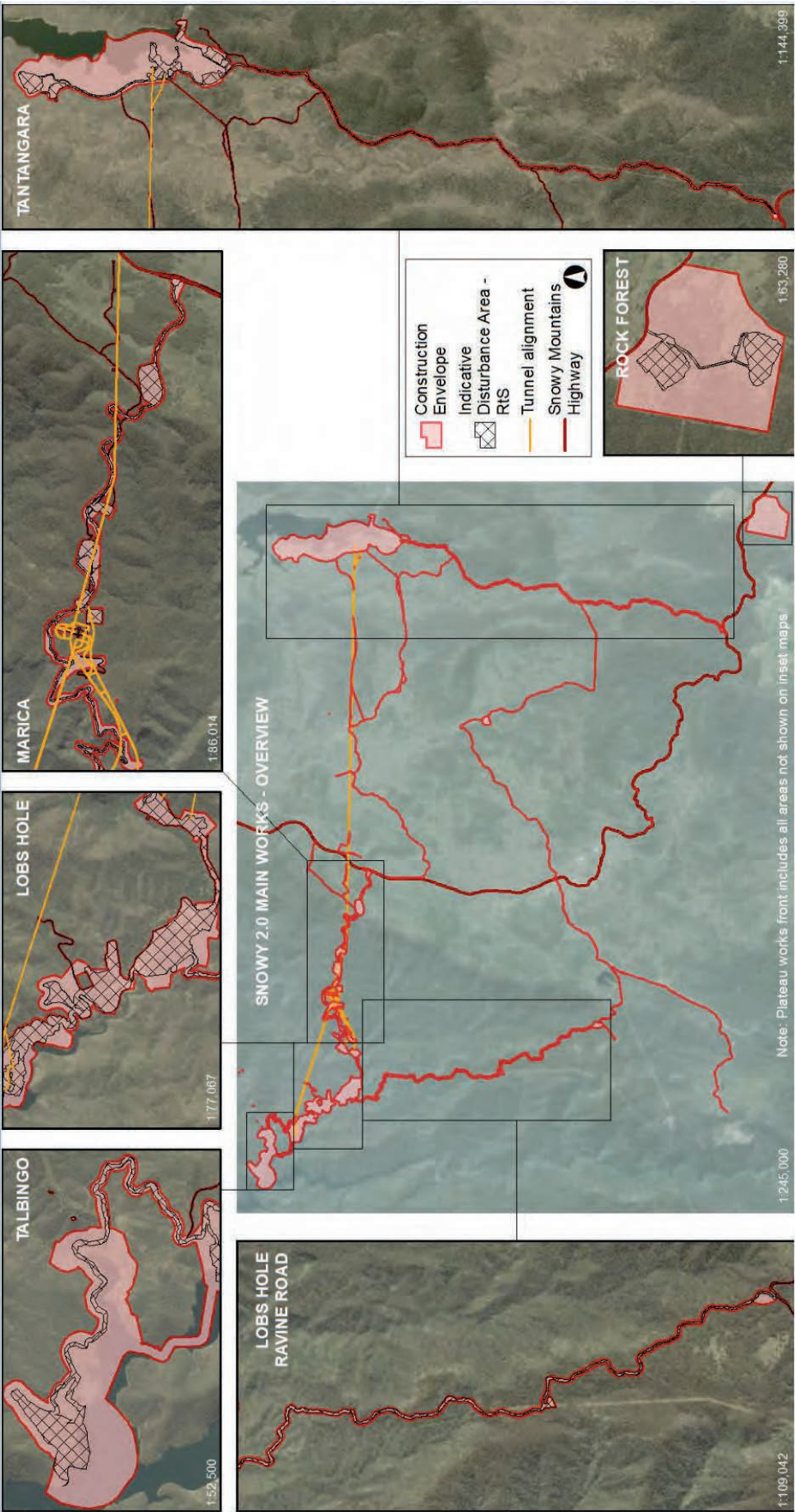


Figure 1-2: Snowy 2.0 Work Sites

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1.2. Project Approval

On 7 March 2018 the NSW Minister for Planning declared Snowy 2.0 to be State significant infrastructure (SSI) and critical State significant infrastructure (CSSI) under the Environmental Planning and Assessment Act 1979 (EP&A Act, 1979) on the basis that it is critical to the State for environmental, economic or social reasons.

An environmental impact statement for the first stage of Snowy 2.0, the Exploratory Works for Snowy 2.0 (Exploratory Work EIS) was submitted to the then Department of Planning and Environment in July 2018 and publicly exhibited between 23 July 2018 and 20 August 2018. Approval for the first stage of Snowy 2.0 was granted for Exploratory Works by the Minister for Planning on 7 February 2019. The purpose of Exploratory Works is primarily to gain a greater understanding of the underground geological conditions at the new power station. In accordance with section 5.25 of the EP&A Act 1979, the infrastructure approval for the Exploratory Works was modified on 2 December 2019 and on 27 March 2020.

An environmental impact statement for the second stage of Snowy 2.0, the Main Works for Snowy 2.0 (Main Work EIS) was submitted to Department of Planning, Housing and Infrastructure (DPHI) in September 2019 and was publicly exhibited between 26 September 2019 and 7 November 2019. A total of 222 submissions were received during the public exhibition period, including 10 from government agencies, 30 from special interest groups and 182 from the general public. In February 2020, the response to submissions (RTS or Submissions Report) was issued to DPHI to address the public and agency submissions (Snowy 2.0 Main Works - Preferred Infrastructure Report and Response to Submissions, February 2020).

Following consideration of the Main Works EIS and RTS, approval was granted by the Minister for Planning and Public Spaces on 20 May 2020, through issue of Infrastructure Approval SSI 9687.

Further to the Infrastructure Approval, the Main Works RTS includes revised environmental management measures (REMMs) within Appendix C which will also be implemented for the project.

On 27 January 2022, a modification to SSI-9687 (SSI-9687-Mod-1) was granted under Section 2.22 and clause 20 of Schedule 1 of the EP&A Act, 1979. The scope of the modification included horizontal directional drilling (HDD) to establish water and electricity services between the Lobs Hole and Marica areas of the Project.

On 29 November 2023, a second modification to SSI-9687 (SSI-9687-MOD-2) was granted under Section 5.25 of the EP&A Act 1979, approving the undertaking of sinkhole rectification works near the Tantangara Adit Portal, inclusive of geotechnical investigations and remediation works.

A subsequent planning application (SSI-9687-MOD-3) was approved on 16 December 2024 to permit the construction of an additional adit and launching of a fourth tunnel boring machine at Marica West to facilitate excavation of a section of the headrace tunnel (HRT) through the long plain fault zone (LPFZ). The LPFZ is the most geologically complex section of the HRT and represented a significant risk to the overall project completion date. The application was approved in accordance with Section 5.25 of the EP&A Act, 1979.

In addition to the State approval, a referral (EPBC 2018/8322) was prepared and lodged with the Commonwealth Department of Agriculture, Water and the Environment (DAWE) under the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act, 1999). The Commonwealth Minister's delegate determined on 5 December 2018 that Snowy 2.0 Main Works is a "controlled action" under the EPBC Act, 1999. The EPBC Act referral decision determined that the project will be assessed by accredited assessment under Part 5, Division 5.2 of the EP&A Act, 1979.

1.3. Disturbance Area

A key refinement following public exhibition of the Main Works EIS was a change to and clarification of disturbance area terminology. The revised disturbance area terminology as per the SSI-9687 Instrument, Main Works RTS and this Plan is outlined in Table 1-1, with an example shown at Lobs Hole Ravine Road in Figure 1-3.

Table 1-1: Disturbance area terminology

Term	Definition	Reasoning
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.	The project area does not represent a footprint for the construction works, but rather indicates an area that was investigated during environmental assessments.
Construction envelope	The envelope within which the disturbance area of the development may be located.	As detailed design continues, final siting of the infrastructure (i.e. the disturbance area) can move within the assessed construction envelope subject to recommended environmental management measures and provided it does not exceed the limits defined by the construction envelope.
Disturbance area	The area within the construction envelope where development may be carried out; the precise location of the disturbance area will be fixed within the construction envelope following final design.	



Figure 1-3: Disturbance area and construction envelope

1.4. Works within the Construction Envelope

Where project works are required to occur in locations outside of the disturbance boundary, FGJV will review the proposed area of clearing against the limits included within condition 5 of schedule 2. The review will be undertaken to ensure that the maximum disturbance area and maximum native vegetation clearing remains within the total areas nominated within the condition. These area limits are included within Table 1-2.

All vegetation clearing that occurs on the project will be monitored regularly to record the extent of clearing which has occurred, and to ensure that the clearing limits are not exceeded.

Table 1-2: Maximum disturbance area and native vegetation clearing

Matter	Exploratory Works	Main Works	Total
Maximum Disturbance Area	126 ha	504 ha	630 ha
Maximum Native Vegetation Clearing	107 ha	425 ha	532 ha

1.5. Environmental Management System

The overall environmental management system for the Project is described in the Environmental Management Strategy (EMS). The EMS forms part of the Project Management System (Future Generation-PMS) and will include any requirements specified in the contract documents, where appropriate. All Future Generation-PMS procedures will support, interface or directly relate to the development and execution of the Plan.

The management plans and post-approval documents for the project include those listed within Figure 1-4.

This Surface Water Management Plan (SWMP or Plan is an appendix to the Water Management Plan (WMP) which has been prepared for the Snowy 2.0 Main Works project and superseded the Stage 1 and Stage 2 Exploratory Works Water Management Plan. It does not address the operational phase of the project.

This Plan forms part of FGJV's environmental management framework.

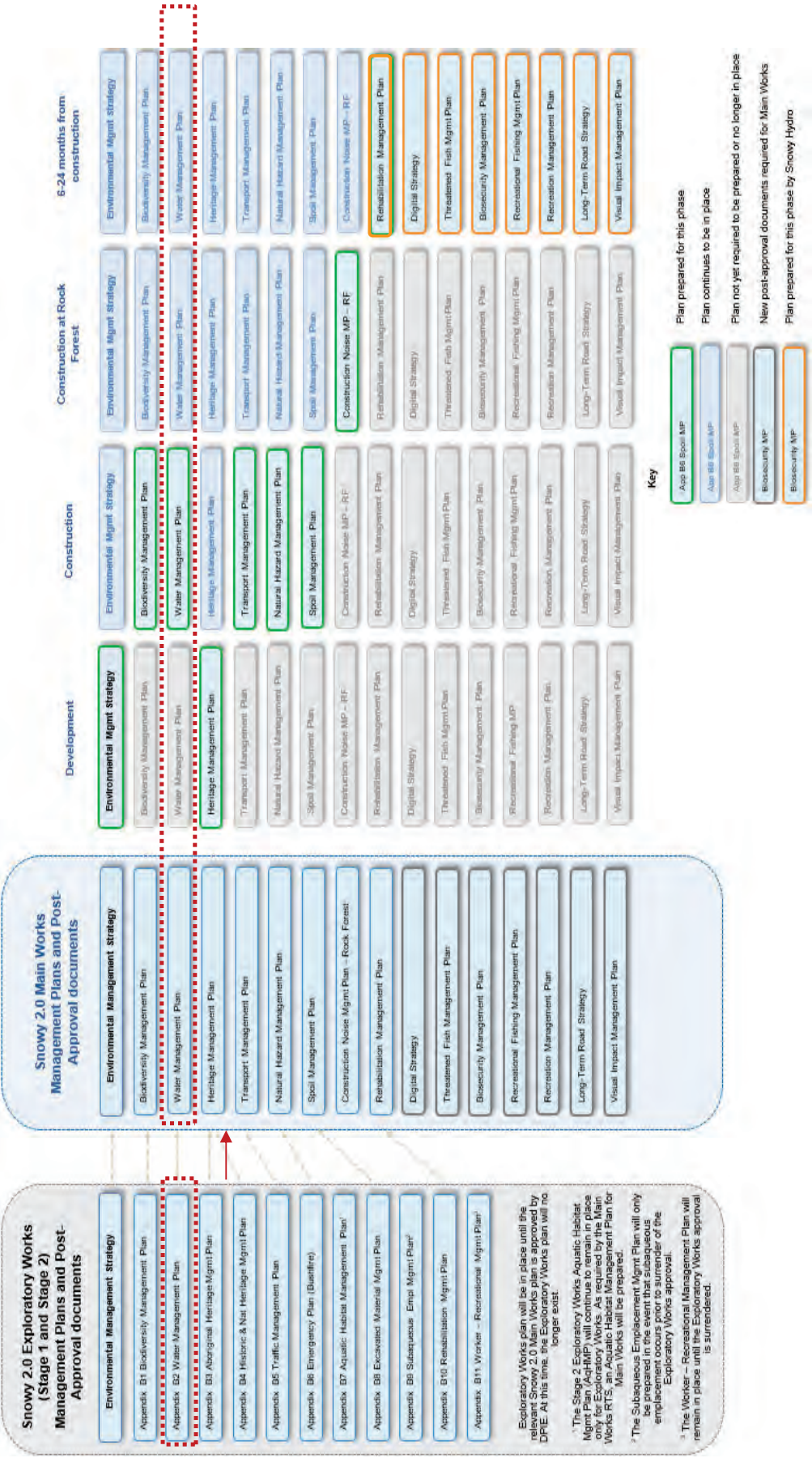


Figure 1-4: Management Plans and Documents

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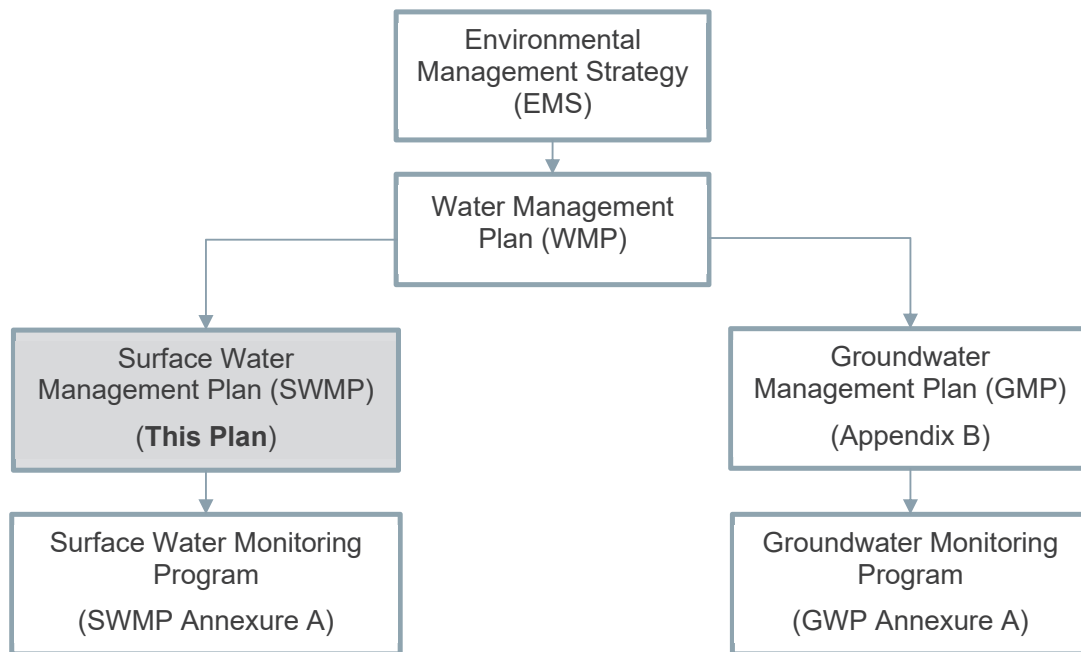


Figure 1-5: Water Management Plan Structure

1.6. Purpose and Objectives

This plan has been prepared to address the construction environment management requirements detailed in the:

- Main Works Snowy 2.0 - Environmental Impact Statement, September 2019;
- Revised Environmental Management Measures within the Main Works RTS, February 2020;
- Infrastructure Approval SSI 9687, May 2020;
- Main Works Snowy 2.0 – Modification 1 Assessment Report, January 2022;
- Main Works Snowy 2.0 – Modification 2 Assessment Report, November 2023;
- Main Works Snowy 2.0 – Modification 3 Assessment Report, December 2024; and
- Environmental Protection Licence 21266, latest variation May 2024.

The objectives of the SWMP are to ensure that impacts on surface water quality are minimised and within the scope permitted by the CoA. To achieve this, SHL and FGJV will implement:

- Appropriate measures to address relevant conditions;
- Appropriate measures during construction to avoid or minimise potential impacts to surface water quality;
- A water quality monitoring program to assess the effectiveness of management controls;
- Construction activities in a manner to minimise flood impacts and risks; and
- Corrective actions and contingency measures during construction when triggered.

1.7. Staging

This Plan contains management measures relevant to surface water, for the following sites:

- Lobs Hole;
- Marica;
- Plateau;
- Rock Forest;
- Talbingo; and
- Tantangara.

Some distinct work activities require greater detail prior to commencement. Consequently, this Plan will be updated in consultation with relevant government agencies and submitted to DPHI prior to the commencement of the activities detailed in Table 1-3.

Table 1-3: Activities Requiring Update

Activities	Timing
Dredging, channel extraction or underwater blasting	This SWMP will be updated for approval prior to dredging, channel extraction or underwater blasting.
Permanent in-reservoir emplacement areas	This SWMP will be updated prior to in-reservoir emplacement.
Construction works for the purposes of determining need/location streamflow monitoring sites	This SWMP will be updated if visual observations (undertaken by site environmental staff, during routine site inspections) note changes to streamflow have occurred. This update will enable identification of suitable locations to monitor potential streamflow impacts (based on additional groundwater monitoring data / revised drawdown predictions and visual observations).
Operation of Snowy 2.0 Project, including dewatering of the tailrace tunnel during operations.	Operation will be addressed through a separate SHL framework or document.

1.8. Plan Preparation

Amendments to the current plan reflect the amendments to lining requirements within all Project emplacement areas, EPL variations including the latest one issued on May 9, 2025, Leachate Detection Procedures, and the additional requirements as stated in the Modification 3 Assessment Report (December 2024).

As a dynamic document, this Management Plan will be subject to further revisions should any additional EPL variations or other regulatory changes be enacted. We are committed to maintaining its accuracy and ensuring it consistently reflects the most current environmental requirements.

1.9. Consultation

In accordance with schedule 3, condition 31 of the Infrastructure Approval and revised environmental management measure (REMM) WM01, the WMP (which includes this SWMP) is to be prepared in consultation with;

- NSW Environment Protection Agency (NSW EPA);
- National Parks and Wildlife Services (NPWS);

- Department of Climate Change, Energy, The Environment and Water (DCCEEW);
- Department of Planning, Housing and Infrastructure (DPHI);
- Department of Planning Industry and Environment– Water (Water Group);
- Natural Resources Access Regulator (NRAR); and
- NSW Department of Primary Industries (NSW DPI).

Table 1-4: Consultation Timeline

Date	Consultation	Outcomes
30/04/2020	NSW EPA, NPWS, DPHI Fisheries, CPHR, Water Group	Agency briefing (online PowerPoint) providing overview of document structure and surface water management approach.
07/05/2020	NSW EPA, NPWS, CPHR, Water Group	Agency briefing (online PowerPoint) providing overview of the development of the surface water monitoring program and groundwater monitoring program.
15/06/2020	NPWS, NSW EPA, Water Group, NRAR, DPHI	WMP (revision C) issued to stakeholders for review and comment
26/06/2020	DCCEEW	WMP (revision D) issued to DAWE for review and comment
08/07/2020	DCCEEW	Agency briefing (online PowerPoint) providing overview of document structure and water management approach.
24/08/2020	DCCEEW	Further rationale for adjustment to surface water monitoring locations, details of bushfire impact on water quality and general clarifications.
09/09/2020	NSW EPA	Amendment to surface water monitoring program, specifically in relation to discharge outlet verification monitoring.
11/11/2024	NPWS, NSW EPA, Water Group, NRAR, DPHI	Updates to include Modification 3 works

1.9.1. Ongoing Consultation

FGJV will consult with stakeholders identified in schedule 3, condition 31 of the Infrastructure Approval for updates to this SWMP. A separate document was provided to DPHI and DCCEEW detailing the consultation process, along with FGJV responses to stakeholder comments and how feedback has been implemented during the action.

Where additional monitoring infrastructure is proposed outside the construction envelope, FGJV will review environmental constraints and consult with relevant stakeholders.

2. ENVIRONMENTAL REQUIREMENTS

2.1. Legislation and Guidelines

Legislation relevant to water management includes:

- Environmental Planning and Assessment Act 1979 (EP&A Act);
- Environmental Planning and Assessment Regulation 2000 (EP&A Regulation);
- Protection of the Environment Operations Act 1997 (POEO Act);
- Protection of the Environment (General) Regulation 2009 (POEO General Regulation);
- Water Management Act 2000 (WM Act);
- Water Management Amendment Act 2014 (WMA Act);
- Water Management (General) Regulation 2018 (WM General Regulation);
- Fisheries Management Act 1994; and
- Snowy Hydro Corporatisation Act 1997 (SHC Act).

Relevant provisions of the above legislation are explained in the register of legal and other requirements included in Appendix A1 of the EMS.

The main guidelines, specifications and policy documents relevant to this Plan include:

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018);
- Australian Rainfall and Runoff (Commonwealth of Australia, 2016);
- Managing Urban Stormwater: Soils and Construction – Volume 2C – Unsealed roads (DECCW 2008a);
- Managing Urban Stormwater: Soils and Construction – Volume 2D – Main road construction (DECCW 2008).
- Managing Urban Stormwater: Soils and Construction - Volume 2E Mines and quarries (DECCW 2008);
- Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings. NSW Fisheries, Cronulla, 16 pp; Fairfull, S. and Witheridge, G. (2003)
- Department of Primary Industries Guidelines for Controlled Activities on Waterfront Land (2012);
- NSW Office of Water Guidelines for working within riparian corridors;
- Approved Methods for the Sampling and Analysis of Water Pollutants in NSW – March 2004.
- Environmental Best Management Practice Guideline for Concreting Contractors, DEC, 2004;
- NSW Floodplain Development Manual (2005);
- Guidelines for Treatment of Stormwater Runoff from the Road Infrastructure (AP- R232) (Austroads, 2003);
- Australian Standard: AS1940 - 2017, The Storage and Handling of Flammable and Combustible Liquids (Standards Australia, 2017);
- Australian and New Zealand Standard: ASNZS 4452 – 1997, The storage and handling of toxic substances (Joint Standard Australia/Standard New Zealand Committee, 1997);
- NSW Environment Protection Authority's Requirements for publishing pollution monitoring data (EPA 2013).

- NSW Water Quality and River Flow Objectives (DECCW 2006)
- Liquid Chemical Storage, Handling and Spill Management: Review of Best Practice Regulation (DEC 2005); and
- Storing and Handling Liquids: Environmental Protection: Participant's Manual (DEC 2007).

2.2. Conditions of Approval

Table 2-1: details the CoA that are relevant to surface water management and demonstrates where these conditions are addressed. For a detailed list of CoA relevant to water, refer to Water Management Plan.

Table 2-1: Water Relevant Conditions of Approval

Condition	Requirement	Where addressed
SCHEDULE 3		
Spoil Management – Spoil Management Requirements		
Schedule 3, Condition 4 (h)	The Proponent must: (h) minimise the water quality impacts of the temporary and permanent emplacement areas.	Spoil Management Plan Project Leachate Detection Procedures SWMP
Spoil Management – Design Objectives for Permanent Spoil Emplacement Areas		
Schedule 3, Condition 6	The Proponent must ensure the permanent spoil emplacement areas comply with the design objectives in Table 2. Water Management: • Integrate the drainage of the emplacement area with the surrounding drainage network, including any upstream flows and residual run-on water • Minimise downstream water flows and velocities with any changes to be quantified and addressed through suitable design • Minimise valley infill • Create natural drainage lines that are long-term sustainable having regard to the selection of suitable underlying materials, including rock sizing and grading • Minimise the concentration of water on landforms unless this is consistent with accepted drainage density and geomorphic design practices • Minimise the generation and dispersion of sediment in the Talbingo Reservoir, Tantangara Reservoir or other waterways	Spoil Management Plan Project Leachate Detection Procedures SWMP
Flora and Fauna - Potential Additional Offsets - Alpine Sphagnum Bogs and Associated Fens		
Flora and Fauna - Biodiversity Management Requirements		
Schedule 3, Condition 17 (j)	The Proponent must: (j) minimise the generation and dispersion of sediment to watercourses, particularly Yarrangobilly River and Wallace Creek.	ERSED Procedure SWMP
Water – Water Supply		
Schedule 3, Condition 28	The Proponent must ensure it has sufficient water for each stage of the development; and if necessary, adjust the scale of development on site to match its available water supply.	WMP SWMP GMP
Water – Water Pollution		
Schedule 3, Condition 29	Unless an environment protection licence authorises otherwise, the Proponent must comply with Section 120 of the POEO Act.	SWMP GMP

Condition	Requirement	Where addressed
Water – Water Management Requirements		
Schedule 3, Condition 30	The Proponent must:	
	(a) maximise the recycling and reuse of water on site;	SWMP
	(b) maximise the diversion of clean water runoff around the disturbance areas;	SWMP
	(c) minimise the flow rates and velocities of any clean water runoff diversions to adjoining watercourses;	SWMP
	(d) minimise the flooding impacts of the development;	SWMP Natural Hazard Management Plan Spoil Management Plan
	(f) minimise erosion and the generation and dispersion of sediment using suitable controls in accordance with the relevant requirements in the <i>Managing Urban Stormwater: Soils and Construction</i> guidance series;	SWMP
	(g) design all instream works, particularly the inlet and outlet works, to minimise scour and erosion;	SWMP
	(h) unless permitted by this approval, avoid carrying out of any development within 40 metres of any watercourse;	SWMP
	(i) carry out all instream works or development within 40 metres of any watercourse generally in accordance with the requirements in the <i>Guidelines for Controlled Activities on Waterfront Land</i> ;	SWMP
	(j) treat all wastewater and surplus process water prior to discharging it at the approved discharge points at the Talbingo Reservoir or Tantangara Reservoir;	SWMP
	(k) reduce the number of diffuser points for low velocity discharges to the Talbingo Reservoir or Tantangara Reservoir;	SWMP
	(l) not discharge any surplus process water to the stormwater basins on site;	SWMP
	(m) minimise the surface water quality impacts associated with the development, including: - the development carried out in the vicinity of waterways, particularly in the Talbingo Reservoir, Tantangara Reservoir and Yarrangobilly River; - all instream works, including dredging, channel excavations, underwater blasting, barge infrastructure, fish barriers and screens, culverts and bridges, and service crossings; - the temporary and permanent spoil emplacement areas; - development at the Marica, Plateau and Rock Forest sites; - road works; - the operation of the power station and associated infrastructure, including the operation of the inlets and outlet to minimise sediment disturbance risks and the dewatering of the tailrace tunnel.	SWMP Dredging Management Plan Project Leachate Detection Procedures
	(n) minimise the risk of spills or leaks on site, and clean up any spills or leaks as quickly as possible;	SWMP Spill Response Procedure
	(p) store chemicals and hydrocarbon products in bunded areas in accordance with the relevant Australian Standards.	SWMP Spill Response Procedure
Water - Water Management Plan		
Schedule 3, Condition 31	Prior to the commencement of construction, the Proponent must prepare a Water Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:	WMP

Condition	Requirement	Where addressed
	(a) be prepared by a suitably qualified and experienced person in consultation with the EPA, NPWS, the Water Group, NRAR and NSW DPI;	
	(c) include a Surface Water Management Plan, containing detailed plans for the Talbingo Reservoir, Lobs Hole, Marica, Plateau, Tantangara Reservoir, and Rock Forest sites with: • detailed baseline data on surface water flows and quality in the watercourses that could be affected by the development, and a program to augment this baseline data over time; • detailed criteria for determining the surface water impacts of the development (flows, quality and flooding), including criteria for triggering remedial action (if necessary); • description of the measures that would be implemented to minimise the surface water impacts of the development and comply with the relevant water management requirements in conditions 4,6 and 30 above, including specific plans covering: – the temporary or permanent emplacement of spoil; – dredging, channel extraction and underwater blasting in the Talbingo Reservoir and Tantangara Reservoir – operation of the discharge points – the design of the inlets and outlets; and – dewatering of the tailrace tunnel during operations; • identify the key risks to the successful implementation of these measures, and describe the contingency measures that would be implemented to address these risks; • a program to monitor and publicly report on the surface water impacts of the development.	SWMP
Schedule 3, Condition 38	The Proponent must implement the approved Water Management Plan for the development.	SWMP.
Subsistence - Performance Measures – Natural and Heritage Features		
Schedule 3, Condition 63	The Proponent must ensure that any project related subsidence impacts do not cause greater than negligible environmental consequences on the National Park Estate, including but not limited to water, biodiversity and heritage values.	SHL issued document.

2.3. Revised Environmental Management Measures

During preparation of the Main Works Submissions Report, Revised Environmental Management Measures (REMMs) were developed and are included in Appendix C of the Main Works RTS.

The Main Works REMMs relevant to surface water are listed in Table 2-2.

Table 2-2: Main Works REMMS relevant to surface water management

Impact	Reference	Revised Environmental Management Measures	Where addressed
General	WM01	A Water Management Plan will be developed for Snowy 2.0 Main Works that includes:	
		proposed mitigation and management measures for all construction water management categories;	SWMP – Table 5-3 (All measures) GMP – Table 5-1 (All measures)
		spill management and response;	SWMP – Annexure C (Spill Response Procedure)
		a surface and groundwater monitoring program;	SWMP – Annexure A GMP – Annexure A
		water quality trigger action response plan;	SWMP – Section 6.4, Annexure B (TARPs) GMP – Section 7, Annexure B, Annexure C, Annexure D
		reporting requirements;	WMP – Section 6.6 SWMP – Section 6.7 GMP – Section 6.8
		corrective actions;	SWMP – Section 6 GMP – Section 7
		contingencies; and	SWMP – Section 5.4.1, Section 5.13 and Section 6.4 GMP – Table 5-1: GW13
		responsibilities for all management measures.	SWMP – Section 5.12, Table 5-3, Section 6.1 GMP – Table 5-1: GW13
		The WMP will be prepared in consultation with DPHI, EPA, WaterNSW and key local stakeholders, and would consider concerns raised during the exhibition and approvals process for the project.	WMP – Section 1.9
General	WM02	A water monitoring program will be developed as part of the water management plan to monitor quality and quantity impacts to surface water, groundwater and reservoirs. The water monitoring program will incorporate and update the existing monitoring network and detail monitoring frequencies and water quality constituents.	SWMP - Annexure A GMP – Annexure A
Water quality impacts from stormwater runoff	WM03	Where practical, clean water will be diverted around or through construction areas. Runoff from clean water areas that cannot be diverted will be accounted for in the design of water management systems.	SWMP – Section 5.2, Table 5-3: SW07
Water quality impacts from stormwater runoff	WM04	An Erosion and Sediment Control Plan (ESCP) will be prepared for each construction area that will include relevant information presented in the water management report.	SWMP – Section 5.2, Table 5-3: SW04

Impact	Reference	Revised Environmental Management Measures	Where addressed
Water quality impacts from stormwater runoff	WM05	A suitably qualified erosion and sediment control professional(s) will be engaged to: - oversee the development of ESCPs; - inspect and audit controls; - train relevant staff; and - provide advice regarding erosion and sediment control	SWMP – Section 5.2, Table 5-3: SW05
Water supply	WM08	A water supply system will be established to supply water for potable water use and construction activities. The system will most likely source water from regional groundwater resources, but may also source water from either Tantangara or Talbingo Reservoirs provided licences are available. Extraction from watercourses will be avoided where practicable. The most suitable extraction locations and water sources will be established during detailed design	WMP – Section 2.5.3, Section 5
Reservoir water quality (wastewater management)	WM09	A wastewater management system will be established to manage effluent from construction compounds and accommodation camps. All wastewater will be treated to meet the water quality specifications provided in the water management report and will be discharged to reservoirs. Wastewater discharges to watercourses will be avoided.	SWMP - Section 5.4.2, Table 5-3: SW30
Reservoir water quality (process water management)	WM10	A process water management system will be established to manage water during construction; and to supply water to construction activities. All surplus process water will be treated to meet the water quality specifications provided in the water management report and will be discharged to reservoirs. Process water discharges to watercourses will be avoided.	SWMP - Section 5.4.1, Table 5-3: SW22
Changes to reservoir water quality due to plug removal within the reservoirs	WM11	The specifications and locations of the proposed environmental measures will be determined as part of detailed design, including the installation of silt curtains. They will be designed such that water quality criteria is agreed with the regulators, with the application of a mixing zone if required.	SWMP - Section 0, Table 5-3: SW66
Reservoir bed sediments are disturbed by commissioning water flows	WM12	Investigations to minimise the disturbance of bed sediments due to water flows during commissioning will be undertaken as part of detailed design. Potential measures to minimise the disturbance of bed sediments include: - investigate mitigated design measures; - dredging sediments from the potential disturbance zones and placing them in another part of the reservoir; and/or - armouring the sediments in the potential disturbance zones. These options are currently being assessed.	SWMP - Section 0, Table 5-3: SW67
Flooding	WM13	Further consideration of flooding conditions and impacts, including flood modelling where necessary, will be undertaken to support future detailed design of both temporary and permanent works.	SWMP - Section 5.3, Table 5-3: SW18
Flooding	WM14	Flood emergency response plans will be developed for both construction and operational phases	Natural Hazard Management Plan (S2-FGJV-ENV-PLN-0090)

Impact	Reference	Revised Measures	Environmental Management	Where addressed
Impacts to aquatic habitats	AE02	Bridges or culverts would be designed and constructed in accordance with NSW DPI fish passage requirements for waterway crossings (Fairfull & Witheridge 2003) where practicable.		Aquatic Habitat Management Plan (S2-FGJV-PLN-009)
Impacts to aquatic habitats	AE03	Construction works within the channel of a permanent waterway with type 1 or 2 key fish habitat would allow some flow to maintain fish passage at all times and be staged to minimise the total disturbance at any given time.		Aquatic Habitat Management Plan (S2-FGJV-PLN-009)
Soil erosion and sedimentation	SOIL03	Site-based Erosion and Sediment Control Plans (ESCPs) will be prepared or reviewed by a Certified Professional in Erosion and Sediment Control (CPESC) for the construction works.		SWMP – Section 5.2, Table 5-3: SW04

2.4. EPBC Approval

The EPBC Act approval for Snowy 2.0 Main Works was granted by DCCEE in 2020. This approval was provided for the impact of the Snowy 2.0 Main Works Project on national heritage values of a national heritage place (Sections 15B and 15C of the EPBC Act), listed threatened species and communities (Section 18, Section 18A of the EPBC Act) and listed migratory species (Section 20, Section 20A of the EPBC Act).

Table 2-3 details the EPBC Act Approval conditions which are relevant to water and demonstrates where these conditions are addressed.

Table 2-3: Commonwealth Conditions of Approval

Condition	Requirement	Where addressed
17	To minimise impacts on water resources, the approval holder must comply with conditions 30 – 32 of the NSW approval relating to water management	Refer to Table 2-1
18	The approval holder must prepare the Water Management Plan required by condition 31 of the NSW approval in consultation with the Department, before it is approved by the NSW Planning Secretary	Section 1.7
19	The Water Management Plan must include provisions to make monitoring data (excluding sensitive ecological data) available as part of the monitoring, evaluation and reporting programs required by condition 31c and 31d of the NSW approval	SWMP – Annexure A SWMP – Section 6.7
20	Once the Water Management Plan is approved by the NSW Planning Secretary, the approval holder must implement the plan for the duration of the approval, unless otherwise agreed by the Minister in writing.	This SWMP will be implemented for the development Refer to Section 6.

2.5. Licences and Permits

2.5.1. Environment Protection Licence

Environment Protection Licence (EPL) (No 21266) was issued as part of the Exploratory Works phase for extractive activities.

The premises boundary for the Exploratory Works EPL was expanded to encompass both Exploratory Works and Main Works activities and the governing schedule activity for Main Works was updated to Electricity Generation.

At times, the surface water monitoring requirements of the EPL may differ to that detailed within this plan, particularly in the event of variations to the EPL. Differences may include changes to the monitoring locations; changes to the frequency of monitoring; or changes to the parameters which are required to be monitored.

Should differences arise, the monitoring requirements of the EPL will take precedence. This will occur until such time that the revised SWMP is updated and approved.

EPL 21266 has been varied on a number of occasions since being issued by the EPA. A summary of EPL variations is provided below:

- March 2020: variation of EPL monitoring locations and location descriptions and removal of requested analytes;
- April 2020: variation of EPL monitoring locations and change to sampling requirements;
- October 2020: variation to reflect the commencement of Main Works, including change to the premises boundary, primary fee-based scheduled activity, ancillary activities, scheduled development works and a range of administrative, limit, monitoring, reporting and special conditions;
- November 2020: removal of groundwater monitoring bore EPL 3 and amendment of the frequency of groundwater monitoring from monthly to quarterly;
- December 2020: variation to EPL surface water monitoring locations and amended to include approved scheduled development works;
- April 2021: variation to allow the discharge of treated effluent from the Lobs Hole sewage treatment plant and process water treatment plant, following EPA review of the treated effluent reuse risk assessment and Mixing Zone Verification Program; and
- August 2021: variation to move the diffuser location (discharge point 42) to avoid removal of trees, aquatic habitat and minimise reservoir disturbance.
- January 2022: variation to increase discharge volume limit at point 43 from 1.66 ML/day to 4.32 ML/day and to include a discharge flow rate limit of 50 L/s, and the inclusion of a correlation assessment in order to monitor faecal coliforms.
- February 2022: inclusion of a The EPA considers it appropriate to capture a Pollution Reduction Program (PRP) to facilitate improved water and contaminant management at the MAT spoil stockpile area.
- 13 May 2022: variation to allow for the discharge of treated sewerage and processed water at Tantangara with additional new water discharge and monitoring points within the Tantangara Reservoir.
- 31 May 2022: variation to remove the PRP following project commitments.
- July 2022: approval of updated Spoil Management Plan and inclusion of O5.1 – O5.8 operational conditions relating to spoil characterisation, treatment, emplacement, leachate management and contingencies.
- October 2022: Variation to scheduled development works, updated surface and groundwater water monitoring points, updated sampling methodology for select locations, inclusion of the Diffuse Source Water Pollution Management PRP and the addition of the Generator Emission Improvements Program.
- June 2023: Variation to include updated monitoring locations, include Spoil Contingency Plan details, updated Environmental Monitoring Report requirements, updated Quarterly Spoil Monitoring Report requirements and updates to both the Diffuse Source Water Pollution Management and Generator Emissions Improvement Plan.

- March 2024: Variation to include updated monitoring locations and analytical requirements, volume monitoring requirements, the removal of the Diffuse Source Water Pollution Management and the Generator Emissions Improvement Plan, addition of Process Water Treatment Plant Pollution Study, addition of lining and capping of Ravine Bay and Tantangara Permanent Spoil Emplacement Areas.
- December 2024: Variation to include reference to works associated with the Marica Adit and the spoil emplacement areas Ravine Bay and Rock Forest, update the location description for all monitoring points and inclusion of additional monitoring points, the revision of 90 percentile limit for biological oxygen demand from 1mg/L to 2mg/L as 1mg/L is below the limit of detection, amend the sampling method for several pollutants from grab sample to in-situ due to limitations in the transportation of samples, addition of conditions relating to the development of and compliance with a Nitrogen Management Plan.
- July 2025: Variation to include updated monitoring locations and analytical requirements, volume monitoring requirements, addition of Pollution Studies and Reduction Programs, addition of lining and capping of Rock Forest Permanent Spoil Emplacement Area.

2.5.2. Agreement for Lease

SHL have established an Agreement for Lease (AFL) with NPWS. A Construction Lease and Works Access Licence will be established with NPWS in order to carry the works in accordance with Main Works, Exploratory Works, CSSI 9687 and the approved management plans.

2.5.3. Water Access Licence

Section 60A of the Water Management Act 2000 requires that a water access licence be obtained to extract water from a water source.

Water required for construction purposes that require a water access licence includes the Project activities below:

- Interception activities (i.e. intercepted groundwater during tunnelling);
- Potable uses for human consumption associated with the accommodation camp; and
- Process water via the services pipeline from Talbingo and Tantangara Reservoirs for tunnelling and construction activities.

SHL secured two groundwater access licences (WAL42408, WAL42960) and a surface water specific purpose access licences (WAL42407) during the Exploratory Works Project. These three licences allow for direct and indirect take of water from the Lachlan Fold Belt (LFB) Murray Darling Basin (MDB) Groundwater Source and direct take from the Upper Tumut water source (i.e. from Talbingo Reservoir).

SHL have secured groundwater licences via Controlled Allocation Order for additional share entitlement from the LFB MDB groundwater source (RO13-19-093), the LFB South Coast groundwater source (RO13-19-192) and a surface water specific purpose access licence (to take water from Tantangara Reservoir) for the Main Works Project. The additional allocation covers the peak predicted annual take modelled for both Main Works and Exploratory Works.

These Water Access Licences were processed by the Natural Resources Access Regulator (NRAR) and registered with NSW Land Registry Services (LRS). Actual take will be reported to NRAR on an annual basis in accordance with licence conditions.

Modification 3 includes the requirement to install an additional potable water bore at Marica Site, to accommodate the increased user demands. Appendix C of the Modification Submission Report 3 further identifies the requirement for SHL to seek an additional 41 megalitres per year of entitlements to account for the anticipated groundwater ingress during tunnelling works. These are expected to be obtained through trading schemes.

Table 2-4: Water Access Licences

Water Access Licence	Project	Water source	Share (ML)
WAL42407– Specific Purpose Access Licence	Exploratory Works	Upper Tumut water source	227 per year
WAL42408 – Groundwater Licence	Exploratory Works	Lachlan Fold Belt MDB	0
WAL42960 – Groundwater Licence	Exploratory Works	Lachlan Fold Belt MDB	354 per year
WAL43328 – Groundwater Licence	Main Works	Lachlan Fold Belt MDB	3,375
WAL43329 – Groundwater Licence	Main Works	Lachlan Fold Belt South Coast	1,722
WAL43544 - Specific Purpose Access Licence	Main Works	Tantangara Water Source	532 per year

3. EXISTING ENVIRONMENT

3.1. Bushfire

In January 2020, during the Main Works EIS application, significant bushfires occurred within the Project area and northern section of Kosciuszko National Park. The project site at Lobs Hole was severely impacted with much of the groundcover and trees burned, leaving the catchment area with bare soil and no ground protection. Other parts of the Main Works project area including the Plateau, Marica and Tantangara were also impacted by the bushfire to varying degrees.

The bushfires have led to a reduction in ground cover and increase in burnt ash material within and adjacent to the construction envelope. For some time, the existing pre-fire baseline water data that has been gathered and discussed in Annexure A (Surface Water Monitoring Program) will differ to the post-fire water quality. As such, management measures in this Plan have been developed to ensure that any adverse impacts can be adaptively managed throughout the bushfire recovery period.

3.2. Topography and Landscape

The Snowy 2.0 Project is mostly located within the Kosciuszko National Park (KNP) and spans the NSW Western Slopes, Southeastern Highlands and Australian Alps Interim Biogeographic Regionalisation for Australia (IBRA) regions. The geomorphic history of the project area is complex and has resulted in a landscape of disrupted drainage patterns, swampy basins and erosion surfaces (Snowy Hydro 2017). This complexity is seen in the diverse landforms present in the area, ranging from valleys to mountain ranges. For the most part, the project area can be broken into two distinctive terrains the incised ravine area and the plateau area.

The Ravine area; located mostly to the west of the Snowy Mountains Highway, is characterised by deep gorges and steep sloping ridges, the product of incision from river flow, historic glaciation and structural movement. The ravine area includes the Talbingo, Lobs Hole and Marica work zones.

The Plateau area; located to the east of the Snowy Mountains Highway and spanning the area between the highway and Tantangara Reservoir, is typical of elevated alpine environments, dominated by low energy streams, gentle rolling hills and mostly flat floodplains. The plateau area includes the Marica and Tantangara work zones.

The Rock Forest work zone is located on agricultural land to the south east and is outside of KNP.

3.3. Geology

The project area is located within the south-eastern portion of the Lachlan Fold Belt (LFB) of NSW. The LFB comprises a suite of Ordovician to Devonian sedimentary, igneous and metamorphic rocks that have developed during multiple orogenic periods.

The geology between Talbingo and Tantangara reservoirs is structurally deformed with numerous folds and several major faults associated with the north-south trending Long Plain Fault (LPF) zone. The terrains are separated by an escarpment caused by movement on the LPF zone.

There are eight karst areas in KNP, all of which are developed in Silurian or Devonian limestones. These include Yarrangobilly Caves, a known groundwater dependent ecosystem (GDE) and karst area, and Coolemans Plain karst area; both are recognised in the KNP Plan of Management (DEC 2014) for their cultural and natural significance. This complex geology, in association with topography, has resulted in a diverse soil landscape. Soils vary significantly in relation to altitude, temperature and rainfall.

Rock Forest is characterised as Silurian and Ordovician geology and is within the Lachlan Fold Belt.

3.4. Climate

The project area has an alpine climate that is characterised by cool summers and cold, damp, and snowy winters. The highest and most consistent precipitation occurs in winter to early spring, with precipitation amounts increasing with elevation. Summer and autumn are generally drier and experience greater variation in monthly rainfall. Summer rainfall is generally of higher intensity and of shorter duration than in winter. Climate data for the project area has been sourced from regional Bureau of Meteorology (BoM) and SHL rainfall gauges, as well as climate maps produced by BoM. A summary of climate data for the ravine and plateau areas is provided in Table 3-1. Precipitation comprises rainfall and snowfall, however, the term rainfall has been used throughout the water assessment to maintain consistency with other sections of the Main Works EIS.

Table 3-1: Climate Summary

Parameter	Ravine area	Plateau area
Temperature¹		
Mean annual maximum	21.3 C	12.6 C
Mean annual minimum	9.1 C	5.1 C
Annual rainfall²		
Highest	1315 mm/year	1,902 mm/year
Median	878 mm/year	1,158 mm/year
Lowest	382 mm/year	525 mm/year
Mean Class A pan evaporation³		
Annual	1,256 mm/year	
Lowest monthly	27 mm/month	
Highest monthly	206 mm/month	

1. Representative temperature for the ravine and plateau have been sourced from SHL operated Talbingo gauge and BoM operated Cabramurra SMHEA AWS (72161) gauge.

2. Representative rainfall for the ravine and plateau areas have been sourced from SHL operated Ravine gauge and BoM operated Yarrangobilly Caves (72141) gauge.

3. Representative pan evaporation sourced from Climate Atlas maps (BoM website).

3.5. Rainfall

The 10th, 50th and 90th percentile monthly rainfall have been calculated by BoM from the Yarrangobilly Caves (72142) gauge records and are presented in Figure 3-1. Mean monthly pan evaporation sourced from the BoM website are also shown in Figure 3-1. The trends shown indicate that a soil moisture deficit is likely to occur from December to March, when monthly evaporation exceeds the 90th percentile rainfall.

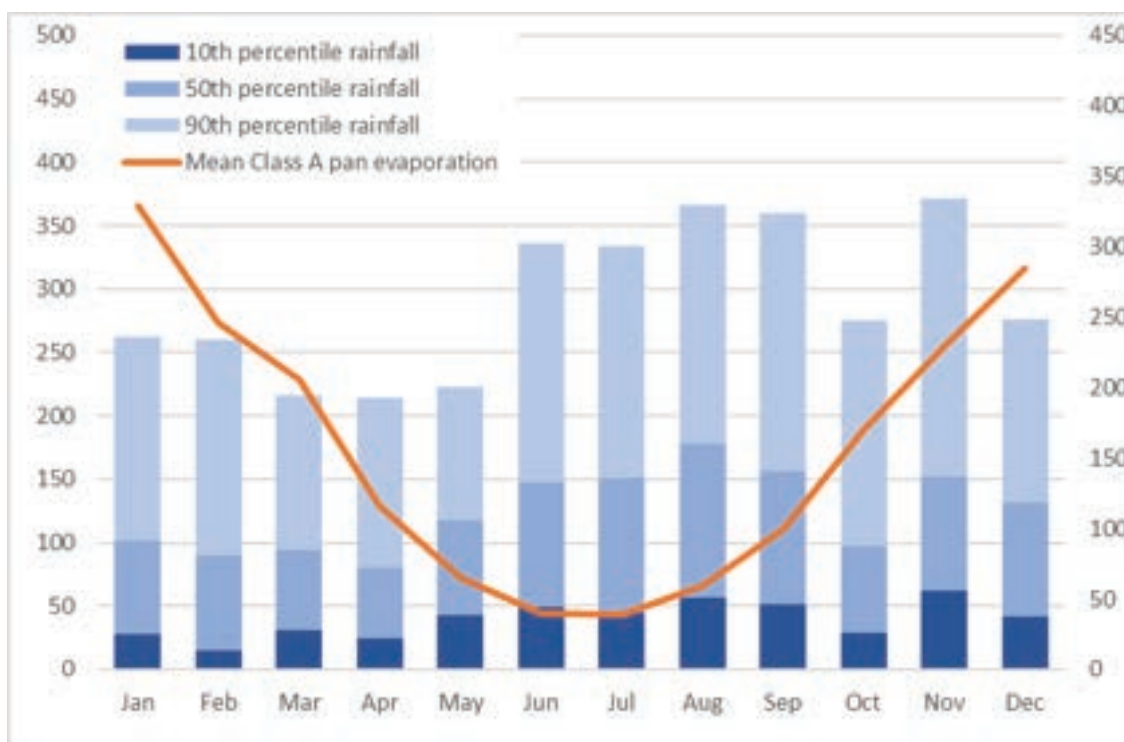


Figure 3-1: Monthly rainfall variability (BoM: 72141) and mean monthly pan evaporation

Monthly rainfall totals recorded at Yarrangobilly Caves (BoM station 72141) from 2002 to November 2022 are shown in Figure 3-2. The deviation of rainfall totals over the previous 12-month period have been calculated and compared to annualised monthly average rainfall to identify and characterise periods of extended dry and wet conditions. A positive value relates to wetter than average conditions while a negative value relates to drier than average conditions. These deficits and excess in rainfall can also correspond to long-term groundwater level and streamflow trends. The trends in Figure 3-2 indicate that:

- Below average rainfall occurred between mid-2002 to late 2003, mid-2004 to early 2005, mid-2006 to late 2010, early 2013 to mid-2016 and mid-2017 to mid-2019. The most significant below average rainfall conditions occurred between mid-2006 and late 2010.
- Above average rainfall occurred between April 2005 to May 2006, late 2010 to early 2013, mid-2016 to mid-2017, and 2020 to 2022.
- Above average rainfall has also been experienced in late 2021 and throughout 2022.

It is noted that data collected for the EIS during 2018 and early 2019 were collected during drier than average conditions.

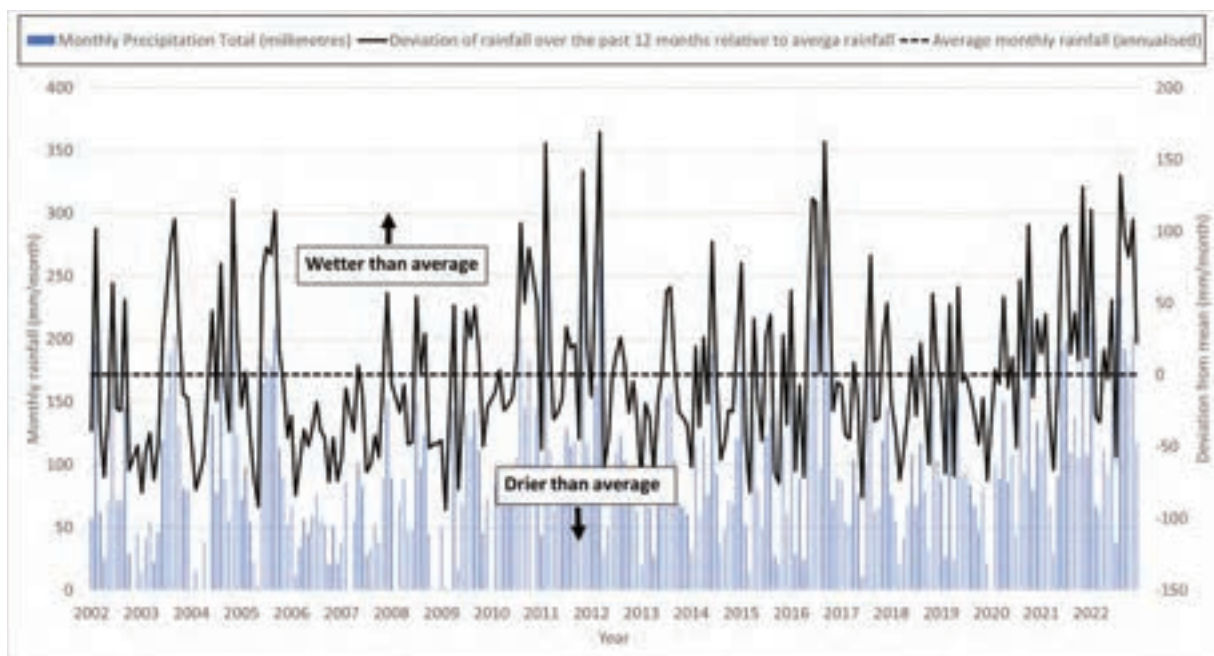


Figure 3-2: Yarrangobilly Caves (BoM: 72141) Rainfall – 2002 to 2022

3.5.1. La Nina

La Nina is a weather event that causes greater than average rainfalls through Spring and Summer. This has been experienced in NSW after the bushfires in 2020 and on into 2021 with the Bureau of Meteorology (BOM) recording the 5th highest annual rainfall on record for 2021 (records began in 1900). La Nina is also predicted for 2022. In 2021 the Project experienced approximately 1287 mm of rainfall.

The prediction of a La Nina weather event does not change the Project's approach to surface water management on the Snowy 2.0 Project. The principles and management measures described in the Surface Water Management Plan remain applicable to La Nina periods, including but not limited to minimising the extent and duration of disturbance, segregating clean and dirty water, controlled stormwater flows, minimising soil erosion and maximising sediments retention. During La Nina events, additional controls will be deployed where practicable safe to do so.

Erosion and sediment controls including sediment basins will be sized at a minimum with a design rainfall depth of 85th percentile 5-day rainfall event, with consideration given to increasing basin size at locations where sufficient space is available and / or topography does not constrain the basin size.

3.6. Soils

3.6.1. The Plateau

Climate in these alpine and subalpine areas has a dominant role in soil formation leading to the development of one soil group, the Alpine Humus Soil, across all parent geological materials (e.g. volcanic, sediment and metamorphic) (NPWS 2004). Kandosols are the most common soil type from the site data, forming on a range of geologies. Rudosols/Tenosols are the second most common soil type and are most likely to be Alpine Humus Soils with high organic or peaty layers in the profile. Dermosols (on a range of geologies) and Chromosols (on granites and sediments) were also relatively common. Other soil types include Ferrosols (on basic igneous geologies), Hydrosols, and Organosols (in drainage depressions or alluvial areas).

The plateau soils are likely to have high organic matter content and are generally moderately to strongly acidic likely reflecting a highly leached environment. Soils are not likely to be sodic or magnesian. Topsoil erodibility is likely to be low to moderate depending on the organic matter content. The subsoils are generally non-dispersible ranging from loams to clays. Some subsoils are likely to have relatively low coherence particularly for lighter textures (i.e. loams) or coarser sandy soils.

The erosion hazard of the soils in this area is moderate to very high with the affects of cold climate, shallow soils, highly organic soils and steep slopes increasing the erosion hazard of the soils.

Alpine and subalpine soils with very high organic layers such as the Alpine Humus Soils (most commonly Tenosols) and bog and fen peats (usually Organosols) are fragile soils that are difficult to return to their natural state once disturbed. They are fragile due in part to the restricted growing season of the alpine and subalpine regions, but also due to the very fragile nature of some systems, particularly alpine snowpatch vegetation and the Alpine Sphagnum Bogs and Associated Fens ecological community.

3.6.2. Ravine Area

Ravine soils are generally sandy or silty clay loams that are neutral to strongly acid depending on the parent material. Depending on depth, the soils are generally either Kandosols or Rudosols/Tenosols. Occasionally the lithology of these sediments may result in different soils (e.g. Dermosols or Ferrosols in limestone or more clay rich layers).

There are relatively minor areas of clayey alluvium of Dermosols and Vertosols associated with the Yarrangobilly River. There are also deeper Kandosol and Ferrosol soils on more gently sloping basic and intermediate volcanics towards the top of Ravine Road.

The topsoils generally have moderate to low erodibility with moderate to high organic matter contents. The subsoils are loams to light clays and have a moderate erodibility and range from non-dispersible to showing some dispersion following remoulding. The majority of the soils have only weak structure, low coherence, and moderate to very high class of erosion hazard due to the steep long slopes and shallow soils of the ravine.

The soils analysed from the Exploratory Works soil survey (EMM 2018b) did not contain any samples that were sodic or magnesian. The NSW Office of Environment and Heritage site data noted one dispersive soil (Sodosol - Yarrangobilly survey site 81), 2.3 km to the north-west of the footprint on rhyolite in a drainage depression. There are seven other sites in the same geology which are Tenosols or Kandosols. Based on the landforms of the project footprint with this geology, Sodosols may occur.

3.6.3. Rock Forest

Rock Forest is located on the lower to mid-slopes of gently undulating to undulating rises of sandstone. The soils are likely to be Kandosols and Dermosols that have moderately deep gradational profiles of clay loam over light clays.

The topsoils generally have moderate to low erodibility with possible highly organic layers. The subsoils have a moderate erodibility. The Kandosols have massive to weak structure throughout and are likely to have low coherence. The Dermosols do not have low coherence in the subsoil and are likely to be slightly less erodible due to their better structure. The soils are moderately to strongly acidic likely to reflect a highly leached environment. Soils are not likely to be sodic or magnesian.

The erosion hazard is moderate to high due to the climatic conditions of the area (snow and limited growing season), the possible highly organic topsoils, low coherence of Kandosols, and the gently undulating to undulating slopes.

3.7. Reservoirs

3.7.1. Tantangara Reservoir

Tantangara Reservoir is an existing reservoir that forms part of the Snowy Scheme and construction of the dam was completed in 1960. The reservoir is approximately 14 km long and has a surface area of approximately 21.2 km² (at full supply level).

The reservoir captures runoff from the head waters of the Murrumbidgee River and flows diverted from Goodradigbee River via the Goodradigbee aqueduct. Water is transferred to Lake Eucumbene via the Murrumbidgee to Eucumbene tunnel. Tantangara Reservoir also provides environmental releases to the Murrumbidgee River.

A summary of key operating levels, storage volumes, tunnel discharge capacities and flood peak water levels are provided in Table 3-2.

Table 3-2: Tantangara Reservoir

Characteristic	Value
Full supply level (FSL)	1,228.7 m AHD
Minimum operating level (MOL)	1,205.8 m AHD
Operating range (FSL-MOL)	22.9 m
Spillway crest	1,228.7 m AHD
Active storage (within operating range)	240 GL
Gross storage	254 GL
Murrumbidgee – Eucumbene tunnel peak discharge	22 m ³ /s
Murrumbidgee – environmental release	Annual targets range from 0 to 40 GL/year, with a long-term average of 20 GL/year.
Peak water level – 2% AEP	1,230.1 m AHD
Peak water level – 1% AEP	1,230.3 m AHD
Peak water level – PMF	1,236.3 m AHD

3.7.2. Talbingo Reservoir

Talbingo Reservoir is an existing reservoir on the Tumut River that forms part of the Snowy Scheme. Construction of Talbingo Reservoir was completed in 1971. The reservoir is approximately 25 km long and has a surface area of approximately 19.4 km² (at spillway crest).

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

A summary of key operating levels, storage volumes, tunnel discharge capacities and flood peak water levels are provided in Table 3-3.

Table 3-3: Talbingo Reservoir

Characteristic	Value
Full supply level (FSL)	543.2 m AHD
Minimum operating level (MOL)	534.4 m AHD
Operating range (FSL-MOL)	8.8 m
Spillway crest	544.7 m AHD
Active storage (within operating range)	239 GL
Gross storage	921 GL
Tumut 3 discharge (maximum)	1,133 m ³ /s
Tumut 3 pump back rate (maximum)	300 m ³ /s
Peak water level – 2% AEP	545.8 m AHD
Peak water level – 1% AEP	546.1 m AHD
Peak water level – PMF	552.1 m AHD

3.8. Surface Water Courses

All water courses are defined as receiving baseflow from groundwater (gaining streams). The key watercourses are described below for the Ravine Area (Figure 3-3), The Plateau (Figure 3-4) and Rock Forest (Figure 3-5). The ravine watercourses generally flow to the Talbingo Reservoir and the Plateau watercourses generally flow into the Tantangara Reservoir.

3.8.1. Ravine Area

Within the ravine, the Yarrangobilly River is the major regional watercourse that flows into Talbingo Reservoir, downstream of Lobs Hole. Its catchment has an area of 271 km² that is wholly within the KNP. The majority of annual stream flow occurs in late winter and early spring, which is typical for rivers in the Australian Alps. The following watercourses occur within the ravine zone:

- Yarrangobilly River
- Tumut River
- Wallaces Creek
- Stable Creek
- Cave Gully
- Lick Hole Gully
- Sheep station Creek
- Highground Creek; and
- Unnamed watercourses 1 through to 7.

3.8.2. The Plateau

The plateau is within the upper reaches of the Murrumbidgee and Eucumbene River catchments, wholly within the KNP. The headwaters of the Eucumbene River are in the western plateau, and the river flows in a southerly direction to Lake Eucumbene. The Murrumbidgee River flows from north of the plateau in a south easterly direction into Tantangara Reservoir.

A number of perennial waterways are present across the plateau, that either flow north into the Murrumbidgee River or directly into Tantangara Reservoir. The following watercourses occur within the Plateau zone:

- Eucumbene River;
- Murrumbidgee River;
- Tantangara Creek;
- Gooandra Creek;
- Nungar Creek; and
- Kellys Plain Creek.

3.8.3. Rock Forest

Rock Forest is in the headwaters of the Goorudee Rivulet Catchment outside of KNP. The site is within the proximity of two watercourses, being Cameron's Creek and an unnamed 3rd order watercourse.



Figure 3-3: Watercourses - Ravine

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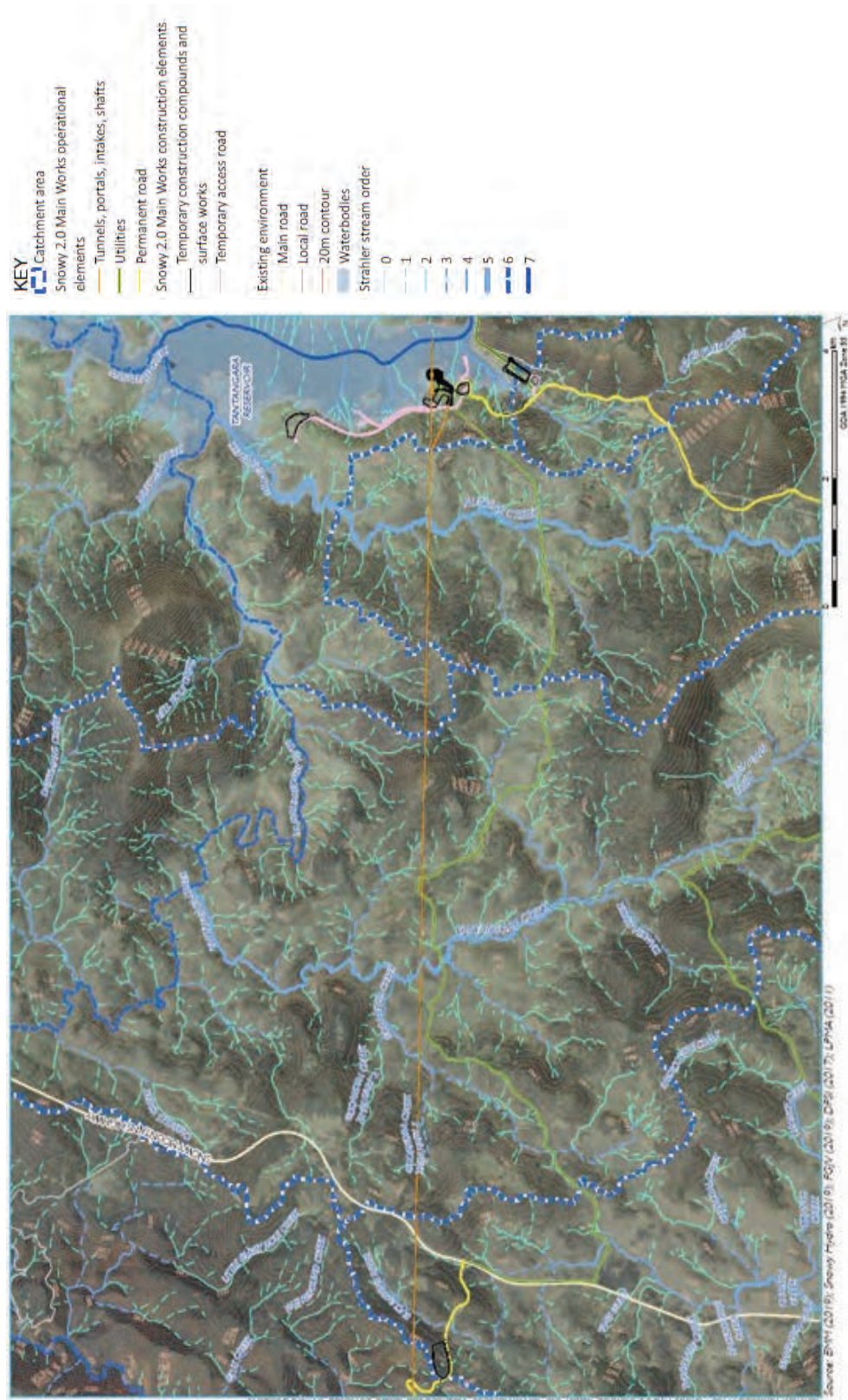


Figure 3-4: Watercourses - Plateau



Figure 3-5: Watercourses - Rock Forest

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3.9. Existing Water Quality

Baseline monitoring of reservoir and watercourses was undertaken for the preparation of the Main Works EIS. This section details the findings identified in the Water Characterisation Report (EIS Appendix J Annexure A). Percentiles of baseline water quality data for the reservoirs and water courses are provided in the Surface Water Monitoring Program (Appendix A).

During the Main Works EIS application, significant bushfires occurred within the Project area. This has led to a reduction in ground cover and increase in burnt ash material within and adjacent to the construction envelope. It is likely that, for some time, the existing pre-fire baseline data that has been gathered and discussed in the sections below will differ to the post-fire water quality. This has been confirmed by the Exploratory Works surface water monitoring program, which has found increases in a number of parameters since the fires, such as turbidity and electrical conductivity.

3.9.1. Reservoirs

3.9.1.1. Tantangara Reservoir

Baseline monitoring was undertaken over the March 2018 to February 2019 period. The program comprised sampling from nine locations within the reservoir. Water quality characteristics from this monitoring period are described as follows:

- pH ranges between 6.6 and 8.0, with one lower and upper bound exceedance occurring;
- Low levels of suspended solids and low turbidity;
- Carbonate and salinity vary seasonally, with higher levels occurring in summer/autumn;
- Oxidised nitrogen and ammonia occasionally exceeded WQO values in summer/autumn;
- Total phosphorus frequently exceeded WQO values in summer/autumn and winter/spring while reactive phosphorus occasionally exceeded WQO values;
- All dissolved metal concentrations were below WQO values except for:
 - aluminium concentrations exceeded WQO values on a frequent basis;
 - copper, iron and zinc exceeded WQO values on a frequent basis during summer/autumn; and
 - chromium (total), cobalt and lead exceeded WQO values on an occasional basis during summer/autumn.

It is noted that all of the copper exceedances and the zinc exceedances occurred during March 2018 sampling, where 100% of samples exceeded the WQO values. Different analysis methods (consistent with the methods applied more broadly to EIS sampling) were applied to subsequent sampling (post-March 2018).

- Reservoir water quality during and following wet weather conditions is poorly understood. There is potential for elevated turbidity, nutrients and some metals to occur near watercourse inflow locations for several weeks following a substantial runoff event.

3.9.1.2. Talbingo Reservoir

Baseline monitoring was undertaken over the March 2018 to February 2019 period. The program comprised sampling from ten locations within the reservoir. Water quality characteristics from this monitoring period are described as follows:

- pH ranges between 6.3 and 8.2, with occasional lower and upper bound exceedances;
- low concentrations of suspended solids and low turbidity;
- carbonate and salinity vary seasonally, with higher levels occurring in summer/autumn,

correlating with the higher salinity of streamflow over summer and autumn months;

- oxidised nitrogen concentrations exceeded WQO values frequently in winter/spring and occasionally in summer/autumn. This is the opposite trend to the Yarrangobilly River, where exceedances occurred more often in summer/autumn;
- ammonia concentrations frequently exceed WQO values during winter/spring, correlating with the elevated oxidised nitrogen;
- total phosphorus concentrations exceed WQO values in all summer/autumn samples and in approximately 25% of winter/spring samples;
- all dissolved metal concentrations were below WQO values except for:
 - copper and zinc concentrations exceeded WQO values frequently in summer/autumn and occasionally in winter/spring; and
 - chromium (total) and lead concentrations occasionally exceeded WQO values in summer/autumn.
- It is noted that all but one of the copper and zinc exceedances occurred during March 2018 sampling, where 80% of samples exceeded the WQO values. Different analysis methods (consistent with the methods applied more broadly to EIS sampling) were applied to subsequent sampling (post-March 2018).
- Reservoir water quality during and following wet weather conditions is poorly understood. There is potential for elevated turbidity, nutrients and some metals to occur near watercourse inflow locations for several weeks following a substantial runoff event.

3.9.2. Watercourses

3.9.2.1. The Plateau

Water quality characteristics for the plateau watercourses are described as follows:

- The Murrumbidgee and Eucumbene rivers, Tantangara, Gooandra, Nungar and Kellys Plain creeks have similar water quality during dry weather conditions, key characteristics include:
 - pH that generally ranges between 6.2 and 8.5, with occasional lower and upper bound exceedances;
 - carbonate and salinity vary seasonally, with higher levels occurring in summer/autumn; and
 - low concentrations of suspended solids and low turbidity.
 - total and reactive phosphorus concentrations are generally below WQO values; and
 - aluminium concentrations exceed the WQO value on a frequent basis. Copper, iron and zinc concentrations exceed WQO values on an occasional basis
- The water quality of minor watercourses in the vicinity of the proposed surface works near Tantangara Reservoir is generally poorer than larger watercourses, with elevated suspended sediment, nutrients and some metals (aluminium and iron).
- The water quality during wet weather conditions is poorly understood. It is expected that concentrations of suspended sediment and some metals may be higher than dry weather concentrations. Wet weather sampling is proposed prior to commencement of works.

3.9.2.2. Ravine Area

Water quality characteristics for the ravine watercourses are described as follows:

- Yarrangobilly River and Wallaces Creek have similar water quality during dry weather conditions. Key characteristics include:

- pH ranges between 6.2 to 8.5, with occasional lower and upper bound exceedances;
 - low concentrations of suspended solids and low turbidity;
 - carbonate and salinity vary seasonally, with higher levels occurring in summer/autumn;
 - oxidised nitrogen concentrations exceed WQO values frequently in summer/autumn and occasionally in winter/spring;
 - total and reactive phosphorus concentrations are generally below WQO values; and
 - aluminium concentrations in the Yarrangobilly River exceed WQO values frequently in winter/spring and occasionally in summer/autumn. Copper concentrations in Wallaces Creek exceed WQO values occasionally.
- The water quality during dry weather conditions in minor watercourses in Lobs Hole is generally poorer than larger watercourses, with elevated suspended sediment, nutrients and some metals (aluminium and copper). Former mine workings including shafts and spoil piles are located adjacent to the Yarrangobilly River channel and immediate areas. These works are remnant from copper mines that operated intermittently from the late 1800s to early 1900s. Seeps from flooded underground workings are known to discharge directly into the river and are known to have acid mine drainage characteristics (very low pH and high dissolved metal concentrations). The rate of discharge is poorly understood.
 - The water quality in Lick Hole Gully generally has higher concentrations of electrical conductivity, total hardness and some dissolved metals compared to the other ravine water courses as it is predominantly groundwater fed, and is often dry during summer/autumn conditions.
 - The understanding of water quality during wet weather conditions is informed by data from monitoring undertaken in March and May 2019 following moderate rainfall. Receiving water quality during wet weather conditions is generally poorer relative to baseflow conditions with higher turbidity, lower pH, higher nutrients and potential for non-trivial concentrations of some metals such as aluminium and copper.
 - Runoff samples were collected from existing disturbed areas in Lobs Hole such as access tracks and remnant copper mining areas in March and May 2019. Existing disturbed area runoff is characterised as being mildly acidic, having very high suspended sediment and turbidity levels, high total nitrogen and total phosphorous, and very high aluminium and copper concentrations. During wet weather conditions (when runoff is occurring to local watercourses in Lobs Hole), the water quality in the Yarrangobilly River is expected to be degraded as it passes through Lobs Hole.

3.10. Flood Characteristics

Existing flooding characteristics are identified in the Flood Risk Assessment (EIS Appendix J, Annexure C) and summarised below:

- Existing flood characteristics for the Lobs Hole area indicate that:
 - During the lower magnitude flood events such as the 20% and the 5% AEP event, flooding is predominantly confined to the channel and immediate floodplain areas;
 - Full inundation of the floodplain occurs in the 1% AEP and greater magnitude events;
 - For all events except the probable maximum flood (PMF), most of the flow conveyance occurs within the channel and immediate floodplain areas.
- Existing flood characteristics for Kelly Plain Creek indicate that:
 - Floodwaters generally follow the alignment of Kelly Plain Creek for all event up to the PMF, with no major breakouts or flow diversions;

- Peak flood levels in the lower reaches of Kelly Plain Creek are influenced by reservoir water levels
- Existing flood characteristics for Rock Forest indicate that floodwaters generally follow the alignment of watercourses for all event up to the PMF, with no major breakouts or flow diversions; and
- Reservoir flood peak water levels are presented in Table 3-2 and Table 3-3.

4. WATER ASPECTS AND IMPACTS

4.1. Construction Activities

An environmental aspect is an element of an organisation's activities, products, or services that has or may have an impact on the environment.

Key aspects of the project that may result in impacts to surface water impacts are identified in Table 4-1. The extent of these impacts will depend on the nature and magnitude of construction activities and their interaction with the natural environment. The below activities include all Modification assessment reports.

Table 4-1: Project Aspects and Potential Impacts

Environmental Aspects (Construction activities that may impact surface water)	Environmental Impacts	Environmental Factors (Conditions)
• Vegetation clearing • Topsoil stripping • Bulk earthworks • Stockpiling • Water use and extraction • Dewatering • Subaqueous placement / excavated rock placement • Dredging activities • Storage of fuels and chemicals • Accidental leaks and spills • Works on waterfront land and instream works • In reservoir works (i.e. removal of intake rock plug) • Drilling and piling • On-site water management (run off from construction areas)	• Sediment-laden runoff entering waterways • Contamination of stormwater runoff due to construction activities (including accidental spills) • Changes to flow regime from new infrastructure • Water quality impacts associated with the discharge of treated process water and wastewater (sewage) to Talbingo and Tantangara reservoirs • Water quality impacts including sediment impacts associated with dredging, drilling, blasting and subaqueous placement works.	• Soil type – more erodible soil types have an increased soil erosion potential; • Soil moisture – increased soil moisture decreases soil mobilisation; • Rainfall – heavy rainfall increases soil entrainment • Extent of vegetation cover – vegetation assists in stabilising soils and reduces the ability for erosion. The presence of acid forming and acid neutralising materials. Existing soil and water contamination • Sensitivity of aquatic environments – Dispersion of contaminants is increased when working within aquatic environments

4.2. Project Impacts

4.2.1. Overview

The Main Works RTS revised Water Management Report (RTS Appendix J) was prepared to assess the impact of Main Works on the environment. Subsequent reports included in the three Modification Assessment Reports also assessed the potential impacts of the scope variation to the existing surface water environment. Finally, the Treated Effluent and Process Water Reuse Technical

Memorandum (Revision 6), issued by Arcadis, 11 October 2024 discusses potential impacts from treated water reuse.

The residual impacts have been described in the following sections.

4.2.2. Watercourses

Key sources of contaminants to watercourses include:

- Direct stormwater runoff from disturbed areas;
- Stormwater overflows from sediment basins;
- Stormwater overflow from leachate basins;
- Overland runoff from treated water reuse; and
- Sub-surface seepage from excavated rock stockpiles and final landforms.

Potential changes to water quality in the Yarrangobilly River, the upper Eucumbene River and Kellys Plain Creek have been assessed using a conceptual stormwater discharge model. Table 4-2 provides a summary of the estimated disturbance durations and profiles the potential magnitude of changes to receiving water quality during construction.

Potential changes to water quality are described using categories that represent varying magnitudes of change relative to the relevant default NSW Water Quality Objective values.

Table 4-2 Summary of Potential Changes to Watercourse Water Quality (EMM, 2020)

Watercourse	Construction phase 1 (Initial 15 months of construction program)	Construction phase 2 (Majority of construction program)
Percentage of time no change to receiving water quality is expected		
Yarrangobilly River 2 ¹	85%	85%
Upper Eucumbene River	72%	81%
Kellys Plain Creek 3 ²	81%	76%
Percentage of time concentrations of suspended solids, nutrients or metals in receiving waters may increase by between 0 to 10% of WQO values³		
Yarrangobilly River 2 ¹	7%	12%
Upper Eucumbene River ³	10%	8%
Kellys Plain Creek 3 ²	2%	8%
Percentage of time concentrations of suspended solids, nutrients or metals in receiving waters may increase by between 10 to 50% of WQO values³		
Yarrangobilly River 2 ¹	6%	3%
Upper Eucumbene River	10%	8%
Kellys Plain Creek 3 ²	2%	8%
Percentage of time concentrations of suspended solids, nutrients or metals in receiving waters may increase by between 50 to 100% of WQO values³		
Yarrangobilly River 2 ¹	1%	0%
Upper Eucumbene River	4%	2%
Kellys Plain Creek 3 ²	3%	%
Percentage of time concentrations of suspended solids, nutrients or metals in receiving waters may increase by more than 100% of WQO values³		

Watercourse	Construction phase 1 (Initial 15 months of construction program)	Construction phase 2 (Majority of construction program)
Yarrangobilly River 2 ²	1%	0%
Upper Eucumbene River	5%	1%
Kellys Plain Creek 3 ²	12%	5%

1. Results for Yarrangobilly River include discharge from disturbance areas adjacent to the Yarrangobilly River arm of Talbingo Reservoir.

2. Results for Kellys Plain Creek include discharge from disturbance areas to the north of Kellys Plain Creek that also drain into the southern portion of Tantangara Reservoir

3. WQO values refer to the Water Quality Objective values established in the water assessment

4.2.3. Reservoirs

Key sources of contaminants to the reservoirs include:

- Inflows from watercourses potentially impacted by the Project;
- Treated wastewater and process water discharge and reuse;
- Surface runoff and sub-surface seepage from excavated rock stockpiles and final landforms (including subaqueous placement of excavated rock into Talbingo reservoir); and
- Dredging, drilling and blasting operations.

The revised Water Management Report (RTS Appendix J) identified that the combination of stormwater migration and controlled discharges of treated water have the potential to increase the salinity levels and nutrient concentrations within reservoir waters. The report detailed::

- Mixing zone assessments were undertaken to determine the dilutions associated with the Project discharges to reservoirs and estimate the size of the mixing zones required to dilute key analytes to ambient water quality conditions;
- Concentration increases may occur near treated wastewater and process water discharge locations. However, the spatial extent of the mixing zone was predicted to be less than 10 m from the outfall location for most of the discharge scenarios modelled; and
- Additional changes to reservoir water quality may occur due to spoil management activities.

Table 4-3 Summary of Potential Changes to Reservoir Water Quality (EMM, 2020)

	Units	Summer / Autumn (Drought) ¹	Summer / Autumn (Typical)	Winter / Spring (Typical)
Tantangara Reservoir				
Construction phase 1 – Initial 15 months of construction program				
Salinity (as indicated by EC)	µS/cm	22 to 22	22 to 22	14 to 14
Total Nitrogen	mg/L	0.20 to 0.22	0.20 to 0.21	0.11 to 0.11
Total Phosphorus	mg/L	0.03 to 0.03	0.03 to 0.03	0.01 to 0.01
Construction phase 2 – Majority of construction program				
Salinity (as indicated by EC)	µS/cm	22 to 28	22 to 24	14 to 14
Total Nitrogen	mg/L	0.20 to 0.23	0.20 to 0.21	0.11 to 0.11
Total Phosphorus	mg/L	0.03 to 0.03	0.03 to 0.03	0.01 to 0.01
Yarrangobilly River arm of Talbingo Reservoir				
Construction phase 1 – Initial 15 months of construction program				

	Units	Summer / Autumn (Drought) ¹	Summer / Autumn (Typical)	Winter / Spring (Typical)
Salinity (as indicated by EC)	µS/cm	27 to 27	27 to 27	22 to 22
Total Nitrogen	mg/L	0.20 to 0.24	0.20 to 0.21	0.12 to 0.12
Total Phosphorus	mg/L	0.03 to 0.04	0.03 to 0.03	0.01 to 0.01
Construction phase 2 – Initial 15 months of construction program				
Salinity (as indicated by EC)	µS/cm	27 to 35	27 to 29	22 to 23
Total Nitrogen	mg/L	0.20 to 0.25	0.20 to 0.21	0.12 to 0.12
Total Phosphorus	mg/L	0.03 to 0.04	0.03 to 0.03	0.01 to 0.01

The predicted values for total nitrogen and total phosphorus make no allowance for decay and assimilation are there conservative. Ambient values refer to typical or median values.

1. Calculations based on reservoir inflows and calculated stormwater discharges for the 2006/2007 summer/autumn period.

A revised mixing zone assessment was undertaken in July 2021 (RHDHV, 2021) to reflect engineering design refinements and resulting changes to the proposed volumes of water to be treated and discharged to the reservoirs. The revised mixing zone assessment provided updated estimates of the mixing and dilution characteristics for key constituents.

In comparison to the RTS mixing zone assessment, the revised assessment identified that near-field mixing results meet or improve upon the number of dilutions required to satisfy target concentration at the end of the mixing zone. Due to the increased volume of lower concentration process water in comparison to volume of treated wastewater, target dilutions for total nitrogen and total phosphorus are lower in comparison to the RTS.

A summary of analyte loads in comparison with the RTS is presented in Table 4-4.

Table 4-4 Updated Reservoir Water Quality (RHDHV, 2021)

Talbingo Reservoir	Summer / Autumn (Drought)		Summer / Autumn (Typical)		Winter / Spring (Typical)	
	RTS	Revised	RTS	Revised	RTS	Revised
Salt in combined stormwater discharges (kg/season)	625	No change	977	No change	1,479	No change
Salt in combined controlled discharges (kg/season)	116,330	302,738	116,330	302,738	116,330	302,738
Salt in reservoir inflows (kg/season)	404,800	No change	1,997,600	No change	3,501,575	No change
Increase in salinity of inflows (%)	28.9	74.8	5.9	15.2	3.4	8.7
TN in combined stormwater	36	No change	56	No change	85	No change

Talbingo Reservoir	Summer / Autumn (Drought)		Summer / Autumn (Typical)		Winter / Spring (Typical)	
	RTS	Revised	RTS	Revised	RTS	Revised
discharges (kg/season)						
TN in combined controlled discharges (kg/season)	83	216	83	216	83	216
TN in reservoir inflows (kg/season)	460	No change	2,270	No change	9,095	No change
Increase in TN of inflows (%)	25.8	54.8	6.1	12.0	1.8	3.3
TP in combined stormwater discharges (kg/season)	4	No change	6	No change	10	No change
TP in combined controlled discharges (kg/season)	9	23	9	23	9	23
TP in reservoir inflows (kg/season)	46	No change	227	No change	910	No change
Increase in TP of inflows (%)	28.0	59.6	6.7	13.0	2.0	3.7

The controlled discharges of treated wastewater and process water during the construction phase of the project have potential to increase the ambient salinity levels and nutrients concentrations. In comparison to the RTS, ambient water quality of EC, TN and TP would:

- Increase in the drought scenario as a result of a greater proportion of controlled discharge water relative to the small inflow volumes; and
- Marginally increase in the typical summer/autumn and winter/spring scenarios.

It is noted that this represents a worst case scenario which assumes that no water reuse would occur for the entire season from mid-2024 onwards.

In January 2022, the Project EPL was amended to increase the approved discharge limit at point 43 from 1.66 ML/day to 4.32 ML/day and to include a discharge rate limit of 50 L/s.

4.2.4. Flooding

The key flood impact mechanisms are associated with:

- Project works occurring on or within flood prone areas (i.e. land susceptible to flooding by the PMF), including instream works and works on the adjacent floodplain;
- Leachate water ingress from emplacement activities; and
- Placement of excavated material in the reservoirs.

Evacuation and flood response will be undertaken in accordance with the Natural Hazard Management Plan.

Table 4-5: Potential Flood Impacts (EIS Appendix J Annexure C)

Project area	Location	Summary
Ravine	Talbingo Reservoir	No significant change to flooding characteristics for Talbingo Reservoir is anticipated as the volume of excavated material to be placed in the reservoir is very small in comparison to the existing storage.
	Lobs Hole	Whilst the spatial extent and magnitude of impacts is extensive throughout Lobs Hole, in particular for floods of 1% AEP and above, these impacts are not anticipated to impact on existing infrastructure or other areas of significance, and the design of temporary works can accommodate the changed flooding characteristics.
Plateau	Tantangara Reservoir	No significant change to flooding characteristics for Tantangara.
	Kelly's Plain Creek	Temporary surface infrastructure in the vicinity of Kelly's Plain Creek largely avoids flood prone land and therefore will not significantly impact on existing flooding characteristics. Minor increases to peak flood levels are expected to occur from the proposed upgraded road crossing of this watercourse, however these impacts will be localised and are not anticipated to impact on infrastructure or other areas of significance.
Rock Forest	Rock Forest	Temporary surface infrastructure associated with the proposed logistic yard at Rock Forest largely avoids flood prone land and therefore will not impact on existing flooding characteristics.

4.3. Environmental Risk Assessment

The impacts to water are further considered within Appendix A3 of the EMS, which details risk assessment requirements for Project works, including variation works discussed in relevant Modification Assessment Reports. The risk assessment is based on:

- The likelihood of an impact occurring as a result of the aspect; and
- The consequences of the impact if the event occurred.

These risks as well as any regulatory requirement form the basis for the management measures.

5. SURFACE WATER MANAGEMENT

Surface water impacts will be mitigated as much as practicable through the implementation of management measures conditions of approval (including all modifications). The overarching management measures to be implemented during construction are described in the following sections.

5.1. Principles

The principles of surface water management are to:

- Provide targeted training and education;
- Minimise the extent and duration of disturbance;
- Monitor weather conditions and modify work programs accordingly;
- Segregate clean and dirty water;
- Control stormwater migration on and off sites;
- Reuse process water as much as practicable;
- Discharge water as per EPL 21266;
- Minimise soil erosion and maximise retention;
- Conduct regular inspections of control measures;
- Implement contingency actions as required;
- Prepare and maintain relevant documentation; and
- Report outcomes and impacts as required.

5.2. Stormwater

Potential erosion and sedimentation impacts will be managed through the development of Erosion and Sediment Control Plans (ESCP) and Progressive Erosion and Control Plans (PESCP's). ESCPs will be developed for each primary site, and individual work scopes Project wide. ESCPs will be required for any works involving clearing and grubbing or previously uncontrolled soil disturbance.

Plans will be designed by a suitably qualified practitioner in consultation with relevant Project personnel. The plans will be updated as required based on the progression of new areas of ground disturbance and changing site conditions.

The Environment team, through site inspections and consultation with relevant personnel, will manage updates of the ESCPs.

5.2.1. Stormwater Controls

The Project will implement the following stormwater control and treatment options:

- Controls be designed in accordance with Main Works RTS predicted stormwater discharge characteristics;
- Controls will be installed and maintained in compliance with the best practice guidelines and specialist recommendations;
- Regular Loss Prevention Inspections will be conducted across all sites and controls;
- Regular inspections will be conducted by a suitably qualified practitioner, such as a third-party consultant;

- Clean water diversions will be installed around disturbance areas;
- Sediment basins will be installed with a design rainfall depth of 85th percentile 5-day rainfall event with consideration given to increasing basin size at locations where sufficient space is available;
- Application of pH buffers to sediment basins will be undertaken where necessary to enable reuse of water on site, following site specific risk assessments;
- Application of flocculants will be undertaken following consultation with NSW EPA;
- Stabilisation of appropriate works areas;
- Additional control installation to reduce reliance on sediment basins (where possible);
- Standpipes will be considered at operational (wetland) basins; at long-term (>12 months) sediment basins; and at high-risk short-term sediment basins;
- Sprinkler irrigation systems will be installed and utilised at key basins;
- Maximisation of water reuse on Project sites;
- Locating stockpiles away from waterways and severe flood areas;
- De-silting of basins when sediment accumulation has reached design intent; and
- Where active discharge is required, pH buffers may be applied to sediment basins following site specific risk assessments and flocculants may be applied following consultation with NSW EPA.
- A wastewater management system will be established to manage effluent and grey water from construction compounds and accommodation camps. The wastewater (sewage) system will include emergency storage of untreated wastewater. All wastewater treatment plants will be designed to operate during winter when sub-zero temperatures can persist for extended periods of time.

5.2.2. Design Rainfall Depths

Design rainfall depths for the Project are identified in Table 5-1 below.

Table 5-1: Design Rainfall Depths (Main Works EIS Appendix J.2 Annexure A (EMM), 2020)

Catchment	Description	85 th percentile, 5-day rainfall (mm)	90 th percentile, 5-day rainfall (mm)	95 th percentile, 5-day rainfall (mm)
Yarrangobilly River	Surface works at Lobs Hole and Marica	28.1	35.6	49.0
Upper Eucumbene River	Surface works between Marica and the Snowy Mountain Highway	35.2	43.4	56.9
Tantangara construction compound	Surface works adjacent to the southern portion of Tantangara Reservoir	30.5	37.0	51.0
Goorudee Rivulet	Surface works at Rock Forest	20.0	25.7	36.1

5.2.3. Stormwater irrigation

The use of irrigation for stormwater management will take into consideration relevant statutory guidelines throughout the Project timeline.

Factors to be considered when setting up the irrigation system will include (but not be limited to):

- Slope;
- Landform;
- Vegetation condition;
- soil characteristics; and
- Available soil water holding capacity.

Sprinkler irrigation systems will generally consist of throw range sprinkler heads powered by various portable pumping units. Irrigation will be used in conjunction with stormwater harvesting for dust suppression to de-water and empty sedimentation basins appropriately.

Irrigation areas will generally be located up or cross-catchment of the sediment basins, away from watercourses, to the other side of “no go” fencing and away from works. Irrigation will not be directed to sensitive environmental habitats such as the 50 m buffer zones of Wallace and Yarrangobilly creeks.

Irrigation will occur in vegetated areas (as opposed to cleared areas) to enable increased overland filtration and infiltration. Irrigation will be scheduled and monitored to minimise the risk of over-irrigating or excessive ponding in one location.

It is noted that following consultation with the NSW EPA, some irrigation may occur during rain events to minimise the risk of sediment laden water migration to waterways.

5.3. Flooding

Stockpiles and work areas will be located where they are not exposed to flood flow. Flood flow is defined as the 20% Annual Exceedance Probability (AEP) flood event. Details regarding the placement of excavated material is contained within the Spoil Management Plan.

Flood emergency response will be undertaken in accordance with Natural Hazard Management Plan. This includes protocols for evacuation to areas outside the flood prone land and protocols for storage of plant, equipment and materials in flood prone areas commensurate with the frequency of inundation.

5.4. Water Treatment Facilities

Water treatment facilities and systems have been installed and made operational across the Project in response to the evolving water management requirements facing the Project. The dynamic water management conditions have resulted in various water treatment applications being implemented. The primary purposes of the treatment facilities are to:

- Manage tunnel process water;
- Treat accommodation camp wastewater;
- Manage water quality prior to discharge and reuse; and
- Treat accommodation camps for potable water consumption.

In accordance with a previous licence condition E1.1, FGJV provided the NSW EPA with detailed designs of the various process water treatment plants and wastewater treatment plants used on the Project.

Figures 5-1 through to 5-3 are visual representations of site-based water treatment systems.

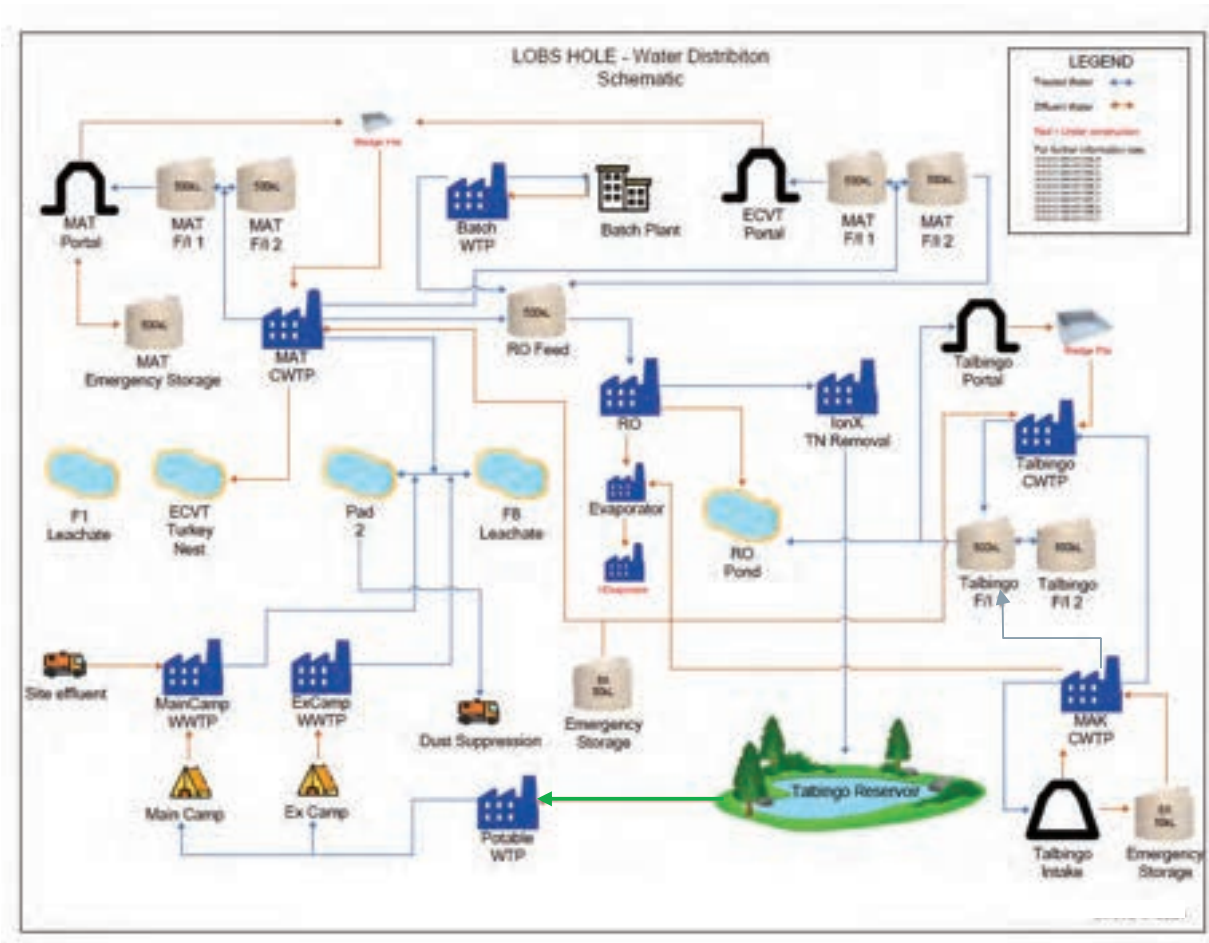


Figure 5-1 Lobs Hole Water Distribution System

Note the water transfer pipeline between MAT CWTP and Tabbingo CWTP and the pipeline between F1 and the MAT CWTP have been excluded from this image for visual clarity.

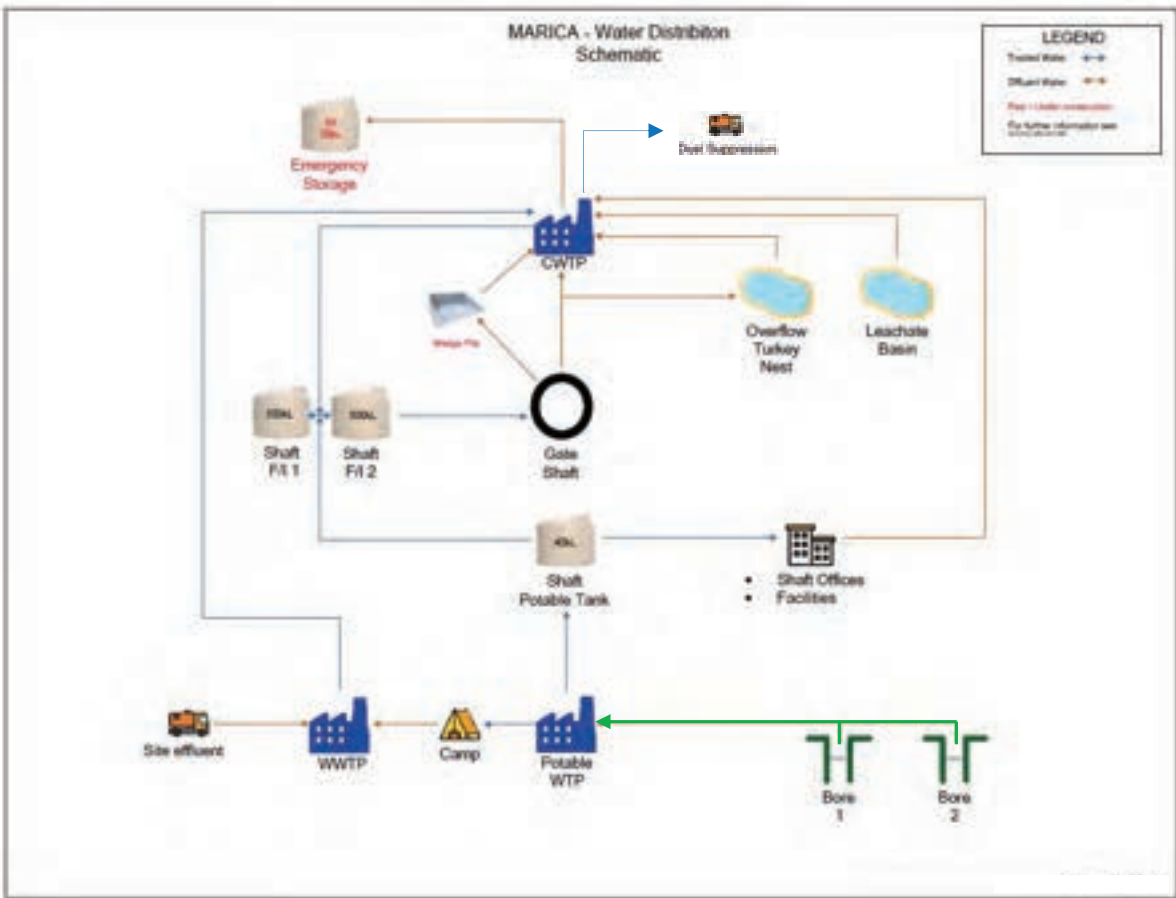


Figure 5-2 Marica Water Distribution System

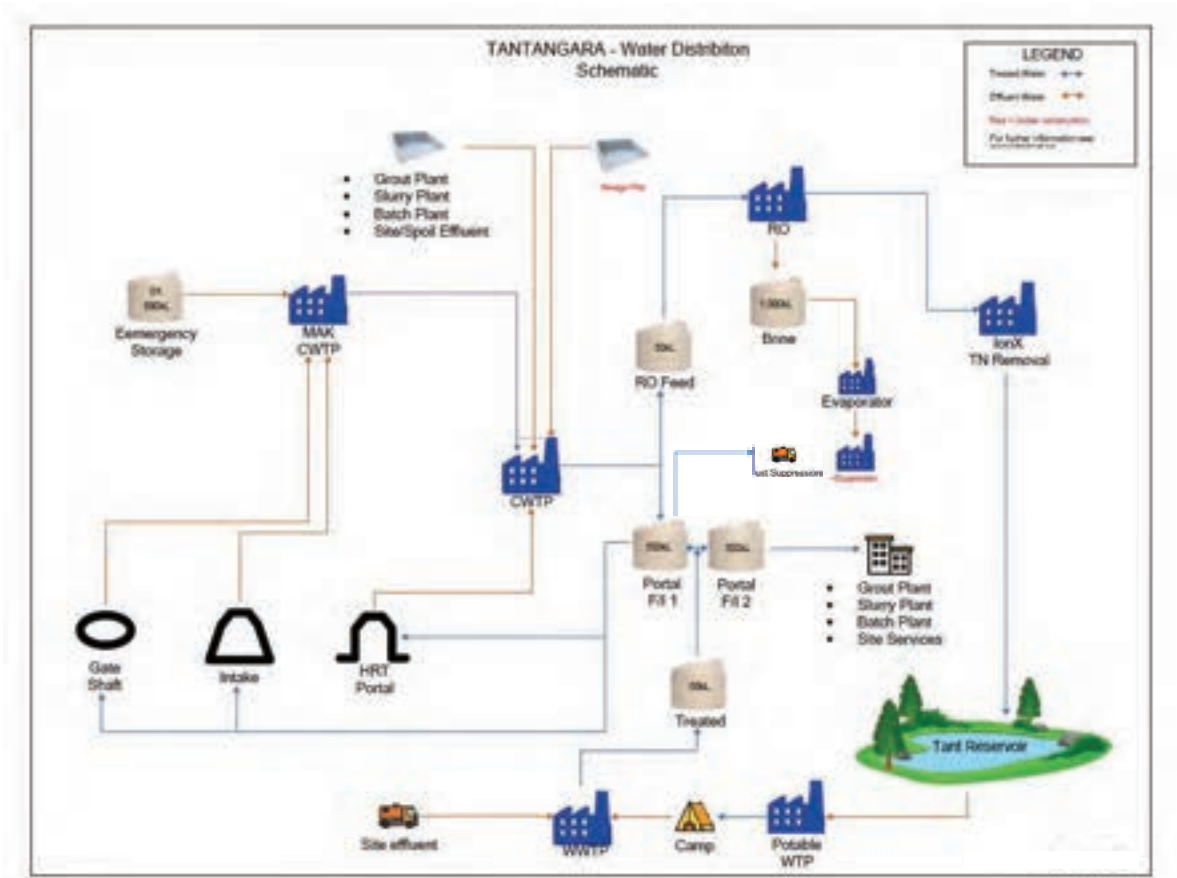


Figure 5-3 Tintangara Water Distribution System

5.4.1. Process Water Treatment Plants

As shown the Figure 5-1 through to 5-3, process water treatment plants (WTP's) or construction water treatment plants (CWTP's) are located across the Project for use during the Main Works.

In response to the ongoing water treatment challenges, the treatment facilities at Lobs Hole and Tintangara augmented with tertiary treatment by adding reverse osmosis plants, ion exchange treatment to treat the water to meet the discharge criteria at the reservoirs including nutrients (Total Nitrogen and Phosphorous). The additional facilities have been implemented to reflect the Project's adherence to the relevant discharge and reuse criteria.

It is noted the proposed installation of an additional treatment plant at Marica is forecast prior to the works outlined in the Modification 3 Assessment Report (December 2024). The additional WTP at Marica will be connected to the Lobs Hole treatment system to allow for suitable water to be discharged to Talbingo Reservoir, in accordance with EPL 21266.

The process water WTP systems have been designed for emergency scenarios and include the following contingency measures:

- The water treatment system was designed to work in stages, therefore, if any one component fails, the treatment system will continue to work without stopping the entire operation of the treatment plant;
- Treatment plants will have a contingency period during which the plant is able to hold process waters;
- Process waters can be transferred to nearby plant or additional storage facilities located on each site;
- Water supply can be reduced, decreasing the volume of process water which requires treatment;
- Process water can be directed to the mainstream line for reuse in the tunnel boring machines;
- Utilisation of the clean water storage tanks within the tunnels. In a time of emergency, these tanks would be emptied of clean water and used as the emergency storage; and
- Discharging back into the tunnel so that the water can be recollected in the various storage facilities.

5.4.2. Wastewater Treatment Plants

Multiple wastewater treatment plants (WWTP) currently exist within the Project. The current locations are Lobs Hole Main camp, Marica camp, Tantangara camp and Lobs Hole Exploratory works camp. Wastewater from remote offices not plumbed to treatment facilities is trucked to wastewater treatment plants for treatment.

The sanitary sewer system collects wastewater from showers, kitchens, laundries and toilets. The collected sewage is treated at the sewage treatment plants before being pumped into the combined treated process water services main for either re-use on site or discharge to reservoir.

As per Modification 3 Assessment Report, the Marica WWTP will have a capacity increase to accommodate the proposed increase in treatment demands.

5.4.3. Potable Water Treatment Plants

Potable water treatment plants (PWTP) are operational on each site across the Project. The PWTP produce potable water from both Talbingo and Tantangara Reservoirs and the two groundwater bores installed at Marica. The water is used for the accommodation camps, concrete production and other construction requirements where technical specifications demand high quality water.

It is noted an additional supply bore is proposed for the Modification 3 works, to assist with the projected increase in demand.

5.5. Treated Water Reuse

The Project is committed to maximising the reuse and recycling of water. A key mechanism that has been designed is the reuse of treated waste and process water as much as practicable in order to avoid release into the surrounding water environments.

5.5.1. Risk Assessment

In May 2021, an investigation of the opportunities to reuse treated effluent within the Project boundary was undertaken. The investigation included a risk review of the permissibility of using treated effluent against the Project Approval, environment and human health legislation and guidelines. The third-Party Consultant's Memo was prepared to inform treated water effluent reuse from the Exploratory and Fly Camp STP, however results were considered applicable to the Main

Camp, Marica and Tantangara systems. As both STP and Process Water are required to meet the same water quality criteria, the reuse recommendations provided in the Memo were considered applicable to both.

In May 2023, the third-party consultant issued a revised Risk Assessment document addressing treated water reuse across the Project. The document contained a range of analytical criteria for water across the project that would be considered acceptable for beneficial reuse avenues.

At the time of this management plan revision, the Risk Assessment is under review. The review includes assessment of monitoring data from 2021 through to 2024 and the intended water reuse methods.

5.5.2. Reuse Activities

The reuse of treated Water is restricted to reuse for the following activities:

- Dust suppression on unsealed roads (with an intent to primarily use on major haul roads);
- Irrigation of suitable locations;
- Concrete batching;
- Wheel washing infrastructure;
- Material preparation and compaction;
- Rock and concrete crushing;
- Fire and emergency water systems;
- Drilling operations (HDD etc.); and
- Tunnelling activities.

Treated water not required for reuse would be discharged to the reservoirs in accordance with the Project EPL. To ensure that process and wastewater is reused in a safe and responsible manner, treated water reuse is required to comply with the most recent water reuse management documentation.

5.5.3. Operation of Discharge Points

The Treated water is discharged at licensed locations within the Talbingo and Tantangara Reservoirs, through a series of tertiary treatment processes, including reverse osmosis and ion exchange system as shown in Figures 5-1 and 5-3.

A specific plan for the operation of the discharge points is contained within the Dewatering Arrangement - Project Wide S2-FGJV-TEC-PLN-0006.

5.6. Chemical Control and Spill Management

Chemicals will be stored and managed in a manner that is consistent with the CoA and REMMs. The adopted management strategy involves conforming to manufacturer's instructions, which detail the product specific requirements as per the relevant Australian Standards. Details of these requirements and the manner with which they will be complied is detailed in Annexure C.

Chemical transport, handling and storage controls are detailed in the Chemical, Hazardous and Fibrous Material Management Plan. Designated chemical storage areas will be established on the Project including appropriate bunding consistent with Storing and handling of liquids: Environmental protection participant's manual (DECC NSW2007).

Response to incidents will be managed in accordance with Section 7 of the EMS.

5.7. Accommodation Camps

Four accommodation camps will be built and used, including:

- Lobs Hole Exploratory Camp and Main Camp;
- Marica Camp; and
- Tantangara Camp.

As per Modification 3 Assessment Report (December 2024), Marica accommodation facilities are proposed to have a capacity increase to service the additional tunnelling activities.

5.8. Works on Waterfront land and Instream Works

All waterfront or instream works, including works within 40 metres of any watercourse will be undertaken in accordance with the requirements in the relevant CoA's and management plans.

Table 5-2 describes proposed instream and waterfront works, along with the overarching management approach.

Table 5-2: Waterfront and Instream Work

Type	Description	Management approach
Fish weir (undertaken by SHL)	A fish weir is proposed in the upper reaches of Tantangara Creek to protect the Tantangara Galaxias from the threat of potential migration of the larger Climbing Galaxia.	Fish Wier works were completed before mid-2025. The weir is in operation and all disturbed areas at the construction site and along Nungar Trail are in post-construction rehabilitation, the first phase of rehabilitation having been completed with demobilisation before mid-2025.
Tantangara Fish Screen	A filtration station/s to screen pest fish species from being discharged through the Murrumbidgee Eucumbene Tunnel and Tantangara Reservoir wall is proposed at Tantangara Reservoir. While it is considered highly unlikely to occur as a result of the project, this is aimed to avoid potential secondary transfer of any pest fish species that may establish in Tantangara Reservoir.	Should these works proceed, the fish screen works will be constructed as per the requirements in the Biosecurity Risk Management Plan, including a site specific environmental management plan.
Permanent watercourse diversions	Any watercourse that traverses the project disturbance area may be permanently diverted.	Any watercourse that will be permanently diverted around permanent infrastructure will: • be a piped and/or surface drainage system; • be designed and constructed to have non-erosive hydraulic capacity and be structurally sound for the 1% AEP event; and • have adequate scour protection at the system inlets and outlets. During detailed design a risk assessment will be undertaken to identify risks associated with by-pass flows that may occur as a result of system blockage or an event greater than the design event. An aquatic ecological survey will be undertaken. Watercourses will be rehabilitated in accordance with Rehabilitation Management Plan.
Temporary watercourse diversions	Any watercourse that traverses the project disturbance area may be temporarily diverted.	Where practical, any watercourse that will be temporarily diverted will; • be a piped and/or surface drainage system; • be designed and constructed to have non-erosive hydraulic capacity and be structurally sound for a design event (that will be established by a risk assessment); and • have adequate scour protection at the system inlets and outlets. A risk assessment will be undertaken to identify risks associated with by-pass flows that may occur as a result of system blockage or an event greater than the design event. An aquatic ecological survey will be conducted. Watercourses will be rehabilitated in accordance with Rehabilitation Management Plan.
Watercourse crossings (Bridge, access, culvert and services)	Culvert and bridge crossings of watercourses are proposed at numerous locations within the project disturbance area. Service crossings of watercourses are	Watercourse crossing works will be conducted in accordance with CoA's and relevant statutory obligations. All culverts and bridges will be designed by a suitably qualified professional in accordance with the relevant Austroads Guidelines.

Type	Description	Management approach
	proposed at numerous locations within the project disturbance area.	All service crossings will be designed by a suitably qualified professional in accordance with best practice methods. Where necessary, an aquatic ecological survey will be undertaken.
Works within 40m of a watercourse	Disturbance may occur on any land within the project disturbance area that is within 40 m of a watercourse or reservoir.	ESCPs are to dictate the specific controls to be used on waterfront land. Typical measures include: • monitoring weather forecasts and taking appropriate action prior; • minimising the extent of work and the amount of time disturbance where possible; • isolating work areas from natural flows where possible; • stockpiles to be located outside of the waterfront area; • Use of temporary ground covers in areas of concentrated flow to minimise erosion of exposed soils during rainfall; • Stabilisation of exposed batters within 40m of a natural watercourse prior to forecasted 80% chance of 10 mm rain. • completing and stabilising works as quickly as possible after works are complete. • Installation of silt curtains where necessary.

5.9. Dredging and Intake Structures

A Dredge Management Plan will be developed in consultation with NSW EPA, NPWS, Water Group, NRAR, NPWS, DPHI and NSW Maritime prior to approval by DPHI. The Dredge Management Plan will be developed and approved prior to dredging channel and intake extraction or underwater blasting.

5.10. Stockpiles

Temporary spoil stockpiles will be managed in accordance with The Stockpile and Sludge Management Procedure.

5.11. Permanent Spoil Emplacement Areas

Management details and the progression of design regarding the permanent spoil emplacement areas (PSE's) is contained within the Spoil Management Plan. The recent inclusion of lining and leachate control requirements have seen the Project install Geosynthetic clay liners (GCL) on target emplacement areas, and an approved clay lining system at Marica.

In line with Modification 3 Assessment Report (December 2024), the Rock Forest PSE will include adequate lining and leachate management controls.

Sub-aqueous emplacement is proposed for Talbingo. Where emplacement is proposed below FSL risk assessments and investigations will be conducted along with stakeholder consultation prior to seeking approval, as per EPL 21266.

5.11.1. Leachate Detection Procedures

In accordance with the latest EPL 21266 variation, site specific leachate detection procedures have been implemented to control the generation of leachate from excavated spoil. Site specific controls, trigger responses and monitoring programs have been implemented in consultation with the NSW EPA. A list of all Leachate Detection Procedures are available within the Spoil Management Plan.

The individual procedures include a list of monitoring locations, sampling frequencies, analytical schedules and TARP control measures.

5.12. Environmental Management Measures

During preparation of the Main Works Submissions, REMMs were developed and included in Appendix C of the Main Works RTS, February 2020.

Table 5-3 contains a list of surface water relevant REMMs along with references to the appropriate management plans, responsibilities and source documents.

Table 5-3: Surface Water Management Measures

ID	Measure / Requirement	When implement to	Responsibility*	Source document**	Area
General					
SW01	Training will be provided to all project personnel, including relevant sub-contractors on surface water and soil management practices, and the requirements from this plan through inductions, toolboxes and targeted training.	Pre-construction and construction	Contractor – EM, EC	MW CoA 30(m) MW CoA 31(c)	All
SW02	Unless authorised otherwise by an environment protection licence the requirements of Section 120 of the POEO Act will be complied with.	Pre-construction and construction	Contractor – All	MW CoA 29	All
Stormwater management					
SW03	Works will minimise erosion and the generation and dispersion of sediment using suitable controls in accordance with the relevant requirements in the <i>Managing Urban Stormwater: Soils and Construction guidance series</i>	Construction	Contractor – CM, S, SS	MW CoA 30(f) EW REMM SOIL02	All
SW04	An Erosion and Sediment Control Plan (ESCP) will be prepared for each construction area. Each ESCP will: • apply the methods and principles provided in Managing Urban Stormwater: Soils and Construction: - Volume 1 – Soils and construction (Landcom 2004); and/or - Volume 2A – Installation of services (DECC 2008); and/or - Volume 2C – Unsealed roads (DECC 2008);	Construction	Contractor – CM, EM, EC	MW CoA 30(c) MW REMM WM04 MW RWMM WM1.2.1 MW RWMM WM1.3.1 MW RWMM WM2.5.2 EW REMM SOIL02	All
SW05	Suitably qualified erosion and sediment control professional(s) will be commissioned to: • oversee the development of ESCPs; • inspect and audit controls; • train relevant staff; and • provide advice regarding erosion and sediment control.	Construction	Contractor – EM, EC	MW REMM WM05 MW RWMM WM1.2.3 MW RWMM WM1.3.3	All
SW06	Stormwater management systems will be benchmarked to Main Works RTS predicted stormwater discharge quality characteristics.	Construction	Contractor – EM, EC	MW RWMM WM2.2.4	All

ID	Measure / Requirement	When implement to	Responsibility*	Source document**	Area
SW07	Where practical, clean water will be diverted around or through construction areas. Runoff from clean water areas that cannot be diverted will be accounted for in the design of surface water management systems.	Pre-construction and construction	Contractor – CM, S, SS	MW CoA 30(b) MW REMM WM03 MW RWMM W1.1.1 EW REMM WM5.3	All
SW08	Clean water diversions will be designed to minimise potential scour impacts in adjoining watercourses.	Pre-construction and construction	Contractor – DM	MW CoA 30(c) MW RWMM WM1.1.2	All
SW09	Works will be programmed to minimise the extent and duration of disturbance to vegetation where practicable. This will include minimising the time between clearing and site establishment earthworks, initial earthworks and commencement of subsequent ground stabilisation activities	Pre-construction and construction	Contractor – CM, S, SS	Best practice standards and specialist assessments	All
SW10	All slopes that have been cut and/or filled as part of the construction works shall be appropriately stabilised in accordance with erosion and sediment control and other relevant sub plans. Stabilisation including rehabilitation will be undertaken progressively where practicable.	Construction	Contractor – CM, DM, S, SS	EW REMM WM2.4	All
SW11	Stockpiles will be managed in accordance with the Spoil Management Plan (S2-FGJV-ENV-PLN-0019)	Construction	Contractor – CM, S, SS	MW CoA 7	All
SW12	New landforms will maximise surface drainage to the natural environment	Construction	Contractor – DM	REMM REHAB02	All
SW13	Sediment basins will be designed and constructed in accordance with the methods recommended in Managing Urban Stormwater: Soils and Construction: Volume 1 (Landcom 2004) and Volume 2D (DECC 2008). Sediment basins will have adequate capacity for at least a 5 day 85th percentile rainfall event. Consideration shall be given to increasing basin size at locations where sufficient space is available and / or topography does not constrain the basin size.	Pre-construction and construction	Contractor – DM	Best practice standards and specialist assessments MW RWMM WM1.3.1 MW RWMM WM2.3.3 MW RWMM WM2.5.2	All

ID	Measure / Requirement	When implement to	Responsibility*	Source document**	Area
SW14	The following dewatering hierarchy will be used when stormwater is captured in sediment basins: • maximise water reuse on site (e.g. dust suppression and material preparation) • irrigation dewatering methods to adjacent lands within the construction envelope • active discharge based on risk assessment, where reuse and irrigation options are not appropriate	Construction	Contractor – CM, S, SS	MW CoA 30(a)	All
SW15	Sprinkler irrigation systems shall be installed at each basin, on the spoil emplacement pads, in areas of rehabilitation and at the crushing and screening plant	Construction	Contractor – CM, S, SS	Project Requirement	All
SW16	Standpipes will be considered at operational (wetland) basins; at long-term (>12 months) sediment basins; and at high-risk short-term sediment basins.	Construction	Contractor – DM, CM	Project Requirement	All
SW17	Regular inspection and maintenance of (as required) erosion and sediment controls and chemical storage will be undertaken	Construction	Contractor – S, SS, EC	Best practice standards and specialist assessments / Project Requirement	All
Flooding					
SW18	Further consideration of flooding conditions and impacts, including flood modelling where necessary, will be undertaken to support future detailed design of both temporary and permanent works.	Construction	Contractor – DM	MW CoA 30 (d) MW REMM WM13	All
SW19	Where possible, stockpiles will be located where they are not exposed to concentrated of flood flow. Flood flow is defined as the 20% Annual Exceedance Probability (AEP) flood event.	Construction	Contractor – DM, CM	MW CoA 30 (d) EW REMM WM_2.3	All
SW20	Emergency flood response will be managed in accordance with the Natural Hazard Management Plan (S2-FGJV-ENV-PLN-0090).	Construction	Contractor – All	MW REMM WM14	All
SW21	Protocols will be developed for use and storage of plant, equipment and materials in flood prone areas commensurate with the frequency of inundation	Construction	Contractor – CM	EW REMM M1.13	All
Process water management					

ID	Measure / Requirement	When implement to	Responsibility*	Source document**	Area
SW22	A process water management system will be established to manage water during construction; and to supply water to construction activities. All surplus process water will be treated to meet the water quality specifications in Annexure A of this Plan and unless an environmental protection licence authorises otherwise, in compliance with Section 120 of the POEO Act. Process water discharges to watercourses will be avoided.	Construction	Contractor – DM	MW CoA 29 MW CoA 30(j) MW REMM WM10 MW RWMM WM2.7.1 MW RWMM WM2.7.6 EW REMM WM6.1	Tabingo Tantangara
SW23	A detailed design report and a commissioning report for the process water treatment plant will be submitted to the EPA in accordance with EPL 21266 Condition E1.	Construction	Contractor – DM, EM	EPL 21266 Condition E1	Tabingo Tantangara
SW24	The process water system will be designed and constructed to minimise stormwater ingress into the system to reduce the volume of water that requires management.	Construction	Contractor – DM	MW RWMM WM2.7.2 EW REMM WM621	Tabingo Tantangara
SW25	Where practical, the storage and handling of chemicals that have potential to contaminate the process water system will be undertaken in bunded areas.	Construction	Contractor – SS	MW RWMM WM2.7.3	All
SW26	The process water system will be designed to include the following system contingency measures: - water treatment plants will be designed to minimise the risk of complete failure by staging treatment plants (i.e. a treatment plant may include two or more treatment systems in parallel) and providing contingency storage. - water supply to TBMs will be temporarily decreased to reduce the volume of process water that is required to be dewatered from tunnel sumps. - where possible, process water will be transferred to a nearby treatment plant. - where practical and safe to do so, surplus process water will be stored in underground sumps. - the clean water storage tanks can be emptied and utilised to store untreated process water - process water treatment plants will be located at tunnel portals. Hence, only treated water will be reticulated to reservoirs. Any ruptures or leaks upstream of the water treatment plants will be captured in the tunnel portal water management system.	Construction	Contractor – DM	MW RWMM WM2.7.5	Tabingo Tantangara

ID	Measure / Requirement	When implement to	Responsibility*	Source document**	Area
SW27	All treated surplus process water will be discharged to Tantangara and Tabingo reservoirs via diffuser arrangements. Low velocity discharges will be avoided. Discharges to watercourses will be avoided.	Construction	Contractor – DM	MW CoA 30(k) MW RWMM WM2.7.7	Tabingo Tantangara
SW28	Surplus treated process water will not be discharged to the stormwater basins on site	Construction	Contractor – DM	MW CoA 30(l)	Tabingo Tantangara
SW29	Where practical, plant and equipment washdown will be undertaken in designated washdown bays or areas. Washdown water will be captured, treated and reused to minimise or avoid discharge to reservoirs.	Construction	Contractor – SS	MW RWMM WM2.7.4	All
Wastewater					
SW30	A wastewater management system will be established to manage effluent and grey water from construction compounds and accommodation camps. All wastewater will be treated to meet the water quality specifications provided in Annexure A of this Plan and unless an environmental protection licence authorises otherwise, in compliance with Section 120 of the POEO Act. Wastewater discharges to watercourses will be avoided. The wastewater (sewage) system will include emergency storage of untreated wastewater. The storage volume will be calculated at detailed design based on analysis of response times from regional waste management contractors to provide emergency trucking and offsite disposal options. All wastewater treatment plants will be designed to operate during winter when sub-zero temperatures can persist for extended periods of time.	Construction	Contractor – DM	MW CoA 29 MW CoA 30(j) MW REMM WM09 MW RWMM WM2.9.5 EW REMM WM7.5 EW REMM WM7.4	Tabingo/Lobs Holes Tantangara Marica
SW31	Detailed design report and a commissioning report for the wastewater treatment plant will be submitted to the EPA.	Construction	Contractor – DM, EM	EPL 21266 Condition E1	Tabingo Tantangara
SW32	The sewer system will be designed to restrict stormwater ingress into the wastewater system.	Construction	Contractor – DM	EW REMM WM7.1	Tabingo Tantangara
SW33	All wastewater produced (i.e. from showers, kitchens, laundries and toilets) will be directed to a wastewater treatment plant. All reticulation and storages will be designed to restrict stormwater and groundwater ingress into the wastewater system.	Construction	Contractor – DM	MW RWMM WM2.9.1 MW RWMM WM2.9.4	Tabingo/Lobs Holes Tantangara Marica
SW34	Water efficient fittings will be used to minimise wastewater loads.	Construction	Contractor – DM	MW RWMM WM2.9.2 EW REMM WM7.2	All

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ID	Measure / Requirement	When implement to	Responsibility*	Source document**	Area
SW35	Treated wastewater will be discharged to Tabingo and Tantangara reservoirs via diffuser arrangements. Low velocity discharges will be avoided. Discharges to watercourses will be avoided.	Construction	Contractor – DM	MW CoA 30(k) MW RWMW WM2.9.7	Tabingo Tantangara
Chemical control and spill management					
SW36	Emergency response to spills of oils and fuel etc will be managed in accordance with the Spill Response Procedure included in Annexure C of this plan.	Construction	Contractor – All	MW CoA 30(n) MW RWMW WM1.3.2 MW RWMW WM1.2.2 EW REMM WAT01	All
SW37	Construction vehicles and mechanical plant will be regularly maintained and checked for leakage of fuel and /or oils.	Construction	Contractor – All	MW CoA 30(n) MW RWMW WM1.3.2 MW RWMW WM1.2.2 EW REMM WAT01	All
SW38	Where possible, refuelling and maintenance of vehicles and mechanical plant will be undertaken at least 50m away from watercourses. A risk assessment that outlines suitable controls will be undertaken in the event that refuelling or maintenance is constrained to within 50m from a watercourse.	Construction	Contractor – S, SS, EC	EW REMM WAT01	All
SW39	Where practical, activities that have potential to contaminate stormwater runoff will be isolated from the stormwater system by covering (i.e. by a building or roof) and/or bunding.	Construction	Contractor – S, SS	MW CoA 30(n) MW RWMW WM2.3.1 EW REMM WM5.2	All
SW40	Emergency spill kits will be kept onsite. The spill kit must be appropriately sized for the volume of substances in use. All staff would be made aware of the location of the spill kit and trained in its use.	Construction	Contractor – CM, S, SS, EC	EW REMM WAT01	All
SW41	Fuels and chemicals will be stored in banded areas to prevent chemical spills or leakages in accordance with the relevant Australian Standards including: • ASNZS 4452:1997 The storage and handling of toxic substances, • AS1940 – 2017 The storage and handling of flammable and combustible liquids, and • Areas to be used for long-term storage and handling (i.e. those at a site compound or dedicated fuel storage area) of hydrocarbons and chemicals will be enclosed with concrete bunds or other suitably sealed bunding.	Construction	Contractor – S, SS,	MW CoA 30(n) MW CoA 30(p) ASNZS 4452:1997 AS1940 – 2017 EW REMM WAT01	All

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ID	Measure / Requirement	When implement to	Responsibility*	Source document**	Area
Access Roads					
SW42	Any existing access tracks that will no longer be required following the construction of the new access roads will be rehabilitated in accordance with the Rehabilitation Management Plan.	Construction	Contractor – CM, S, SS	MW RWMM WM2.4.1	All
SW43	All cut and fill batters will be stabilised as soon as practical following construction.	Construction	Contractor – S, SS	MW RWMM WM2.4.2	All
SW44	Roads surfaces will be constructed and maintained with aggregate material to reduce soil loss rates and water quality risks. The use of material that presents elevated water quality risks relative to other material available for road construction and maintenance will be avoided where practicable.	Construction	Contractor – CM	MW RWMM WM2.4.3	All
SW45	Where practical access roads will grade to table drains that are designed and constructed to have non-erosive hydraulic capacity for the 10% AEP event. Transverse (or cross drainage) will be constructed to have the following non-erosive hydraulic capacities: • Primary roads – 1% AEP event; • Maintenance roads – 2% AEP event; and • Temporary access roads – 10% AEP event.	Construction	Contractor – DM	MW RWMM WM2.4.4	All
SW46	Temporary roads will be rehabilitated as soon as they are no longer needed.	Construction	Contractor – CM	MW RWMM WM2.4.6	All
Accommodation Camps					
SW47	Where practical, the following source controls for the accommodation camps will be applied: • the storage and handling of chemicals that have potential to contaminate the stormwater system will be undertaken in bunded areas. Any liquid waste stream will be disposed to an appropriate facility; • landscaped areas will be predominately vegetated with endemic native vegetation; and • runoff from road and other hardstand areas will be treated in vegetated swales.	Construction	Contractor – DM	MW RWMM WM2.2.1	Lobs Hole Marica Tantangara

ID	Measure / Requirement	When implement to	Responsibility*	Source document**	Area
SW48	Runoff from accommodation camps will be managed by drainage systems that have a 20% AEP capacity. Overland flow paths will be provided as required.	Construction	Contractor – DM	MW RWMM WM2.2.2	Lobs Hole Marica Tantangara
SW49	Runoff from accommodation camps will be treated in either sedimentation or bioretention basins (also referred to as raingardens). The most appropriate control will be established at detailed design with consideration of topography, soil conditions and other relevant factors.	Construction	Contractor – DM	MW RWMM WM2.2.3	Lobs Hole Marica Tantangara
SW50	Low phosphorus products shall be used for washing activities controlled by site management (i.e. laundry services and mess hall) and encouraged (via training) for general use.	Construction	Contractor – CM, EM, EC	MW RWMM WM2.9.3 EW REMM WM7.3	Lobs Hole Marica Tantangara
Works on Waterfront Land and Instream Works (watercourse diversions and crossings)					
SW51	Unless permitted by this approval, avoid carrying out of any development within 40 metres of any watercourse	Construction	Contractor – CM	MW CoA 30(h)	All
SW52	All instream works or development within 40 metres of any watercourse will be undertaken generally in accordance with the requirements in the <i>Guidelines for Controlled Activities on Waterfront Land</i>	Construction	Contractor – CM, S, SS	MW CoA 30(i)	All
SW53	The temporary bridges at Yarrangobilly River and Wallace's Creek where feasible and reasonable, will be consistent with the Guidelines for Controlled Activities Watercourse Crossings (NRAR, 2018), <i>Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings</i> (Fairfull and Witheridge, 2003), <i>Policy and Guidelines for Fish Friendly Waterway Crossings</i> (NSW Fisheries, February 2004), and <i>Policy and Guidelines for Fish Habitat Conservation and Management</i> (DPI Fisheries, 2013). The permanent bridges at Yarrangobilly River and at Wallace's Creek will be designed and constructed to comply with the <i>Policy and Guidelines for Fish Habitat Conservation - Update 2013</i> (DPI 2013) and <i>Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings</i> (Fairfull and Witheridge 2003) and Guidelines for Controlled activities on Waterfront Land (NRAR, 2018).	Construction	Contractor – DM	EW CoA 39 EW CoA 40	All

ID	Measure / Requirement	When implement to	Responsibility*	Source document**	Area
SW54	ESCPs are to dictate the specific controls to be used on waterfront land. Typical measures include: • monitoring weather forecasts and taking appropriate action prior; • minimising the extent of work and the amount of time disturbance where possible; • isolating work areas from natural flows where possible; • stockpiles to be located outside of the waterfront area; • use of temporary ground covers in areas of concentrated flow to minimise erosion of exposed soils during rainfall; and • completing and stabilising works as quickly as possible after works are complete.	Construction	Contractor – CM, S, SS, EC	MW REMM WM04	All
SW55	The disturbance area and extent to which soil and vegetation within the riparian zone are disturbed will be minimised where practicable.	Construction	Contractor – S, SS	Project Requirement	All
SW56	Direct access to the rivers and creeks by construction vehicles and mechanical plant will be minimised and permitted only within the limits of clearing and designated areas of disturbance	Construction	Contractor – S, SS	Project Requirement	All
SW57	Erosion control matting or other practical methods will be used in the riparian zone to minimise sediment entering the river channel and provision of protection against scouring and erosion of the river bed.	Construction	Contractor – CM, S, SS	MW CoA 30(g)	All
SW58	Any watercourse that will be permanently diverted around permanent infrastructure will: • be a piped and/or surface drainage system; • be designed and constructed to have non-erosive hydraulic capacity and be structurally sound for the 1% AEP event; and • have adequate scour protection at the system inlets and outlets. A risk assessment will be undertaken to identify risks associated with by-pass flows that may occur as a result of system blockage or an event greater than the design event.	Construction	Contractor – DM	MW RWMM WM3.1.1 MW CoA 30(g)	All

ID	Measure / Requirement	When implement to	Responsibility*	Source document**	Area
SW59	Where practical, any watercourse that will be temporarily diverted will; • be a piped and/or surface drainage system; • be designed and constructed to have non-erosive hydraulic capacity and be structurally sound for a design event (that will be established by a risk assessment); and • have adequate scour protection at the system inlets and outlets. A risk assessment will be undertaken to identify risks associated with by-pass flows that may occur as a result of system blockage or an event greater than the design event.	Construction	Contractor – CM	MW RWMM WM2.1.1 MW CoA 30(g)	All
SW60	Where practical, temporary watercourse diversions will seek to avoid increasing flow rates in adjoining watercourses	Construction	Contractor – CM	MW REMM WM2.1.2 MW CoA 30(g)	All
SW61	Where practical, the permanent diversion of drainage lines or watercourses using contour drains will be avoided	Construction	Contractor – DM	EW REMM WM1.4	All
SW62	All culverts, bridges and service crossings will be designed by a suitably qualified professional in accordance with the relevant Austroads Guidelines or best practice methods.	Construction	Contractor – DM	MW REMM WM Instream works 1 and 2	All
SW63	Watercourses will be rehabilitated / reinstated in accordance with Rehabilitation Management Plan	Construction	Contractor SHL	MW RWMM WM2.1.3 MW REMM WM3.1.2	All
Stockpiling					
SW64	Temporary spoil stockpiles will be managed by ESCPs in accordance with the relevant requirements in the Managing Urban Stormwater: Soils and Construction guidance series and in accordance with the Stockpiling Procedure (Annexure C of the Spoil Management Plan)	Construction	Contractor – S, SS	MW CoA 7 EW REMM CON02	All
Design and construction of the intake structures					
SW65	This SWMP will be updated and submitted to DPHI prior to the construction of the intake structure.	Construction	Contractor – EM	CoA 30(g) Project Requirement	Talbingo Tantangara
SW66	The specifications and locations of the proposed environmental measures for the plug removal within the reservoirs will be determined as part of detailed design, including the installation of silt curtains. They will be designed such that water quality criteria is agreed with the regulators, with the application of a mixing zone if required.	Construction	Contractor SHL	MW REMM WM11	Talbingo Tantangara

ID	Measure / Requirement	When implement to	Responsibility*	Source document**	Area
SW67	Investigations to minimise the disturbance of bed sediments due to water flows during commissioning will be undertaken as part of detailed design. Potential measures to minimise the disturbance of bed sediments include: - investigate mitigated design measures; - dredging sediments from the potential disturbance zones and placing them in another part of the reservoir; and/or - armouring the sediments in the potential disturbance zones.	Construction	SHL	MW REMM WM12	Tabingo Tantangara
Monitoring					
SW68	A Surface Water Monitoring Program has been developed and is included in this plan. The Surface Water Monitoring Program (Annexure A) establishes monitoring requirements to assess the quality of discharge and receiving waters	Construction	Contractor – EM, EC	MW REMM WM02 EW REMM ECO15	All
SW69	Surface water extraction will be monitored and tracked against water access licence limits.	Construction	Contractor – CM, EC	Water Access Licence	Tabingo Tantangara
SW70	Rainfall forecasts will be monitored daily and the works planned, and the site works managed to minimise the potential impact of heavy rainfall and flood events. Prior to heavy rain events erosion and sediment controls will be reviewed and improved where necessary to minimise impacts.	Construction	Contractor – S, SS, EC	Best practice standards and specialist assessments	All
SW71	Erosion and sediment controls including clean water diversions will be inspected at least weekly (with maintenance and/or modifications made as necessary). Inspections and/or maintenance during wet-weather may be increased where necessary.	Construction	Contractor – SS, EC	Best practice standards and specialist assessments	All
SW72	A Trigger Action Response Plan provides detail of the response actions that will be implemented in the event of an exceedance. This plan will be implemented.	Pre-construction and construction	Contractor – All	MW CoA 31(c)	All

* Responsibility Regardless of the allocation of responsibilities within this plan, the responsible party is to be assigned in accordance with the Contract

**Source Documents
1. MW RWMM – Main Works Revised Water Management Measure (Main Works RTS Appendix J)
2. MW REMM – Main Work Revised Environmental Management Measures (Main Works RTS Appendix C)
3. CoA – Condition of Approval (SSI 9687)
4. EW REMM – Exploratory Works Revised Environmental Management Measures (Exploratory Works RTS Chapter 8)

Responsibility abbreviations
CM – Construction Manager, DM – Design Manager, EM – Environmental Manager, EC – Environmental Coordinator, S – Superintendent, SS – Supervisor, All – All personnel including subcontractors

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5.13. Risk and Contingency

The key risk to the successful implementation of measures identified in Table 5-3 have been categorised based on the management measure stream. Table 5-4 outlines these risks and discusses contingency measures to reduce these risks.

Table 5-4: Contingency Overview

Management measure stream	Risk	Contingency
Stormwater management	- stormwater management systems / controls not meeting predicted stormwater discharge quality characteristics. - sediment basins frequently over-topping - inadequate diversion of clean water or inclusion within system capacity - inadequate dewatering of captured stormwater	- design reviews - undertake monitoring in accordance with SWMP Annexure A. Implement TARP to identify investigate the exceedance mechanism - prior to heavy rain events, review erosion and sediment controls will be reviewed and make improvements where necessary to minimise impacts - seek advice from suitably qualified erosion and sediment control professional - Dewater in accordance with Basin Dewatering Procedure.
Flooding	flood areas not considered during detailed design	- design reviews - flood mapping extents to be reviewed during temporary and permanent designs - Natural Hazard Management Plan
Process and intercepted water management	- process water treatment plant does not meet water quality design specifications - process water treatment plant performance reduction or failure	- design reviews - contingency measures for emergency scenarios are identified in this plan. Only surplus treated water will be discharged to reservoirs. - continuous in-line monitoring of WTPs - undertake monitoring and implement TARP to identify and remediate the exceedance mechanism - Installation of additional facilities such as reverse osmosis plants, nitrogen removal plants etc

Management measure stream	Risk	Contingency
Wastewater	- wastewater treatment plant does not meet water quality specifications - wastewater treatment plant performance reduction or failure	- design reviews - wastewater system will include emergency storage of untreated wastewater. The storage volume will be calculated at detailed design based on analysis of response times from regional waste management contractors to provide emergency trucking and offsite disposal options. - all wastewater treatment plants will be designed to operate during winter when sub-zero temperatures can persist for extended periods of time. - Installation of additional facilities such as reverse osmosis plants, nitrogen removal plants etc - continuous in-line monitoring of WTPs - undertake monitoring in accordance with SWMP Annexure A. Implement TARP to identify and remediate the exceedance mechanism
Chemical control and spill management	- insufficient spill controls materials (i.e. absorbent pads, spill socks, etc) - inadequate size of chemical storage area	- undertake spill response equipment inspections to confirm that spill kits are adequately stocked and distributed - conduct training / toolboxes on response to spills (i.e. Annexure C spill procedure) - inclusion of designated chemical storage areas through design for proposed storage quantities
Access Roads	stormwater management systems / controls not meeting predicted stormwater discharge quality characteristics	- design reviews - undertake monitoring in accordance with SWMP Annexure A. Implement TARP to identify and remediate the exceedance mechanism
Accommodation Camps	stormwater management systems / controls not meeting predicted stormwater discharge quality characteristics	- design reviews - undertake monitoring in accordance with SWMP Annexure A. Implement TARP to identify investigate the exceedance mechanism
Works on waterfront land and instream works (watercourse diversions and crossings)	- weather, including flooding - inadequate staging of works	- design reviews - all culverts, bridges and service crossings will be designed by a suitably qualified professional in accordance with the relevant Austroads Guidelines or best practice methods - review and plan works according to weather - seek advice from suitably qualified erosion and sediment control professional - undertake monitoring in accordance with SWMP Annexure A. Implement TARP to identify investigate the exceedance mechanism

Management measure stream	Risk	Contingency
Dredging	in-effective or damaged silt curtain	- undertake monitoring in accordance with SWMP Annexure A. Implement TARP to identify and remediate the exceedance mechanism - silt curtain to remain in place until after completion of the works (when water quality sampling demonstrates that it is acceptable to do so)
Stockpiling / spoil emplacement	- stormwater management systems / controls not meeting predicted stormwater discharge quality characteristics. - sediment basins frequently over-topping - inadequate diversion of clean water or inclusion within system capacity	- design reviews - undertake monitoring in accordance with SWMP Annexure A. Implement TARP to identify investigate the exceedance mechanism - prior to heavy rain events, review erosion and sediment controls will be reviewed and make improvements where necessary to minimise impacts - seek advice from suitably qualified erosion and sediment control professional
Monitoring	- monitoring site access restrictions due to weather / safety issues - deficiencies in data management / quality assurance - monitoring program inadequate to detect water quality changes and sources / extents of events	- approved water monitoring program - monitoring, analysis and management of water quality data undertaken by trained professionals and according to relevant guidelines - calibration records - TARP training to be undertaken - periodic review of monitoring program to ensure effectiveness

6. COMPLIANCE MANAGEMENT

6.1. Roles and Responsibilities

FGJV's organisational structure and overall roles and responsibilities are outlined in Section 4 of the EMS. Specific responsibilities for the implementation of mitigation measures are detailed in Section 5 of this SWMP. Regardless of the allocation of responsibilities within this plan, the responsible party is to be assigned in accordance with the Contract.

6.2. Inspection

Inspection of water management measures will be undertaken regularly during construction in the form of weekly environmental inspections and rainfall inspections. All inspections will be internally recorded.

Any opportunities for improvement identified through the inspection process will be recorded in an inspection report (minor issues) in accordance with Section 8 of the EMS or an incident report completed in accordance with Section 7 of the EMS. Findings from inspection and incident report(s) will be reported to relevant agencies where required.

6.3. Monitoring

A surface water quality monitoring program (Annexure A) has been prepared in accordance with CoA 31 and REMM WM01 and will be implemented during construction. The monitoring aspects of the program are summarised in Table 6-1. Additionally, the water sampling and monitoring procedure is to be referred to during works.

Table 6-1: Surface Water Monitoring Overview

Monitoring Aspect	Objective
Routine receiving surface water quality monitoring	- inform and assess the performance of management processes/measures that seek to minimise the Project's impact on surface water quality - help determine source and extent of any water quality changes - collect baseline data to characterise water quality and determine site specific values
Event based wet weather overtopping water quality monitoring	
Streamflow monitoring Note: Details of this monitoring will be included in a future update to this SWMP.	inform and assess the performance of management processes/measures that seek to minimise the Project's impact on streamflow
Leachate detection programs for permanent and temporary spoil emplacement areas	- assess if leachate is being generated - inform management processes that seeks to minimise the Project's impact on surface and groundwater

The surface water monitoring program has been staged, such that initial monitoring focuses on current and impending construction activities, with further monitoring details to be added based on the timing of specific significant construction activities in the specific sites areas (e.g. sub-aqueous rock emplacement for Talbingo Reservoir, dredging/blasting in Talbingo and Tantangara reservoirs and tunnelling under the Plateau, refer to 1.7). Reporting of monitoring results will be in accordance with the details in this plan.

Surface water extraction from the reservoirs will be monitored and tracked against the Water Access Licence, as identified in Section 5 of the WMP.

6.4. Trigger Action Response Plan

6.4.1. Purpose

The purpose of a Trigger Action Response Plan (TARP) is to detail a standardised, response procedure in the event WQO or discharge characteristics are exceeded during a monitoring event for surface water quality monitoring. The TARPs aim to:

- Identify the potential cause of water quality variation;
- Identify the extent of water quality variation;
- Identify and implement potential management measures;
- Perform due diligence;
- Comply with NSW EPA issued Clean Up notice (December 2023); and
- Meet CoA, EPL 21266 and REMM requirements.

6.4.2. Objective

TARP's that have been prepared for the following situations:

- TARP-1: Monthly / Leachate Detection Procedure routine monitoring identifies receiving water quality exceedance against the relevant WQOs; and
- TARP-2: Stormwater controls (i.e. sediment basins) overtop. Stormwater controls are to be bench-marked against predicted stormwater discharge characteristics and the relevant WQOs.

At all times during construction, FGJV will lead the initiation of TARPs and implementation of corrective measures.

Table 6-2: Overview of Trigger Action Response Plans

TARP Type	Trigger	Objective
TARP 1 – Receiving water monitoring exceedance	If a WQO / latest LDP /monthly is exceeded in receiving waters.	To identify (where possible) if the exceedance is naturally occurring or potentially Project related.
TARP 2 – Stormwater overtopping event	If stormwater controls overtop	To establish actions to either improve water management or further investigate the exceedance mechanism.

6.4.3. Limitations

Response to comprehensive monitoring cannot be immediately implemented at the time of the monitoring event due to the delay in receiving laboratory results. Considering this, it is deemed appropriate that response actions based on comprehensive monitoring will be undertaken as soon as reasonably practicable.

A greater depth of understanding of water quality impacts and mechanisms can be gained from comprehensive monitoring. This information can then be applied to establish specific improvements to the water management system.

6.5. Training

All site personnel will undergo site induction training relating to water management issues. The induction training will address elements including:

- Sampling and monitoring training programs;
- Minimisation of water quality impacts to surface water; and
- Procedures required for reuse and discharge of water including incident response.

Targeted training in the form of toolbox talks or specific training will also be provided to personnel with a key role in water management. Examples of training topics include:

- Site specific water management requirements;
- Water extraction and treatment;
- Discharge quality parameters; and
- Erosion and sediment control implementation.
- Dewatering options

Further details regarding the staff induction and training are outlined in Section 5 of the EMS.

6.6. Auditing

Audits will be undertaken to assess the effectiveness of water management measures, and overall compliance with this SWMP. Audit requirements are detailed in Section 8.3 of the EMS.

6.7. Stakeholder Reporting

FGJV will provide the contents of all investigations, assessments and reviews to SHL who will subsequently report to all relevant stakeholders.

Table 6-3: Reporting Requirements

Report	Requirement	Recipient
Reporting		
Weekly inspection	<u>EMS Requirement</u> Weekly inspection report undertaken by environmental advisor which includes aspects relevant to the management of water	FGJV Internal Record
Incident Report	<u>Infrastructure Approval Schedule 4, CoA 6</u> The Proponent must notify the Department and NPWS via the Major Projects Portal immediately after it becomes aware of an incident on site. This notice must set out the location and nature of the incident.	Depending on the type and severity of the incident this may include notification to the Department and NPWS in writing for incidents defined under the conditions of approval, notification to the NPWS where required under the Deed of Agreement of Lease and notification to the EPA for pollution related incidents. SHL will notify DPHI in writing immediately after they become aware of the incident on site.
	<u>EPL 21266</u> Incident reports to be provided to EPA in accordance with EPL notification of environmental harm and written report requirements.	

Report	Requirement	Recipient
EPL Monitoring Reports and Annual Returns	<u>EPL 21266</u> EPL monitoring reports will be prepared in accordance with the requirements of the EPL. An EPL Annual Return will be prepared in respect of each EPL reporting period (typically 12 months)	SHL will issue to relevant stakeholders upon receipt of information from FGJV
Environmental Water Report (every 6 months)	<u>Infrastructure Approval Schedule 3, CoA 31(c)(d)</u> Commentary on the performance of the monitoring programs within the surface water management plan will be documented in the bi-annual environmental water report. Any incidents and key environmental issues will be documented.	Publicly available on project website
Other Aspects		
Updates to this Plan	<u>Section 1.8 of this WMP</u> This SWMP will be updated prior to the commencement of the following activities: - dredging, channel extraction or underwater blasting - in-reservoir emplacement works - Upon visual observation (undertaken by site environmental staff, during routine site inspections) of a noticeable change in streamflow for the purposes of determining need / location of streamflow monitoring sites - Snowy 2.0 operations (a separate SHL document or framework may be prepared)	Proposed future updates to this WMP will be provided to EPA, NPWS, Water Group, NRAR and NSW DPI.

ANNEXURE A – SURFACE WATER MONITORING PROGRAM



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MANAGEMENT PLAN

SNOWY 2.0 MAIN WORKS – SURFACE WATER MONITORING PROGRAM

S2-FGJV-ENV-PLN-0107

REV K

JANUARY 2026

ABSTRACT

The key objective of this Plan is to detail management measures and inform site procedures for implementation so that surface water impacts are minimised and within the scope permitted by the Infrastructure Approval.

Revision Record

Rev.	Date	Reason for Issue	Responsible	Accountable	Endorsed
K	03/02/2026	Updated to address NPWS and SHL comments	S. Lang	E. Porter	F. Lazzarin D. Drummond



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RACIE Record

R esponsible:	Name: Scott Lang Job Title: Environmental Coordinator Signed:  Carolina PP Date: 06 February 2026	
A ccountable:	Name: Ellen Porter Job Title: Environmental Manager Signed:  Ellen Porter Date: 06 February 2026	
C onsulted:	See distribution list on Page 3.	
I nformed:	See distribution list on Page 3.	
E ndorsed:	Name: Fabrizio Lazzarin Job Title: Project Director Signed:  Fabrizio Lazzarin Date: 06 February 2026	Name: David Drummond Job Title: QHSE Director Signed:  David Drummond Date: 06 February 2026

R	Responsible The person who actually produces the document.
A	Accountable The person who has the answer for success or failure of the quality and timeliness of the document.
C	Consulted Those who must be consulted before the document is published.
I	Informed Those who must be informed after the document is published.
E	Endorsed Those who must approve the document before publication.

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Revision Tracking

Rev.	Date	Description of Revision
A	29.11.2019	Initial draft for SHL review
B	2.06.2020	Revised to address Infrastructure Approval
C	15.06.2020	Revised to address SHL comments. For consultation.
D	25.06.2020	Revised to address Commonwealth conditions of approval
E	06.08.2020	Revised to address stakeholder comments
F	19.09.2020	Revised to address DAWE and DPIE comments
G	14.01.2021	Reviewed for currency
H	17.08.2022	Revised to include EPL updates
I	14.02.2023	Revised to address SHL comments.
J	31.07.2025	Updated for currency
K	03.02.2026	Updated to address NPWS and SHL comments

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1. INTRODUCTION

1.1. Context

This Surface Water Monitoring Program (Program) forms part of the Surface Water Management Plan (SWMP), Water Management Plan (WMP) and Environmental Management Strategy (EMS) for construction of Snowy 2.0 Main Works (the Project).

The Program addresses the requirements of the Minister's Conditions of Approval (CoA) as approved on 21 May 2020, the Main Works Snowy 2.0 Environmental Impact Statement (EIS), the revised environmental management measures (REMM) within the Snowy 2.0 Main Works - Preferred Infrastructure Report and Response to Submissions (EMM 2020), and all applicable guidance and legislation.

On December 16, 2024, Modification 3 (SSI-9687-MOD-3) received approval, authorizing the construction of an additional adit at Marica West. This new adit will enable the launch of a fourth tunnel boring machine, specifically to expedite the excavation of a section of the HeadRace Tunnel (HART) that traverses the Long Plan Fault Zone (LPFZ). While the Marica camp upgrade will increase water demand, the project scope includes doubling the capacity of both the Potable Water Treatment Plant (PWTP) and the Sewage Treatment Plant (STP). These expansions, supported by existing monitoring systems, ensure that the water infrastructure can fully accommodate the increased camp population and expanded workfronts.

1.2. Scope

The scope of this Program is to describe how Future Generation Joint Venture (FGJV) will monitor the extent and nature of potential impacts to surface water during construction of the Project. Operational monitoring and operation measures do not fall within the scope of the construction phase and therefore are not included in the processes contained within the Program. Groundwater monitoring is also out of scope for the Program and is covered in detail in the Groundwater Management Plan.

The Program provides details on the following elements:

- performance criteria and their assessment;
- type and frequency of monitoring;
- analytes to be monitored; and
- surface water monitoring sites.

This Program has been developed based on the level of risk, informed by the RTS Revised Water Management Report (EMM, 2020) and as such is predominantly focused on surface water quality.

As the Main Works EIS Flood Risk Assessment (EMM, 2019) identified, the key residual flood risk during construction will be the effective evacuation of the construction workforce in the event of a major flood occurring. Precautionary measures (such as weather monitoring) and evacuation procedures will be undertaken in accordance with the Natural Hazard Management Plan (S2-FGJV-ENV-PLN-0090). Given the EIS assessment, this Program has not identified flood criteria for remedial action.

Streamflow is maintained by discharges from the groundwater system (i.e. baseflow) and quick flow will only occur following significant rainfall events. As there is a long lead time before any impacts are predicted to streamflow and that it is likely that these impacts will be indiscernible in the observed data considering the interannual variability in flow, the need and location for streamflow monitoring

sites and criteria will be reviewed based on additional groundwater monitoring data (refer Section 1.4).

1.3. Purpose and objectives

This Surface Water Monitoring Program is developed in accordance with schedule 3, condition 31 and REMM WM01. It will be implemented throughout the Main Works construction phase to generate essential data and information, enabling effective management and minimisation of the Project’s impact on surface water

The objectives of the Program are to:

- monitor surface water quality at strategic locations to identify any impacts directly attributable to the Project;
- where a change in water quality is detected and exceeds relevant criteria, collect data to help identify the source of the change (via Trigger Action Response Plans);
- continue to collect baseline data (upstream of disturbance areas and in unimpacted disturbance areas) to characterise background water quality for project areas where site-specific WQOs are needed; and
- regularly inspect Project aspects that have the potential to impact on surface water quality and maintaining these elements where required.

1.4. Staging

This Program contains monitoring details for surface water at the following sites:

- Lobs Hole;
- Marica;
- Plateau;
- Rock Forest;
- Talbingo; and
- Tantangara.

Some distinct work activities require greater detail prior to commencement. Consequently, this Program will be updated and submitted to DPIE prior to the commencement of specific activities as detailed in Table 1-1

Table 1-1: Activities that require update to the SWMP

Activities	Timing
Dredging, channel extraction or underwater blasting	A Dredge Management Plan will be developed in consultation with EPA, NPWS, Water Group, NRAR, NWS DPI, NSW Maritime and for approval by DPIE. The Dredge Management Plan will be developed and approved prior to dredging channel extraction or underwater blasting. During dredging and other in reservoir works, adjacent reservoir monitoring points will be monitored weekly for visual and basic analytes (see Table 3-2).
Permanent in-reservoir emplacement areas	This Program will be updated prior to in-reservoir emplacement and will include verification monitoring.

Construction works in the third year for the purposes of determining need/location streamflow monitoring sites	This Program will be updated in the third year of construction to determine the need for surface water flow monitoring sites and if necessary, suitable locations to monitor potential streamflow impacts (based on additional groundwater monitoring data / revised drawdown predictions).
Operation of Snowy 2.0 Project, including dewatering of the tailrace tunnel during operations.	Operation will be addressed through a separate SHL framework or document.

1.5. Responsibility

FGJV's organisational structure and overall roles and responsibilities are outlined in Section 4 of the EMS.

1.6. Consultation

In accordance with schedule 3, condition 31 of the Infrastructure Approval and revised environmental management measure (REMM) WM01, the WMP (which includes this SWMP) is to be prepared in consultation with;

- NSW Environment Protection Agency (EPA);
- National Parks and Wildlife Services (NPWS);
- NSW Department of Industry – Water (Water Group);
- Natural Resources Access Regulator (NRAR); and
- NSW Department of Primary Industries (NSW DPI).

In accordance with condition 18 of the Commonwealth approval, the WMP (including this SWMP) is also to be prepared in consultation with the DCCEE.

A summary of the consultation undertaken is included in the SWMP.

2. PERFORMANCE CRITERIA

Two types of performance criteria are applied to assess water quality – water quality objectives and discharge criteria. Water quality objectives are applied to receiving waterbodies and are described in Section 2.1. Discharge characteristics are applied to discharge waters prior to and/or during their discharge to receiving waters, and are described in Section 2.2 for treated waste water and process water discharges and Section 0 for stormwater discharges.

2.1. Water quality objectives

Waterbodies potentially impacted by Snowy 2.0 Main Works are within the ‘Murrumbidgee River and Lake George catchment’. Tantangara and Talbingo reservoirs and watercourses within the Lobs Hole, Marica and Plateau areas are classified as ‘streams affected by the Snowy Scheme’. Watercourses within Rock Forest are classified as ‘uncontrolled streams’.

The approach for assigning Water Quality Objectives (WQOs) for watercourses and reservoirs is based on the *NSW Water Quality and River Flow Objectives* (DECCW 2006) and is presented in Table 2-1. The approach and default WQOs provided in DCCEEW (2006) are based on the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ 2000). WQOs are assigned based on the type of waterbody and existing ecosystem condition. The approach is essentially the same as that recommended in the recently updated Guidelines for Fresh and Marine Water Quality (ANZG 2018); however, reference to ANZECC/ARMCANZ (2000) has been retained because the updated Guidelines (ANZG 2018) have not yet been formally captured by water quality policy in NSW.

The DCCEEW (2006) approach encourages the derivation of local, or site-specific, trigger values (SSTVs) to use as WQOs in preference to the default WQOs. Although baseline water quality datasets for sites on Yarrangobilly River and Talbingo Reservoir are approaching or have met the minimum requirement (monthly data for 24 months) for deriving SSTVs, the ability to derive SSTVs in the near-term is compromised due to the following two issues: (i) insufficient data for wet weather water quality; and (ii) the impact that the January 2020 bushfire has had on local ambient water quality. Bushfires are known to impact water quality and such impacts have been observed in the Yarrangobilly River since the 2020 bushfire. A brief review of the potential impacts of bushfires on water quality is provided in Attachment A. Until sufficient representative data can be obtained, it would not be appropriate to derive SSTVs. Hence, until SSTVs can be derived, the default WQOs presented in Table 2-2: continue to be applied to characterise and assess receiving water quality during construction phase. The default WQOs are consistent with those presented in the Snowy 2.0 Main Works revised Water Management Report (Appendix J of EMM 2020).

Despite the current baseline data limitations, the ability to derive SSTVs will continue to be reviewed.

When limitations are overcome, SSTVs may be developed and presented in a future update to this SWMP. Regardless of whether WQO or SSTV are in place, the management approach to surface water shall remain consistent with management principles and management measures identified in Section 5 of the SWMP.

Table 2-1: Summary of approach for assigning water quality objectives (from Main Works EIS, Appendix J)

Waterbody type	Project area	Ecosystem condition	Ecosystem condition justification	Proposed WQO approach	Default WQOs
Watercourses	Lobs Hole	High conservation	- Watercourses are located within KNP. - A number of watercourses provide relatively undisturbed aquatic and riparian habitat – non-native species of fish (brown trout and rainbow trout) are abundant, but there are climbing galaxias, Murray crayfish and other native species in the river.	Physical and chemical stressors – no change to natural variability Toxicant trigger values for the protection of 99% of aquatic species	Default trigger values for upland rivers in South Eastern Australia
	Marica				Toxicant trigger values for the protection of 99% of freshwater aquatic species
	Plateau				
Reservoirs	Rock Forest	Slightly–moderately disturbed	- The area adjacent to, and downstream of Main Works has been predominantly cleared for grazing. - Instream farm dams located upstream of Rock Forest have modified flow regimes within the primary watercourses.	Physical and chemical stressors – some change to natural variability acceptable Toxicant trigger values for slightly to moderately disturbed ecosystems	Default trigger values for upland rivers in South Eastern Australia
	Tantangara Reservoir				Toxicant trigger values for slightly to moderately disturbed ecosystems
	Talbingo Reservoir				Default trigger values for freshwater lakes and reservoirs in South Eastern Australia
Reservoirs		Slightly–moderately disturbed	- The reservoirs are artificial waterbodies created by flooding natural river valleys in the 1960s to 1970s. - Water levels in the reservoirs are not natural, being controlled for electricity generation as part of the Snowy Scheme. - The reservoirs support low biodiversity, consistent with their relatively recent construction and its largely homogeneous bed habitat.	Physical and chemical stressors – some change to natural variability acceptable Toxicant trigger values for slightly to moderately disturbed ecosystems	Toxicant trigger values for slightly to moderately disturbed ecosystems

Table 2-2: Water Quality Objectives for receiving waters (source: Appendix J of EMM 2020)

Category	Analyte	Unit	Water quality objective	
			Watercourses	Talbingo and Tantangara Reservoirs
Physico-chemical Properties	pH		6.5-8.0 ¹	6.5-8.0 ¹
	Electrical conductivity (EC)	µS/cm	30-350 ¹	20-30 ¹
	Turbidity	NTU	2-25 ¹	1-20 ¹
	Dissolved oxygen (DO)	%	90-110 ¹	90-110 ¹
	Suspended solids	mg/l	No objective	No objective
	Total hardness (as CaCO ₃)	mg/l	No objective	No objective
Nutrients	Total ammonia (NH ₄ ⁺)	µg/l	13 ¹	10 ¹
	Oxidised Nitrogen (NO _x)	µg/l	15 ¹	10 ¹
	Total Nitrogen (TN)	µ/l	250 ¹	350 ¹
	Total Kjeldahl nitrogen	µg/l	No objective	No objective
	Filterable Reactive phosphorus (FRP)	µg/l	15 ¹	5 ¹
	Total Phosphorus (TP)	µg/l	20 ¹	10 ¹
Inorganics (dissolved)	Cyanide	mg/l	0.004	0.007
Metals and metalloids (dissolved) ²	Aluminium (Al)	µg/l	27	55
	Arsenic (As) ⁴	µg/l	5	13
	Total Chromium (Cr) ⁵	µg/l	0.01	0.01
	Copper (Cu)	µg/l	1.0	1.4
	Manganese (Mn)	µg/l	1200	1900
	Nickel (Ni)	µg/l	8	11
	Lead (Pb)	µg/l	1	3.4
	Silver (Ag)	µg/l	0.02	0.05
	Zinc (Zn)	µg/l	2.4	8
	Iron (Fe) ³	µg/l	300	300

- Note
1. The WQOs for physico-chemical properties and nutrients refer to the trigger values for physical and chemical stressors in south-east Australia (for upland rivers or freshwater lakes and reservoirs), as reported in Tables 3.3.2 and 3.3.3 of ANZECC/ARMCANZ (2000).
 2. The WQOs for metals and metalloids are based on the trigger values for 99% or 95% species protection from ANZECC/ARMCANZ (2000), applied according to the approach outlined in Table 2-1
 3. WQO is based on a low reliability trigger value.
 4. For As (V).
 5. For Cr (VI).

2.2. Discharge characteristics

2.2.1. Treated wastewater and process water

Licensed sampling locations in accordance with the Project EPL 21266 will be provided for in both Talbingo and Tantangara reservoirs for the effluent waste streams from the wastewater and process water treatment plants (STP and PWTP respectively). These two waste streams will be combined prior to discharge to the receiving environments such that there will be only one discharge point in each reservoir.

In April 2021, the Talbingo wastewater and process water monitoring and discharge locations were included in the Project EPL, following EPA review of the Lobs Hole Sewerage Treatment Plant Design Report and the revised Waste and Process Water Mixing Zone Assessment (RHDHV, 2021). These points include:

- EPL 41 – the final Lobs Hole STP and PWTP effluent quality monitoring point;
- EPL 42 – the diffuser outlet discharging into the Talbingo Reservoir;
- EPL 43 – the final Lobs Hole STP and PWTP final volume monitoring point;
- EPL 44 – the Lobs Hole PWTP inflow volume monitoring point;
- EPL 45 – the Lobs Hole Exploratory Camp STP inflow volume monitoring point; and
- EPL 47 – the Talbingo Main Camp STP inflow monitoring point.

In May 2022, the Tantangara wastewater and process water monitoring and discharge locations were included in the Project EPL. These points include:

- EPL 46 – the diffuser outlet discharging into the Tantangara Reservoir;
- EPL 48 – the Tantangara STP inflow volume monitoring point;
- EPL 49 – the Tantangara PWTP inflow volume monitoring point;
- EPL 50 – the final Tantangara STP/PWTP effluent quality and volume monitoring point;
- EPL 51 – the surface water monitoring point, downstream of the Tantangara diffuser outlet.

Predicted characteristics for the combined waste discharge stream prior to discharge are shown in Table 2-3. Table 2-3 has been amended to reflect the revised Waste and Process Water Mixing Zone Assessment, updated to reflect engineering design refinements and resulting changes to the proposed volumes of water to be treated and discharged to the reservoirs. The revised assessment resulted in either no change or an improvement in discharge characteristics and resulting dilution factors.

These characteristics are based on the water quality of the combined waste streams estimated for the treated process water and wastewater mixing zone assessment). They reflect the median water quality values reported in revised Waste and Process Water Mixing Zone Assessment, adjusted to account for the relative proportions of each of the waste streams contributing to the combined discharge.

Discharge characteristics will be updated where detailed design specifications indicate different characteristics, noting that specifications need to be such that the WQOs will be met in the receiving environment wherever possible. Updating of the discharge characteristics will be done in consultation with SHL and regulators.

Beyond the discharge point to the reservoirs, the effect of the combined (treated) waste stream on receiving water quality will be monitored against the WQOs in Table 2-2: at the relevant receiving water monitoring locations (see section 3.2).

Table 2-3: Predicted major water quality characteristics of combined treated wastewater and process water discharge (source: RHDHV, 2021)

Analyte	Units	Discharge characteristics ¹		Comments
		Talbingo	Tantangara	
Electrical conductivity	µS/cm	700	168	The treatment processes will not remove dissolved solids. Hence, water salinity will not be reduced by the treatment process.
pH	-	6.5-8.5	6.5-8.5	Alkalinity and pH will be adjusted as part of the treatment processes
Turbidity	NTU	<25	<25	Suspended solids and turbidity will be substantially reduced as part of treatment processes
Total nitrogen	mg-N/L	0.26	0.25	Nutrients will be substantially reduced by the treatment processes.
Total phosphorus	mg-P/L	0.023	0.02	

Note 1. Values represent an average of the likely medians for treated wastewater and process water, weighted according to the proportional volume of each discharge contributing to the combined discharge, as reported in Attachment F of the revised Water Management Report (EMM 2020).

EPL 21266 includes concentration limits for EPL monitoring point 41 and 50, the final Lobs Hole and Tantangara Effluent Quality Monitoring Points respectively, prior to discharge to Talbingo Reservoir. Table 2-4 below details the EPL 41 and EPL 50 concentration limits.

Table 2-4: EPL 41 and EPL 50 concentration limits (source: EPL 21266)

Analyte	Units	90% concentration limit	100% concentration limit
BOD	mg/L	1	5
Electrical conductivity	µS/cm		700 (EPL 41) 200 (EPL 50)
Faecal Coliforms	Colony forming units per 100 millilitres	10	100
Nitrogen milligrams per litre 0.2 2 (ammonia)	mg/L	0.2	2
Nitrogen (total)	mg/L	0.35	
Oil and Grease	mg/L	2	5
pH	pH		6.5 – 8.5
Phosphorous (total)	mg/L	0.1	0.3
Total suspended solids	mg/L	5	10

In January 2022, the Project EPL was varied to increase discharge volume limit at point 41 and 50 from 1.66 ML/day to 4.32 ML/day and to include a discharge flow rate limit of 50 L/s.

2.2.2. Stormwater discharges

Stormwater includes water in sediment basins or in swale drains and other erosion and sediment control structures in locations where sediment basins are unable to be installed (e.g. access roads in steep terrain). The predicted discharge characteristics of stormwater are shown in Table 2-5.

The Snowy 2.0 Main Works revised Water Management Report (Appendix J of EMM 2020) listed predicted discharge water quality for at least six different Main Works activities (referred to in the RTS as Water Management Categories), such as Phase 1 Minor works and Major works and Phase 2 accommodation camps, construction pads, access roads and large temporary stockpiles. Predicted water quality for these activities varied for some of the analytes, however, a number of these activities will often co-occur and will drain to common sediment basins. Therefore, it is not possible to specifically assess stormwater discharge water quality for each of the different types of activities. Consequently, the discharge characteristics specified for Phase 1 Minor works and Major works have been adopted (Table 2-5), which encompass the range of discharge characteristics for the other specific Main Works activities. The rationale for selection of the predicted discharge characteristics is detailed in the revised Water Management Report (Appendix J of EMM 2020; see Table A.4). Briefly, the predicted discharge characteristics were based on three rounds of wet weather monitoring of runoff from existing disturbed areas (existing access tracks and areas disturbed by historic construction and mining activities) undertaken as part of the Snowy 2.0 baseline monitoring. A total of 30 disturbed area runoff samples and 20 receiving water samples were collected across Lobs Hole, Marica and Tantangara compound. The water quality treatment benefits of the proposed stormwater management measures, including results from laboratory jar tests, were also taken into account when predicting discharge characteristics. The predicted discharge characteristics will be validated against actual stormwater quality monitoring data and updated as necessary (see section 3).

Stormwater captured as part of erosion and sediment controls will primarily be managed via re-use on site (e.g. for dust suppression, irrigation to natural vegetation and rehabilitated areas) in order to minimise the need to discharge to receiving waters. Discharges from sediment basins may occur under the following situations: (i) passive discharge (i.e. via overflow) during a rainfall event that exceeds the sediment basin design capacity, and (ii) active discharge (i.e. via pumping) under a discharge permit, for example, where a significant rainfall event is imminent, other water management measures are insufficient to maintain basin capacity, and the basin water quality is deemed of sufficient quality to discharge. In the event of passive or (approved) active basin discharges, TARP-2 will be invoked. Briefly, if the stormwater reaches receiving waters, the discharge water at the overflow location will be monitored for pH and turbidity and compared to the discharge characteristics shown in Table 2-5. If one or both of these parameters is exceeded, all the analytes listed in Table 2-5 will be measured, while receiving water quality upstream and downstream of the stormwater discharge will be measured and monitored against the WQOs in Table 2-2; at the nearest upstream and downstream receiving water monitoring sites, allowing for a sufficient mixing zone prior to the downstream site.

Where active discharge is required, pH buffers may be applied to sediment basins following site specific risk assessments and flocculants may be applied following consultation with NSW EPA.

The water quality (pH and turbidity) of over-topping stormwater will be compared with the discharge characteristics to assess whether the controls are achieving the predicted water quality. Due to a general lack of significant rainfall events during the Exploratory Works, there have been limited opportunities to undertake this comparison. Hence, this process will continue during the Main Works period until sufficient data exist for an appropriate validation to be undertaken. The aim is to ensure that stormwater discharge characteristics are well understood and that the erosion and sediment controls are sufficient to ensure that discharge quality is such that WQOs are met in the receiving

environment wherever possible. These refinements to discharge characteristics, along with any recommendations will be included in updates to the SWMP.

Table 2-5 Predicted discharge quality characteristics of stormwater (source: Appendix J of EMM 2020)
1

Analyte	Units	Discharge characteristics ¹	
		Likely range ²	Likely median ³
pH	-	4.0 – 8.0	4.5
Turbidity	NTU	100 – 1000	250
Suspended sediment	mg/L	25 - 300	50
Electrical conductivity (EC)	µS/cm	No values provided	
Total nitrogen (TN)	mg/L	0.1 – 5.0	0.8
Total phosphorus (TP)	mg/L	0.01 – 1.0	0.15
Oil and Grease	mg/L	No visible oil and grease	
Dissolved aluminium ^{4,5,6}	µg/L	0 – 50 x WQO	10 x WQO
Dissolved copper ^{4,5,6}	µg/L	0 – 500 x WQO	7 x WQO
Other dissolved metals	mg/L	WQOs occasionally exceed	< WQOs

- Note*
1. The values presented capture the range of predicted stormwater qualities from across a range of Main Works activities, including Phase 1 minor works and major works and Phase 2 works such as access roads, construction pads and accommodation camps to support construction activities.
 2. Likely range refers to the estimated range of concentrations that could occur during typical discharge conditions. Attachment A of the revised Water Management Report (EMM 2020) describes the supporting information and assumptions that were applied to establishing these values.
 3. Likely median refers to a conservative estimate of typical or median values in discharge from a project level water management category. Attachment A of the revised Water Management Report (EMM 2020) describes the supporting information and assumptions that were applied to establishing these values.
 4. Aluminium and copper are the metals most likely to be elevated above WQOs, due to naturally elevated levels in soils in some areas.
 5. Default trigger values for 99% level of species protection apply as WQOs. Refer to Table 2-2 for relevant values.
 6. Concentrations of metals/metalloids refer to laboratory analysis of a 0.45 µm field filtered sample. Some of the metal concentration may be mineral or organic bound and may have lower ecotoxicology risks than similar concentrations of dissolved metals.

2.2.3. Treated Water Reuse

In May 2021, Arcadis undertook an investigation of the opportunities to reuse treated effluent within the Project boundary. The investigation included a risk review of the permissibility of using treated effluent against the Project Approval, environment and human health legislation and guidelines. The review identified that the reuse of treated effluent for construction activities presents a low risk to environmental and human health given:

- The treatment process and resulting water quality;
- The adoption of management and monitoring measures; and
- Existing monitoring programs contained in the Project's management plans.

Table 2-6 outlines the baseline discharge quality targets for reuse activities. In the interim, site-specific reuse is managed under existing supplementary permit conditions to address current water management requirements. These conditions ensure that reuse criteria are maintained at conservative levels while an investigation into site-specific criteria progresses. While current values align with the 'low strength effluent' classification (DEC 2004), the project is conducting a comprehensive review of reuse criteria to ensure the final framework reflects actual operational requirements and optimized permit conditions.

Table 2-6 Expected treated effluent water quality

Analyte	Units	Expected discharge quality
Electrical conductivity	µS/cm	TBC
pH	-	6.5 – 8.5
Turbidity	NTU	10
Suspended solids	mg/L	5
Oil & Grease	mg/L	5
Biological oxygen demand	mg/L	0.82
Ammonia	mg-N/L	0.18
Total nitrogen	mg-N/L	10.89
Total phosphorus	mg-P/L	1.5
E-coli	cfu/100 mL	<1
Enterococci	cfu/100 mL	<1
Protozoans	cfu/100 mL	<1
Metals and toxicants (dissolved)	-	TBC

* This section is subject to change as an ongoing investigation progresses.

3. MONITORING PROGRAM DETAILS

3.1. Sampling framework

Surface water monitoring for discharges and receiving waters will be undertaken based on the framework defined in Table 3-1. The sampling framework comprises a combination of waterbody type, sampling frequency/event type and analysis suite. Sample collection will comply with the NSW EPA's Approved Methods for the Sampling and Interpretation of Results of Water Pollutants in NSW.

Table 3-2 describes proposed sampling analytes and analysis methods. Each monitoring event will record the date, time, weather conditions, location, visual appearance of water, recent rainfall and the sampling field readings based on monitoring type. It is noted that receiving waterway water monitoring will be located more than 10m from any discharge location to ensure monitoring is undertaken outside of any mixing zone.

Details of the surface water component of the spoil emplacement area Leachate Detection Programs are provided in Section 3.3.

Table 3-1: Surface water monitoring sampling framework

Waterbody type	
Discharge water	Discharges from sediment basins and wastewater and process water treatment plants
Receiving water	Watercourses and reservoirs
Sampling frequency / event type ¹	
Continuous	Monitoring equipment installed long-term within a waterway with data collected at available intervals from the commencement of construction

Daily	Monitoring undertaken on a daily basis
Weekly	Monitoring undertaken on a weekly basis,
Monthly	Monitoring undertaken on a monthly basis
TARP-1	Monitoring undertaken as part of TARP-1 (see Section 6), in response to exceedances of receiving water quality against relevant WQOs (Table 2-2).
TARP-2	Monitoring undertaken as part of TARP-2 (see Section 6), in response to over-topping/discharge of stormwater from sediment basins.
TARP – Tantangara (S2-FGJV-ENV-0472) and Talbingo (S2-FGJV-ENV-PLN-0392) Intake works	Monitoring undertaken as part of TARP (Talbingo and Tantangara Management Plan), in response to water quality exceedances within the reservoir 50m downstream of the outermost silt curtain.
Analysis suite	
Visual	Site observations as shown in Table 3-2. Turnaround time: same day.
Basic	Site observations and the basic water quality parameters shown in Table 3-2, via in situ measurement. Turnaround time: same day.
Comprehensive	The comprehensive water quality parameters shown in Table 3-2, via a combination of in situ measurement and field grab samples with laboratory analysis. Turnaround time: same day for in situ; within 2 weeks for laboratory analysis.

Note 1. All sampling will be subject to work health and safety assessments to ensure worker safety at all times.

Table 3-2: Proposed sampling analytes and analysis method for surface water monitoring

Category	Monitoring analytes	Analysis method
Visual		
Visual inspection	Gross water quality indicators – e.g. visible oil and grease, turbidity plumes Management measures – e.g. erosion and sediment controls, downstream drainage and clean water diversion	Visual inspection
Basic		
Visual inspection	Visible oil and grease	Visual inspection
Physico-chemical Properties	pH, electrical conductivity and turbidity	Measured in situ using a hand-held water quality meter and/or in situ water quality probes
Comprehensive		
Physico-chemical Properties	pH, electrical conductivity, turbidity, dissolved oxygen, temperature and redox potential	To be measured using a portable water quality meter in the field
	Total suspended solids, total hardness	Analysis to be undertaken by a NATA certified laboratory
Oil and grease	Oil and grease	
Nutrients	Total nitrogen, ammonia, oxidised nitrogen and total Kjeldahl nitrogen Total phosphorus and reactive phosphorus	
Metals (dissolved)	Al, As, Ag, Cr (total), Cu, Fe, Mn, Ni, Pb and Zn	
Non-metallic inorganics	Cyanide	

3.2. Surface Water Monitoring Sites

Monitoring will be undertaken in accordance with EPL 21266 and supplemented for Main Works activities where necessary. Proposed monitoring sites have been identified and listed according to the following Main Works activity areas:

- Talbingo Reservoir;
- Lobs Hole;
- Marica;
- Plateau;
- Tantangara Reservoir; and
- Rock Forest.

The monitoring program is based on assessing water quality associated with current or imminent construction activities and will be staged such that additional monitoring sites and details will be added in advance of the commencement of additional activities (e.g. sub-aqueous rock emplacement, dredging, blasting). The exact location of some sites may be updated where disturbance areas and discharge locations are changed, or for safe access reasons. All changes

and additions to the monitoring sites during construction would be approved by SHL and EPA prior to implementation and updated in subsequent revisions of the water quality monitoring program and EPL 21266.

Baseline water quality was assessed as part of the Main Works EIS and, to a lesser extent, since the EIS. The monitoring site network includes some sites for continued collection of baseline water quality data in order to inform TARP processes (i.e. for identifying sources of water quality exceedances). Although baseline data collection specifically for the purposes of deriving site-specific WQOs has not been incorporated in the monitoring program, site-specific WQOs may be proposed for implementation when and where there are sufficient representative data to do so.

The monitoring network encompasses both sites specified in EPL 21266 (EPL sites) and investigation sites for Trigger Action Plan (TARP) investigations (refer to section 6). TARP-1 sites will be sampled in the event of an exceedance of a WQO during routine monthly sampling, while TARP-2 sites will be sampled in the event that a sediment basin is over-topping or needs to be discharged and the discharge water is or will reach the watercourse. TARP sites are used to help identify the source of an exceedance as well as the spatial extent of an exceedance (see Section 6).

3.2.1. Talbingo Reservoir

Monitoring in Talbingo Reservoir is for the purpose of water quality change detection associated with various construction activities occurring in and also upstream of Talbingo Reservoir (e.g. rock emplacement areas, barge launch area, Talbingo intake, water treatment plants, accommodation camp, access roads). The key water quality issues are treated wastewater and process water discharge, runoff and seepage from the excavated rock emplacement area, stormwater discharges and disturbances from in-reservoir blasting and dredging.

A Dredge Management Plan will be developed in consultation with EPA, NPWS, Water Group, NRAR, NWS DPI, NSW Maritime and for approval by DPHI. The Dredge Management Plan will be developed and approved prior to dredging channel extraction or underwater blasting.

During dredging and other in reservoir works, adjacent reservoir monitoring points will be monitored weekly for visual and basic analytes (see Table 3-2).

3.2.1.1. Receiving waters

Monitoring of receiving waters is undertaken across the Project as part of the Main Works Phase. The governance mechanism is captured within EPL 21266 through identification of all monitoring locations, monitoring frequencies and analytical expectations. This document includes numerous downgradient receptor monitoring locations identified for their suitability to measure any conditional changes or possible impacts to the receiving waterbodies as a result of Project activities.

The nature and scale of the Project works is understood to require a robust and dynamic system of management to allow for the addition of monitoring locations or amendments to monitoring requirements in line with the developing Project stages.

Examples of dynamic management are best portrayed through the planned amendments to monitoring systems and locations to increase assurance during in-reservoir placement works (e.g. Talbingo Placement works). Table 3-3 and Figure 3-1 comprise a list of receiving water monitoring locations currently

Table 3-3: Receiving water monitoring site details, Talbingo Reservoir

Site ID ¹	Previous site ID	Site Description	Site type and purpose	Sampling details		Comments
				Frequency/ Event type	Analysis suite	
10	RW_6	Talbingo Reservoir upstream of Lobs Hole STP/PWTP diffuser outlet and water intake point.	EPL site. Control site for treated process water / wastewater discharge outlet and site works for water intake and barge launch area Impact site for construction works upstream in Yarrangobilly River	Monthly	Comprehensive	To be sampled below the surface of the reservoir away from the land edge. <i>This site may need to be relocated further upstream if it is too close site works in this area.</i>
11	RW_7	Talbingo Reservoir downstream of Lobs Hole STP/PWTP diffuser outlet.	EPL site. Impact site for treated process water / wastewater discharge outlet and site works for water intake and barge launch area	Monthly	Comprehensive	To be sampled below the surface of the reservoir away from the land edge. <i>This site may need to be relocated if it is too close to the construction works for the water intake and associated infrastructure.</i>
41	-	Lobs Hole STP/PWTP Final Effluent Quality Monitoring Point. Downstream of final treatment, prior to discharge to Talbingo Reservoir.	EPL site.	Monthly	Comprehensive	
107	N/A	Upstream monitoring of Ravine Bay of emplacement area within Yarrangobilly River, labelled EPL107 in "the Plan"	Talbingo Intake Work zone downstream	To be confirmed according to the Agency's consultation	Comprehensive	
108	N/A	Monitoring of Ravine Bay of emplacement area (centre of PSE) within Yarrangobilly River, labelled EPL108 in "the Plan".	Talbingo Intake Work zone downstream	To be confirmed according to the Agency's consultation	Comprehensive	
109	N/A	Upstream monitoring of Ravine Bay of emplacement area within Yarrangobilly River, labelled EPL109 in "the Plan".	Talbingo Intake Work zone downstream	To be confirmed according to the Agency's consultation	Comprehensive	

Site ID ¹	Previous site ID	Site Description	Site type and purpose	Sampling details		Comments
				Frequency/ Event type	Analysis suite	
TBC ²	N/A	None proposed, location to be installed and decommissioned for placement works only	Talbingo Intake zone Work downstream	To be confirmed according to the Agency's consultation	Comprehensive	

Note 1. Wherever possible, the Site ID for EPL sites corresponds to the EPL 21266 site number. These may be subject to change due to variations to the EPL.
2. TBC: Site ID to be confirmed.
3. TARP-1 monitoring initiated in response to WQO exceedances at Site 11.
4. With works at the Talbingo Intake about to commence, new sampling points have been implemented. Comprehensive details are available in the Talbingo Intake Management Plan S2-FGJV-ENV-PLN-0392.

3.2.1.2. Discharge waters

Treated wastewater and process water

The site description for the Talbingo Reservoir wastewater and process water treatment plants combined discharge water (pre-discharge) is provided in Table 3-4. The sampling details relate to post-commissioning operation of the treatment plants. There are multiple wastewater treatment plants and two process water treatment plants for which treated water will be discharged via the Talbingo treated water outfall. During commissioning, water quality analysis will be undertaken for the combined treated water stream to verify that the discharge characteristics are met.

A Mixing Zone Verification Program, in accordance with EPL conditions E1.1 – E1.5, will be undertaken following commissioning of the Talbingo treated wastewater and process water discharge outlet. The purpose of this program will be to validate the modelled mixing zone estimates from the revised Water and Process Water Mixing Zone Assessment (RHDHV, 2021). Further details are provided in section 4.2.1.

Table 3-4: Treated wastewater and process water discharge site for Talbingo Reservoir treatment plants¹

Site ID	Previous site ID	Site Description	Site type and purpose	Sampling details		Comments
				Frequency/ Event type	Analysis suite	
10		Talbingo Reservoir, upstream of Lobs Hole STP/PWTP diffuser outlet and water intake point.	EPL site	Monthly	Comprehensive	
11		Talbingo Reservoir, downstream of Lobs Hole STP/PWTP diffuser outlet	EPL Site	Monthly	Comprehensive	
41		Lobs Hole STP/PWTP Final Effluent Quality Monitoring point. Downstream of final treatment, prior to discharge to Talbingo Reservoir.	EPL Site	Monthly	Comprehensive	

Site ID	Previous site ID	Site Description	Site type and purpose	Sampling details		Comments
				Frequency/ Event type	Analysis suite	
42	-	Diffuser outlet discharging into Talbingo Reservoir from Lobs Hole STP/PWTP	EPL site.	N/A	N/A	

- Note
1. See section 4.2.1 for details of verification monitoring program sites.
 2. Wherever possible, the Site ID for EPL sites corresponds to the EPL 21266 site number. These may be subject to change due to variations to the EPL.

Stormwater

Stormwater discharge monitoring sites associated with sediment basins will be identified once sediment basin location has been finalised. Once constructed, sediment basins will be subject to monitoring in accordance with TARP-2 (see Section 6).

3.2.2. Lobs Hole

Monitoring in Lobs Hole is for the purpose of water quality change detection associated with various construction activities occurring along the Yarrangobilly River (e.g. portal pad, accommodation camp, temporary rock stockpiles, rock emplacement areas, access roads). Where necessary, monitoring sites are included in tributaries of Yarrangobilly River. For the Yarrangobilly River, the key water quality issue is that of stormwater discharges from sediment basins. Apart from the permanent stream gauge at Yarrangobilly Caves, streamflow will not be monitored in the Yarrangobilly River as the RTS found that no streamflow impacts were predicted to occur as a result of Main Works activities (see Appendices I and J of EMM 2020).

3.2.2.1. Receiving waters

Receiving water monitoring sites are based on the sites specified in EPL 21266. The site rationalisation was based on a number of factors, including duplication, proximity to key Main Works features and efficiency (e.g. sampling some tributary sites as part of TARP investigations only).

Receiving water monitoring site descriptions are provided in Table 3-5 and shown in Figure 3-2.

3.2.2.2. Discharge waters

Stormwater discharge monitoring sites associated with sediment basins will be identified once sediment basin location has been finalised. Once constructed, sediment basins will be subject to monitoring in accordance with TARP-2 (see Section 6).

Table 3-5: Receiving water monitoring site details, Lobs Hole

Site ID ¹	Previous site ID	Site Description	Site type and purpose	Sampling details	
				Frequency/ Event type ²	Analysis suite
Weather station					
Rainfall gauge	n/a	Lobs Hole		Continuous	Record date, time, weather conditions, location, rainfall volume.
Yarrangobilly River and tributaries					

Site ID ¹	Previous site ID	Site Description	Site type and purpose	Sampling details	
				Frequency/ Event type ²	Analysis suite
5	RW_1	Yarrangobilly River, upstream of the exploratory tunnel and construction pad.	EPL site. Control/reference site for construction activities in Lobs Hole. Also acts as a TARP site for determining upstream receiving water quality in event of sediment basin over-topping.	Monthly TARP-2	Comprehensive Comprehensive
6	RW_2	Wallace's Creek, upstream of the confluence with Yarrangobilly River and Wallace's Creek.	EPL site. Impact site for construction activities in Lobs Hole. Also acts as a TARP site for determining receiving water quality in event of sediment basin over-topping.	Monthly TARP-2	Comprehensive Comprehensive
7	RW_3	Wallace's Creek, downstream of Stable Creek confluence.	TARP site. Investigation site for determining source of exceedance at Site 6	TARP-1	Comprehensive
8	RW_4	Yarrangobilly River, downstream of Lick Hole Gully and the Eastern Emplacement stockpile disturbance area.	EPL site. Impact site for construction activities in Lobs Hole. Also acts as a TARP site for determining receiving water quality in event of sediment basin over-topping.	Monthly TARP-2	Comprehensive Comprehensive
9	RW_5	Yarrangobilly River, downstream of Accommodation Camp disturbance area, upstream of Talbingo Reservoir.	EPL site. Impact site for construction activities in Lobs Hole. Also acts as a TARP site for determining receiving water quality in event of sediment basin over-topping.	Monthly TARP-2	Comprehensive Comprehensive
12	RW_8	Yarrangobilly River, immediately downstream of Portal Pad	EPL site. Impact site for construction activities in Lobs Hole. Also acts as a TARP site for determining receiving water quality in event of sediment basin over-topping.	Monthly TARP-2	Comprehensive Comprehensive
13	RW_9	Yarrangobilly River tributary, downstream of the Accommodation camp and new road.	TARP site. Investigation site for determining source of exceedance at Site 9.	TARP-1	Comprehensive
14	RW_10	Yarrangobilly River, downstream of Roads Construction areas.	EPL site. Impact site for construction activities in Lobs Hole. Also acts as a TARP site for determining receiving water quality in event of sediment basin over-topping.	Monthly TARP-2	Comprehensive Comprehensive
15	RW_11	Yarrangobilly River, downstream of Road Construction areas.	EPL site. Impact site for construction activities in Lobs Hole. Also acts as a TARP site	Monthly TARP-1	Comprehensive Comprehensive

Site ID ¹	Previous site ID	Site Description	Site type and purpose	Sampling details	
				Frequency/ Event type ²	Analysis suite
16	RW_12	Yarrangobilly River, downstream of Road Construction areas.	EPL site. Impact site for construction activities in Lobs Hole. Also acts as a TARP site for determining receiving water quality in event of sediment basin over-topping.	Monthly TARP-2	Comprehensive Comprehensive
17	RW_13	Lick Hole Gully, upstream of Eastern Emplacement stockpile disturbance area.	TARP site. Investigation site for determining source of exceedance at Site 18.	TARP-1	Comprehensive
18	RW_14	Lick Hole Gully, downstream of Eastern Emplacement stockpile disturbance area.	TARP site. Investigation site for determining source of exceedance at Site 8.	TARP-1	Comprehensive
22	RW-18	Watercourse 3, upstream of Accommodation Camp disturbance area.	TARP site Investigation site for determining source of exceedance at Site 13.	TARP-1	Comprehensive
24	-	Yarrangobilly River tributary (Watercourse 2), directly downstream of road.	EPL site	Monthly	Comprehensive
55	N/A	Yarrangobilly River, surface water downstream of GF01 emplacement area	EPL site	Monthly TARP-1	Comprehensive
107	N/A	Upstream monitoring of Ravine Bay emplacement area within Yarrangobilly River	EPL site	Monthly TARP-1	Comprehensive
108	N/A	Monitoring of Ravine Bay emplacement area (centre of PSE) within Yarrangobilly River	EPL site	Monthly TARP-1	Comprehensive
109	N/A	Upstream monitoring of Ravine Bay emplacement area within Yarrangobilly River	EPL site	Monthly TARP-1	Comprehensive

Note 1. Wherever possible, the Site ID for EPL: sites corresponds to the EPL 21266 site number. These may be subject to change due to variations to the EPL.

2. If TARP-2 monitoring is required, it will occur only at sites immediately upstream and downstream of relevant stormwater discharges associated with Main Works construction areas (see section 0).

3.2.3. Marica

Monitoring at Marica is for the purpose of water quality change detection associated with various construction activities occurring along the Marica trail (e.g. accommodation camp, temporary rock stockpiles). The key water quality issue is that of stormwater runoff from disturbed areas.

3.2.3.1. Receiving waters

Apart from the Eucumbene River to the east there are no permanent watercourses along the Marica trail, with the area characterised by undefined ephemeral drainage lines that feed into Yarrangobilly River or Highground Creek to the north and Stable Creek to the south. Consequently, it is not possible to identify receiving water monitoring sites for the majority of the area. However, the eastern-most temporary rock stockpile on the Marica Trail drains into the Eucumbene River on the Plateau.

Consequently, sites on the Eucumbene River have been selected to detect any water quality impacts associated with runoff from this structure.

Receiving water monitoring site descriptions are provided in Table 3-6 and shown in Figure 3-3.

Table 3-6 Receiving water monitoring site details, Marica

Site ID	Previous site ID	Site Description	Site type and purpose	Sampling details		Comments
				Frequency/ Event type ¹	Analysis suite	
27	PL_SW_006	Eucumbene River, upstream of Marica Road.	EPL site. Control/reference site for drainage from large temporary stockpile. Also acts as a TARP site for determining upstream receiving water quality in event of sediment basin over-topping.	Monthly TARP-2	Comprehensive Comprehensive	
26	PL_SW_003	Eucumbene River, downstream of Marica Road.	EPL site. Impact site for drainage from large temporary stockpile. Also acts as a TARP site for determining receiving water quality in event of sediment basin over-topping.	Monthly TARP-2	Comprehensive	

Note 1. If TARP-2 monitoring is required, it will occur only at sites immediately upstream and downstream of relevant stormwater discharges associated with Main Works construction areas (see section 0).

3.2.3.2. Discharge waters

The terrain is typically too steep to enable the use of sediment basins as the primary control, so stormwater runoff from disturbed areas will be controlled primarily via structures such as swale drains, berms, check dams and sediment traps. Sediment basins may be installed in some areas (e.g., accommodation camp, rock stockpiles) subject to the detailed design process and erosion and sediment control plan.

Water quality monitoring at Marica will be in accordance with with TARP-2 (see Section 6), but will also focus on opportunistic basic monitoring of wet weather runoff waters in swale drains, check dams, sediment basins (if present) and drainage lines.

3.2.4. Plateau

Monitoring on the Plateau is primarily for the purpose of water quality and/or streamflow change detection associated with potential drawdown of groundwater due to tunnelling and associated activities that could affect water quality (e.g. access roads, communications cable – see below).

3.2.4.1. Receiving waters

The groundwater modelling for the Main Works RTS predicted that any baseflow impacts on Gooandra Creek and Eucumbene River on the Plateau will not occur for 4-5 years. As there is a long lead time before any impacts are predicted to streamflow and that it is likely that these impacts will be indiscernible in the observed data considering the interannual variability in flow, the need and location for streamflow monitoring sites will be reviewed based on additional groundwater monitoring data (refer Section 1.4).

Monitoring of water quality at perennial watercourse crossings during the laying of the communications cable from the Snowy Mountains Highway to Tantangara Reservoir, and any significant works within 40m of waterways, will be undertaken as necessary as the works progress.

Temporary monitoring sites will be established upstream and downstream of the works for approximately four weeks before, during and four weeks after works within the vicinity of a watercourse, these monitoring sites are not identified in this plan. For this period, basic water quality suite will be measured weekly and/or after significant rainfall events in the catchments (sufficient to generate increased flows in local waterways).

3.2.4.2. Discharge waters

As there will be little surface works on the Plateau apart from the communications cable, sediment basins to manage stormwater will not be required and, hence, no stormwater discharge monitoring is proposed.

3.2.5. Tantangara Reservoir

Monitoring at Tantangara Reservoir is primarily related to water quality change detection associated with various construction activities occurring along the shoreline and in the reservoir (e.g., accommodation camp, portal, barge launch area, access roads, Tantangara intake, rock emplacement area). The key water quality issues are stormwater discharges, treated wastewater and process water discharge, runoff and seepage from the excavated rock emplacement area, and disturbances from in-reservoir blasting. In addition, there are potential surface water quality and streamflow impacts in the area to the immediate west of the reservoir as a result of potential drawdown of groundwater due to tunnelling and associated activities. \

A Dredge Management Plan will be developed in consultation with EPA, NPWS, Water Group, NRAR, NWS DPI, NSW Maritime and for approval by DPHI. The Dredge Management Plan will be developed and approved prior to dredging channel extraction or underwater blasting.

During dredging and other in reservoir works, adjacent reservoir monitoring points will be monitored weekly for visual and basic analytes (see Table 3-2).

3.2.5.1. Receiving waters

The Tantangara receiving water monitoring sites include the sites from EPL 21266. Monitoring sites will be added to monitor specific in-reservoir works such as dredging, blasting and borehole drilling.

Receiving water monitoring site descriptions are provided in Table 3-7 and shown in Figure 3-4

Table 3-7 Receiving water monitoring site details, Tantangara Reservoir

Site ID	Previous site ID	Site Description	Site type and purpose	Sampling details		Comments
				Frequency/ Event type	Analysis suite	
28	TAN_09	Tantangara Reservoir, upstream in the mouth of the Murrumbidgee River. Variable location dependent on tide and reservoir levels.	EPL site. Control/reference site for construction works at Tantangara Reservoir.	Monthly	Comprehensive	Upstream baseline site.
29	TAN_01	Tantangara Reservoir, downstream of works area and upstream of lower Murrumbidgee River,	EPL site. Impact site for construction works at Tantangara Reservoir.	Monthly	Comprehensive	

Site ID	Previous site ID	Site Description	Site type and purpose	Sampling details		Comments
				Frequency/Event type	Analysis suite	
TBC	TanS_SW_002	Murrumbidgee River, at bridge crossing ~1.2 km downstream of Tantangara dam	TARP site. Investigation site for determining downstream extent of exceedance at Site TAN_01.	TARP-1	Comprehensive	TARP site in the event of an exceedance at TAN_01 coinciding with water release at the dam wall.
30	Tan_SW_001	Kelly Plains Creek downstream of accommodation and laydown area	EPL site Impact site for construction works at Tantangara Reservoir	Monthly	Comprehensive	
31	New site 2	Kelly's Plain Creek, upstream of accommodation and laydown area	EPL site Control/reference site for construction works at Tantangara Reservoir.	Monthly	Comprehensive	Upstream baseline site.
32	-	Tantangara Reservoir, Intake. Downstream of construction works	EPL site	Monthly	Comprehensive	
33	-	Murrumbidgee River, downstream of Tantangara reservoir outlet	EPL site	Monthly	Comprehensive	
34	-	Nungar Creek, upstream of Tantangara Road	EPL site	Monthly	Comprehensive	
35	-	Nungar Creek, downstream of Tantangara Road	EPL site	Monthly	Comprehensive	
38	-	Tantangara Reservoir, variable location dependant on tide and reservoir levels. Between the emplacement area and the ancillary facilities for emplacement activities.	EPL site	Monthly	Comprehensive	
39	-	Confluence of Nungar Creek and Tantangara Reservoir, variable location dependent on tide and reservoir levels. Upstream of Tantangara construction works.	EPL site	Monthly	Comprehensive	
40	-	Confluence of the upper Murrumbidgee River and Tantangara Reservoir, variable location dependent on tide and reservoir levels. Upstream of works.	EPL site	Monthly	Comprehensive	
50	-	Tantangara STP/PWTP final effluent quality and volume monitoring point.	EPL site	Monthly	Comprehensive	

Site ID	Previous site ID	Site Description	Site type and purpose	Sampling details		Comments
				Frequency/Event type	Analysis suite	
51		Tantangara Reservoir, downstream of Tantangara STP/PWTP diffuser outlet	EPL site	Monthly	Comprehensive	
67	-	Nungar Creek surface water downstream west from Tantangara emplacement area	EPL site	Monthly	Comprehensive	

3.2.5.2. Discharge waters

Treated wastewater and process water

The site description for the Tantangara Reservoir wastewater and process water treatment plants combined discharge water is provided in Table 3-8. The sampling details relate to post-commissioning operation of the treatment plants. In total, there will be multiple wastewater treatment plant and one process water treatment plant for which treated water will be discharged via the Talbingo treated water outfall. During commissioning, water quality analysis will be undertaken for the combined treated water stream to verify that the discharge characteristics are met.

A Mixing Zone Verification Program, in accordance with EPL conditions E1.1 – E1.5, will be undertaken following commissioning of the Tantangara treated wastewater and process water discharge outlet. The purpose of this program will be to validate the modelled mixing zone estimates from the revised Water and Process Water Mixing Zone Assessment (RHDHV, 2021). Further details are provided in section 4.2.1.

Table 3-8: Treated wastewater and process water discharge monitoring site details for Tantangara Reservoir treatment plants¹

Site ID	Previous site ID	Site Description	Site type and purpose	Sampling details		Comments
				Frequency/Event type	Analysis suite	
41	-	Diffuser outlet discharging into Tantangara Reservoir from Tantangara STP/PWTP	EPL discharge site	Daily Monthly	NA	
50	-	Tantangara Reservoir, downstream of Tantangara STP/WTP diffuser outlet.	EPL	Monthly	Comprehensive	

Note 1. See section 4.2.1 for details of verification monitoring program sites.

Stormwater

Stormwater discharge monitoring sites associated with sediment basins will be identified once sediment basin location has been finalised. Once constructed, sediment basins will be subject to monitoring in accordance with TARP-2 (see Section 6).

3.2.6. Rock Forest

Monitoring at Rock Forest is related to water quality change detection associated with the rock emplacement area and logistics laydown area. The key water quality issue is stormwater runoff from these areas.

3.2.6.1. Receiving waters

Receiving water monitoring sites have been tentatively identified but may be subject to change once finer details of on-site water management are known. For example, additional monthly or TARP monitoring sites may need to be added to assess and identify the source of water quality changes.

Receiving water monitoring site descriptions are provided in Table 3-9 and shown in Figure 3-5.

3.2.6.2. Discharge waters

Stormwater discharge monitoring sites associated with sediment basins will be identified once sediment basin location has been finalised. Once constructed, sediment basins will be subject to monitoring in accordance with TARP-2 (see Section 6).

Table 3-9: Monitoring site details, Rock Forest

Site ID	Previous site ID	Site Description	Site type and purpose	Sampling details	
				Frequency/ Event type	Analysis suite
36	-	Cameron's Creek, upstream of works in Rock Forest	EPL site. Control/reference site (i.e. upstream baseline site) for drainage from rock forest work area. Also acts as a TARP site for determining upstream receiving water quality in event of sediment basin over-topping.	Monthly TARP-2	Comprehensive Comprehensive
37	-	Cameron's Creek, downstream of works in Rock Forest	EPL site. Impact site for drainage from rock forest work area. Also acts as a TARP site for determining receiving water quality in event of sediment basin over-topping.	Monthly TARP-2	Comprehensive Comprehensive

3.2.7. Trunk Services

Trunk services refers to the progressive installation of power and other services including the constriction of pipelines, pits, and conduits, linking the Tantangara and Talbingo work areas. The installation of trunk services predominantly follows existing roadways and will utilise horizontal directional drilling (HDD) to pass waterways crossed along the trunk services alignment.

In order to monitor the surface water impact of trunk services works and the effectiveness of temporary erosion and sediment controls, monthly in-situ surface water quality monitoring will be undertaken. Monitoring will occur for the duration of trunk services construction with samples taken, upstream and downstream of nearest down gradient water course.

3.2.8. Other works

Other works include the southern communications cable and roadworks along Lobs Hole-Ravine Road. Monitoring of water quality at perennial watercourse crossings during roadworks and the

laying of the southern communications cable from the Snowy Mountains Highway to Tantangara Reservoir, will be undertaken as necessary as the works progress. Temporary monitoring sites will be established upstream and downstream of the works for approximately four weeks before, during and four weeks after works within the vicinity of a watercourse. For this period, the basic water quality suite will be measured weekly and/or after significant rainfall events in the catchments.

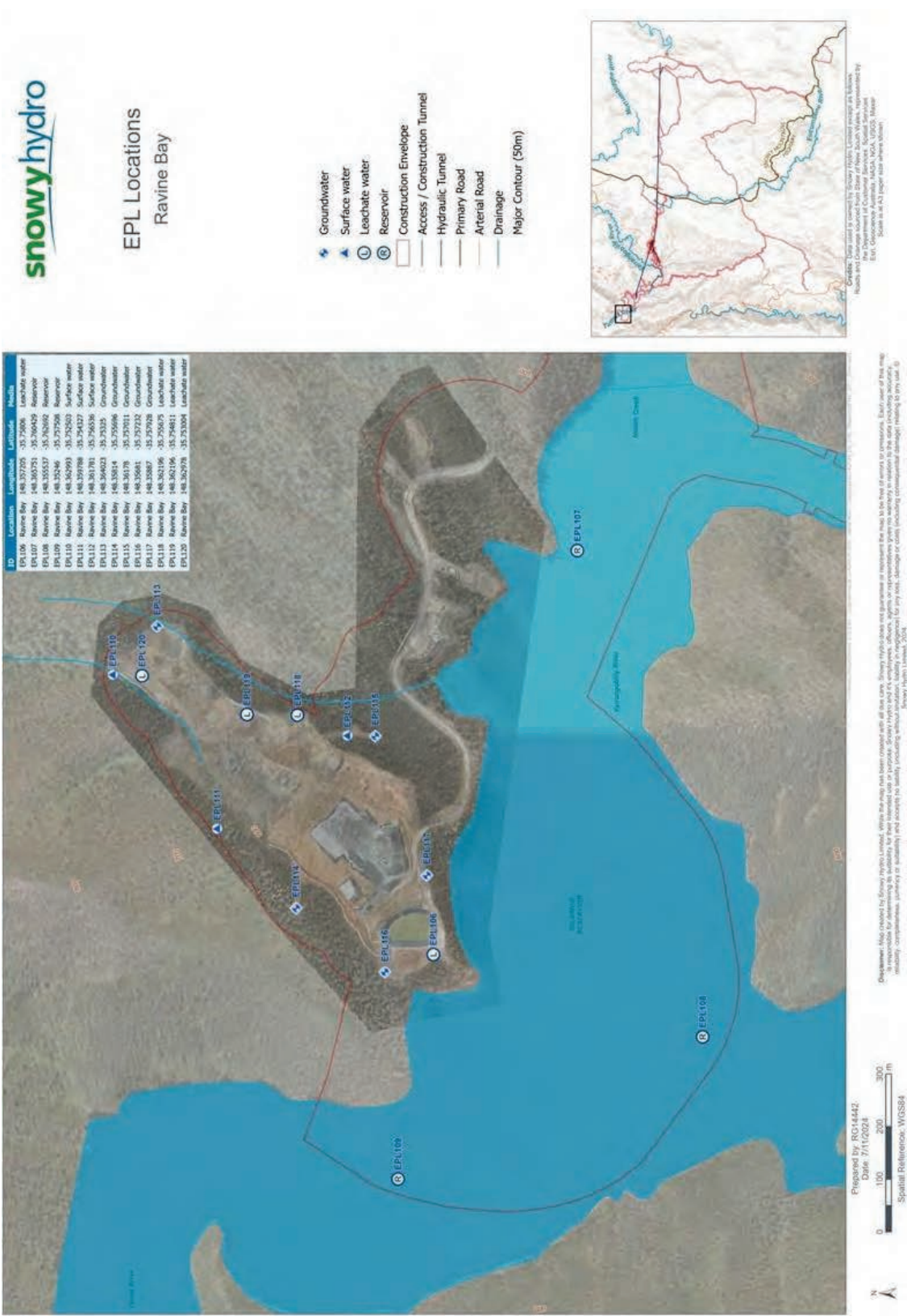


Figure 3-1: EPL Monitoring Locations - Talbingo Reservoir
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Figure 3-3: EPL Monitoring Locations - Marica
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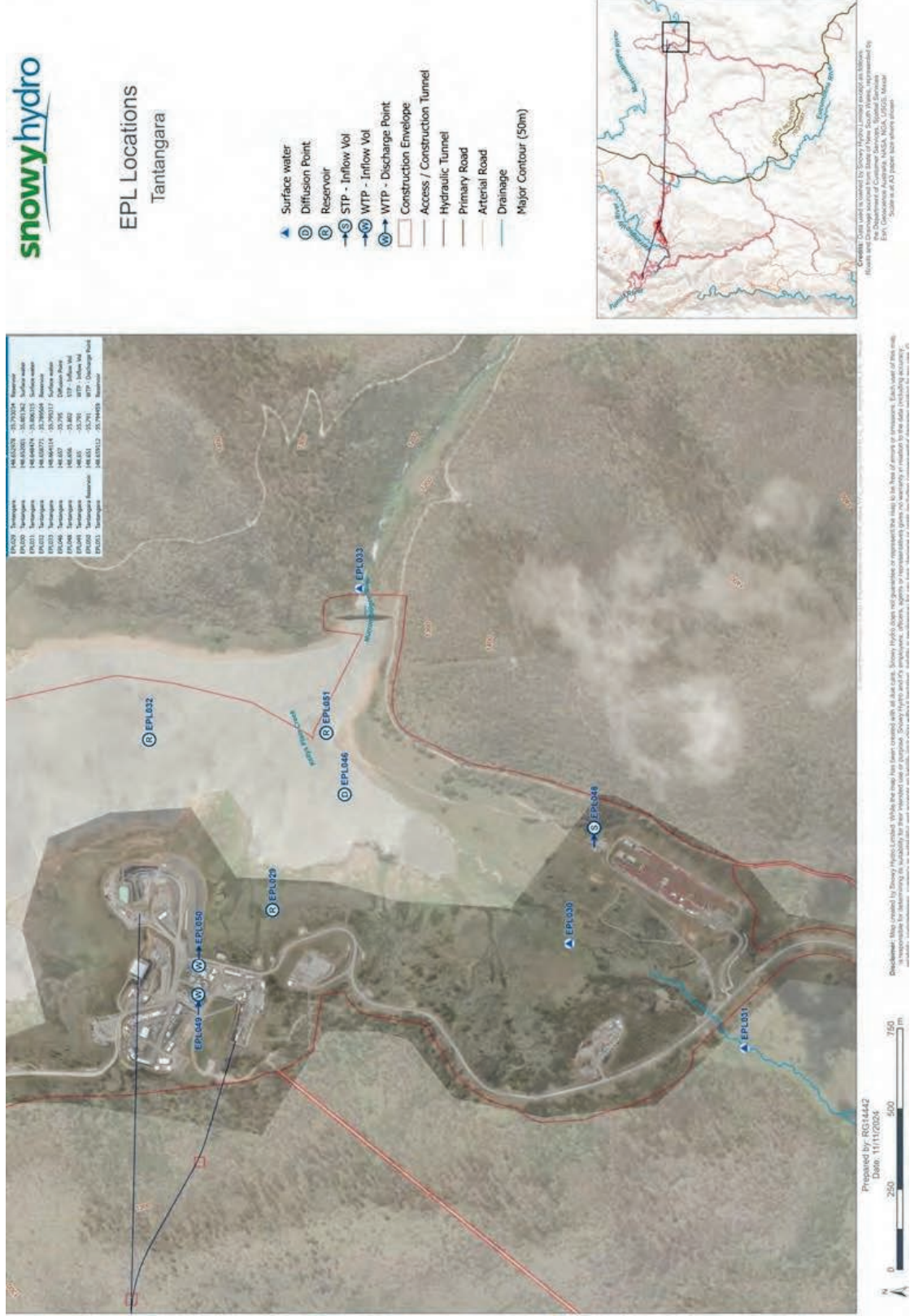


Figure 3-4: EPL Monitoring Locations - Tantangara Reservoir

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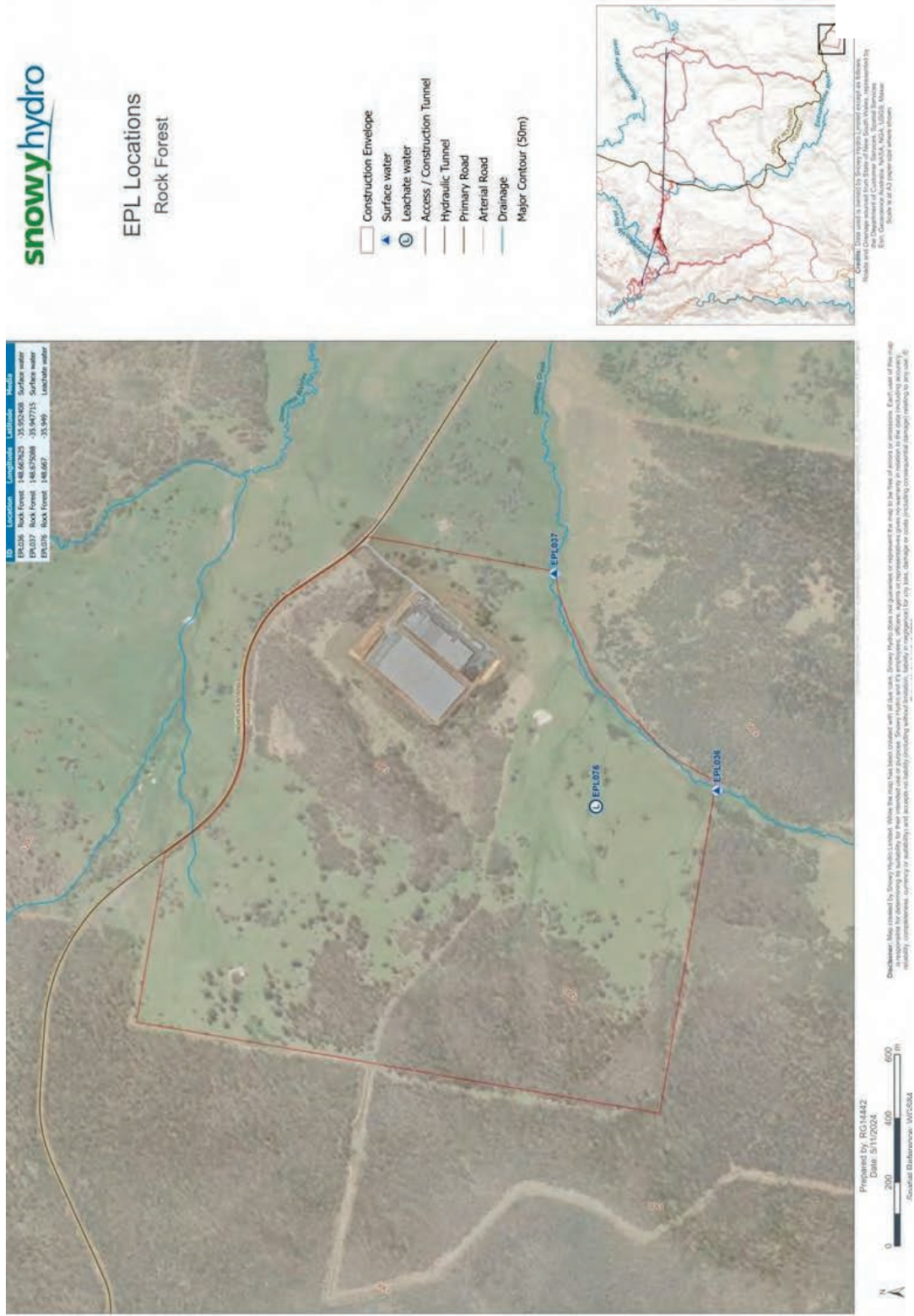


Figure 3-5: EPL Monitoring Locations - Rock Forest

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3.3. Treated Water Quality Monitoring

In order to ensure that treater Process and STP Water is consistent with the water quality criteria specified in Section 2.2.3 above, verification monitoring of the treated water will be undertaken. Weekly comprehensive water testing will be undertaken for 6-weeks following the commissioning of each treatment plant. Following this, sampling will be undertaken monthly during construction of the Project.

Treated water quality monitoring will be coordinated by the FGJV Laboratory Team with the assistance of the FGJV Environment Team as required.

3.4. Following sampling, the FGJV Environment Team and suitably qualified personnel will review water-quality data before water discharge. This review will determine whether the water is suitable for construction use or meets the discharge requirements for the reservoir. Leachate Detection Program

To manage potential leachate seepage, Leachate Detection Procedures will be implemented and followed for relevant PSEs (Ravine, GF01, Main Yard, Rock Forest and Tantangara) and the Marica TSE. In accordance with EPL condition O5.5, these procedures will be developed prior to the placement of spoil at the PSE/TSE. Monitoring via surface water and ground water sampling will continually assess if leachate is occurring from the spoil emplacement.

The LDPs have been developed to fulfil the requirement of a leachate detection system for the placement of spoil in accordance with the Project EPL.

Potential changes to water quality could be caused as a result of potential acid forming (PAF) material being at each of the PSEs without adequate treatment. PAF material that has not been neutralised, or that has been over treated, could result in varying magnitudes of change relative to the relevant default NSW WQO values, specifically:

- pH;
- electrical conductivity;
- Turbidity;
- dissolved oxygen;
- oil and grease,
- nutrients and
- dissolved metals.

Monitoring will commence as soon as the locations are safe to access and will continue for the duration of spoil emplacement. In accordance with EPL condition O5.6, within two weeks of the placement of spoil, a report detailing findings and recommendations for leachate detection will be provided to the EPA.

3.4.1. Monitoring Framework

For the duration of spoil placement, basic water quality suite will be measured weekly and after significant rainfall events in the catchments. This will include surface water and ground water monitoring. Comprehensive monitoring will be performed where the pH falls outside the range of WQO and is not representative of the background water quality. Details of monitoring are provided in Table 3-10.

Table 3-10: Water monitoring sampling framework

Waterbody type	
Surface water	Watercourses
Groundwater	Uppermost aquifer
Sampling Frequency	
Weekly Monitoring	Monitoring undertaken on a weekly basis
Post-rainfall Monitoring	Monitoring undertaken after a rainfall event
TARP Monitoring	Monitoring triggered where water quality results indicate a non-conformance with the relevant criteria.
Water monitoring	
Visual	Gross water quality indicators – e.g. visible oil and grease, turbidity plumes Management measures – e.g. erosion and sediment controls, downstream drainage and clean water diversion
Basic	Site observations and basic water quality parameters via in situ measurement including pH, electrical conductivity, turbidity, dissolved oxygen, temperature and redox potential.
Comprehensive	Site observations, basic water quality parameters via in situ measurement and collection of water samples for laboratory analysis by an external NATA accredited laboratory. Analyses include nutrients (nitrogen, ammonia, oxidised nitrogen, nitrate, nitrite total kjeldahl nitrogen, total phosphorus, and reactive phosphorus), dissolved metals (aluminium, arsenic, silver, total chromium, copper, iron, manganese, nickel, lead, and zinc), and cyanide.

1. All sampling will be subject to work health and safety assessments to ensure worker safety at all times.
2. All analytes will be reported to sensitivities and with units in accordance with EPL 21266.

3.4.2. Water Quality Objectives

WQOs for groundwater refer to the default trigger values for physical and chemical stressors in south-east Australia (upland rivers) for the protection of 99% of aquatic species ANZECC / ARMCANZ (2000).

Table 3-11: Water quality objects for groundwater (source: Appendix J of EMM 2020)

Category	Analyte	Unit	Water Quality Objective Value*
Field	pH	-	6.5-8
	Electrical Conductivity	µS/cm	30-350
	Oxidation Reduction Potential	mV	No Water Quality Objective Value
	Temperature	°C	No Water Quality Objective Value
	Dissolved Oxygen	% saturation	90-110
	Turbidity	NTU	2-25
Laboratory analytes	TSS	mg/L	No Water Quality Objective Value
	Hardness as CaCO ₃	mg/L	No Water Quality Objective Value
Nutrients	Ammonia as N	µg/L	13
	Nitrite + Nitrate as N (NO _x)	µg/L	15
	Kjeldahl Nitrogen Total	µg/L	No Water Quality Objective Value

Category	Analyte	Unit	Water Quality Objective Value*
	Nitrogen (Total)	µg/L	250
	Reactive Phosphorus	µg/L	15
	Phosphorus (Total)	µg/L	20
Inorganics	Cyanide Total	µg/L	4
Hydrocarbons	Oil and Grease	mg/L	No Water Quality Objective Value
Metals	Aluminium (dissolved)	µg/L	27
	Arsenic (dissolved)	µg/L	0.8
	Chromium (III+VI) (dissolved)	µg/L	0.01
	Copper (dissolved)	µg/L	1
	Iron (dissolved)	µg/L	300
	Lead (dissolved)	µg/L	1
	Manganese (dissolved)	µg/L	1,200
	Nickel (dissolved)	µg/L	8
	Silver (dissolved)	µg/L	0.02
	Zinc (dissolved)	µg/L	2.4

3.4.3. Monitoring Locations

3.4.3.1. GF01

The indicative surface water monitoring locations for the GF01 LDP are listed in Table 3-12 and depicted in Figure 3-6.

Table 3-12: GF01 PSE LDP Surface Water Monitoring Information

Sample Location	Sample ID	EPL IDs	GPS Coordinates*
Basin	GF01 – SW – SB	EPL52	35.7781450°S, 148.3880131°E
SW Upstream East	GF01 - SW - USE	EPL53	35.7744780°S, 148.3913740°E
SW Upstream West	GF01 - SW - USW	EPL54	35.7755500°S, 148.3890430°E
SW Downstream	GF01 - SW - DS	EPL55	35.7783900°S, 148.3871875°E
SW Downstream	GF01 Rock Blanket	EPL98	35.7783505°S, 148.3881859°E

1. GPS Coordinates are a guide only, ground truthing is required and sampling locations will be determined based on conditions in field.

3.4.3.2. Lobs Hole Main Yard

The indicative surface water monitoring locations for the Lobs Hole Main Yard LDP are listed in Table 3-13 and depicted in figure 3-7.

Table 3-13: Lobs Hole Main Yard PSE LDP Surface Water Monitoring Information

Sample Location	Sample ID	Proposed EPL ID	GPS Coordinates*
Basin SB3	Main Yard – SW – SB3 (F8)	EPL84	35.788017 S 148.398896 E
Basin SB2	Main Yard – SW – SB2 (MY07)	EPL85	35.790453 S 148.401224 E
Basin SB4	Main Yard – SW – SB4 (LHG01 Basin)	EPL86	35.791298 S 148.402909 E
SW Upstream	EPL14	-	35.794012 S 148.404983 E
SW Downstream	EPL8	-	35.789042 S 148.401127 E
SW Downstream	EPL16	-	35.785473 S 148.392766 E

1. GPS Coordinates are a guide only, ground truthing is required and sampling locations will be determined based on conditions in field.

3.4.3.3. Tantangara

The indicative surface water monitoring locations for the Tantangara PSE are listed in Table 3-14 and depicted in Figure 3-8

Table 3-14: Tantangara PSE LDP Water Surface Water Monitoring Information

Sample Location	Sample ID	EPL ID (proposed)	GPS Coordinates*
PSE Basin 1	Tan – SW – SB1	EPL59	35.761807S 148.64445E
PSE Basin 2	Tan – SW – SB2	EPL60	35.760387S 148.64473E
PSE Basin 3	Tan – SW – SB3	EPL61	35.760057S 148.648002E
PSE Basin 4	Tan – SW – SB4	EPL62	35.761683S 148.649503E
PSE Basin 5	Tan – SW – SB5	EPL63	35.762963S 148.649257E
PSE Basin 6	Tan – SW – SB6	EPL64	35.763713S 148.64872E
PSE Basin 7	Tan – SW – SB7	EPL65	35.764105S 148.648205E
SW Downstream East	Tan - SW - DSE	EPL66	35.763047S 148.650588E
SW Downstream West	Tan - SW – DSW	EPL67	35.759873S 148.642513E
EPL28	EPL28	EPL28	35.747597S 148.653607E
EPL38	EPL38	EPL38	35.769468S 148.652978E
EPL39	EPL39	EPL39	35.761213S 148.639317E

1. GPS Coordinates are a guide only, ground truthing is required and sampling locations will be determined based on conditions in field.

3.4.3.4. Ravine Bay

The indicative surface water monitoring locations for the Ravine Bay PSE are listed in table 3-15 and depicted in figure 3-10.

Table 3-15: Ravine Bay PSE LDP Water Surface Water Monitoring Information

Sample Location	Sample ID	Proposed EPL ID	GPS Coordinates ¹
Basin 1	RB - SW - SB1	EPL106	35.7580599S 148.3572051E
Basin 2	RB - SW – SB2	EPL 118	35.7556754S 148.3621964E
Basin 3	RB - SW – SB3	EPL 119	35.7548112S 148.3621964E
Basin 4	RB - SW – SB4	EPL 120	35.7530035S 148.3629776E
SW Upstream Yarrangobilly	RB - SW - YAR	EPL107	35.760429S 148.365751E
SW Upstream Tumut	RB - SW - TUM	EPL108	35.762692S 148.355537E
SW Downstream Reservoir	RB - SW - DSR	EPL109	35.7575076S 148.3524600E
SW Upstream PSE	RB - SW - USP	EPL110	35.7525029S 148.3629933E
SW Downstream East	RB-SW-DSE	EPL128	35.756939S 148.362549E

1. GPS Coordinates are a guide only, ground truthing is required and sampling locations will be determined based on conditions in field.

3.4.3.5. Rock Forest

The indicative surface water monitoring locations for the Rock Forest PSE are listed in table 3-16 and depicted in figure 3-8.

Table 3-16: Rock Forest PSE LDP Water Surface Water Monitoring Information

Sample Location	Sample ID	EPL ID	GPS Coordinates*
SW Upstream	RF – SW – US	EPL 37	35.56853S 148.407648E
SW Downstream	RF – SW – DS	EPL 36	35.571407S 148.40.013E
Leachate Basin 1	RF – SW – SB1	EPL 76	35.569293S 148.400395E

1. GPS Coordinates are a guide only, ground truthing is required and sampling locations will be determined based on conditions in field.

3.4.3.6. Marica TSE

The indicative surface water monitoring locations for the Marica TSE are listed in Table 3-17 and depicted in Figure 3-9.

Table 3-17: Marica TSE LDP Surface Water Monitoring Information

Sample Location	Sample ID	EPL ID	GPS Coordinates*
SW Downstream	EPL71	EPL71	-35.786057 148.452542
SW Downstream (leachate basin overflow – US TN01)	EPL99	EPL99	-35.785469 148.463248
SW Downstream (leachate basin – SPLB01)	EPL100	EPL100	-35.785835 148.461039
SW Downstream (Leachate basin)	EPL101	EPL101	-35.786252 148.461624
Proposed SW Relocation	EPL71	EPL71 (Proposed Relocation)	-35.786391 148.449331
Proposed SW Downstream (Pad 3 leachate basin)	Pad 3 LB	New EPL designation required	-35.784093 148.454536
Proposed SW Downstream (Pad 4 leachate basin)	Pad 4 LB	New EPL designation required	-35.783779 148.445931
Proposed SW Downstream (Pad 5 leachate basin)	Pad 5 LB	New EPL designation required	-35.785950 148.448301

1. GPS Coordinates are a guide only, ground truthing is required and sampling locations will be determined based on conditions in field

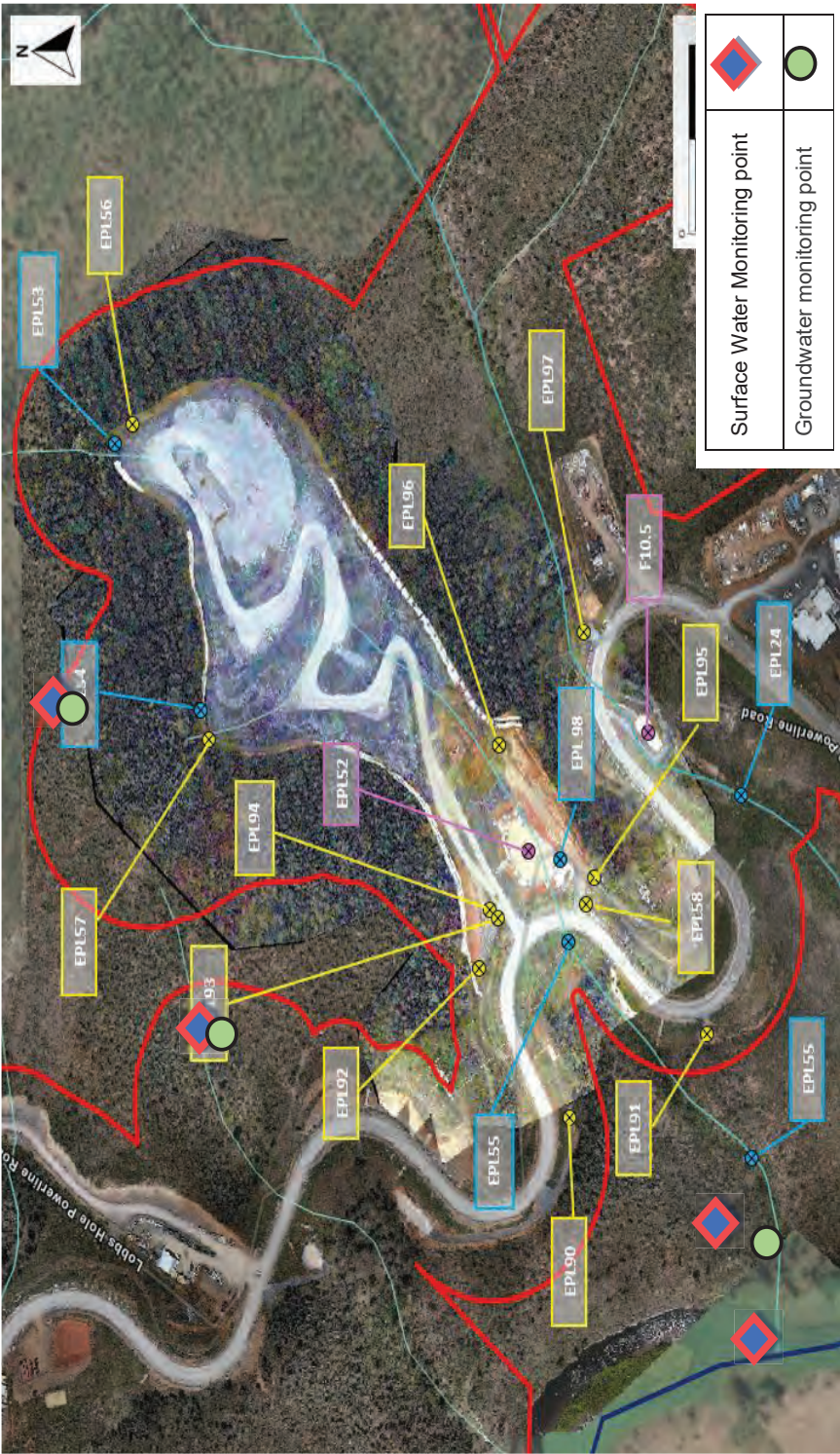


Figure 3-6: GF01 PSE LDP Monitoring Locations



Figure 3-7: Lobs Hole Main Yard PSE LDP Monitoring Locations

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Figure 3-8: Tantangara PSE LDP Monitoring Location

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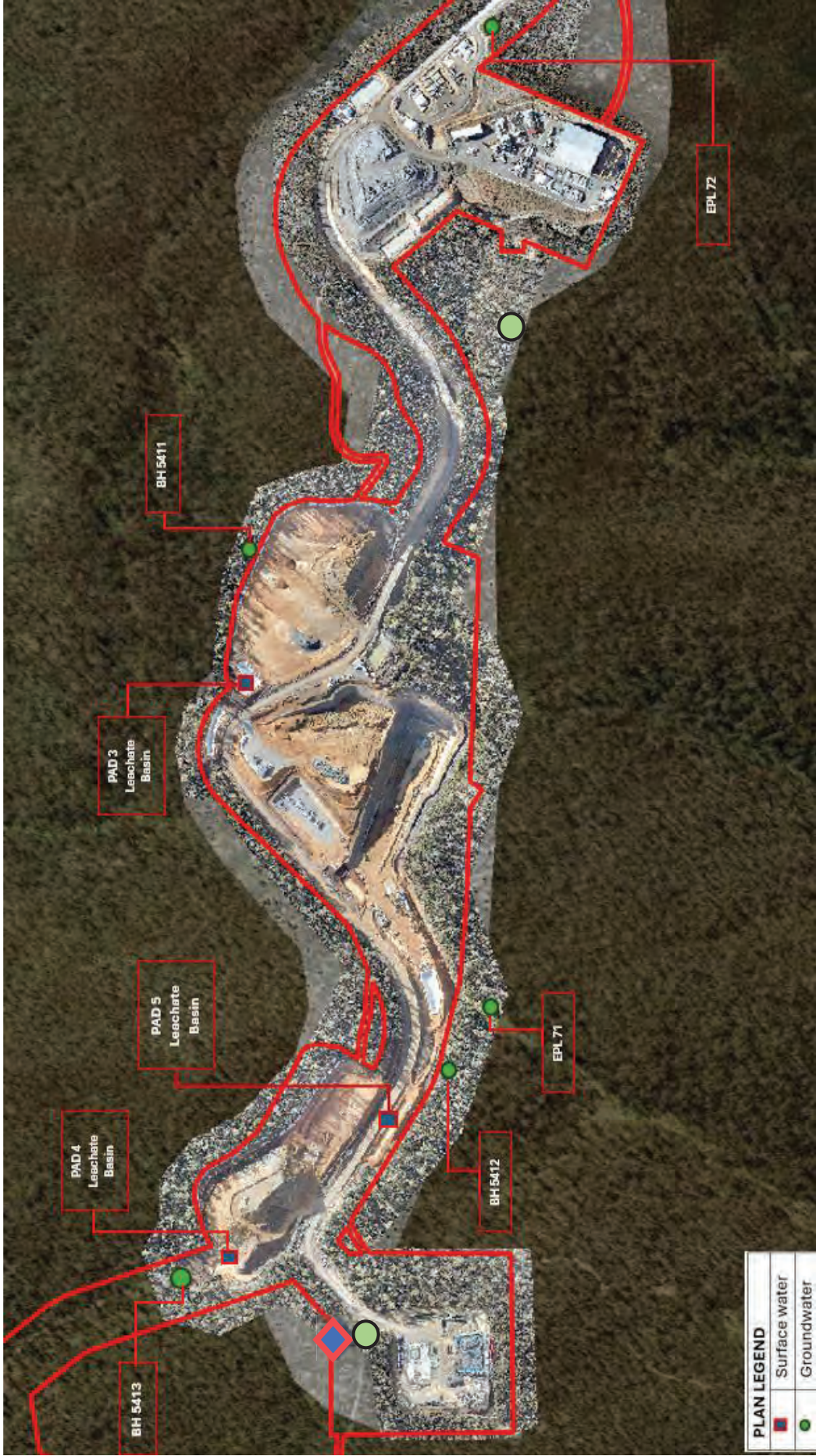


Figure 3-9: Marica TSE LDP Monitoring Locations

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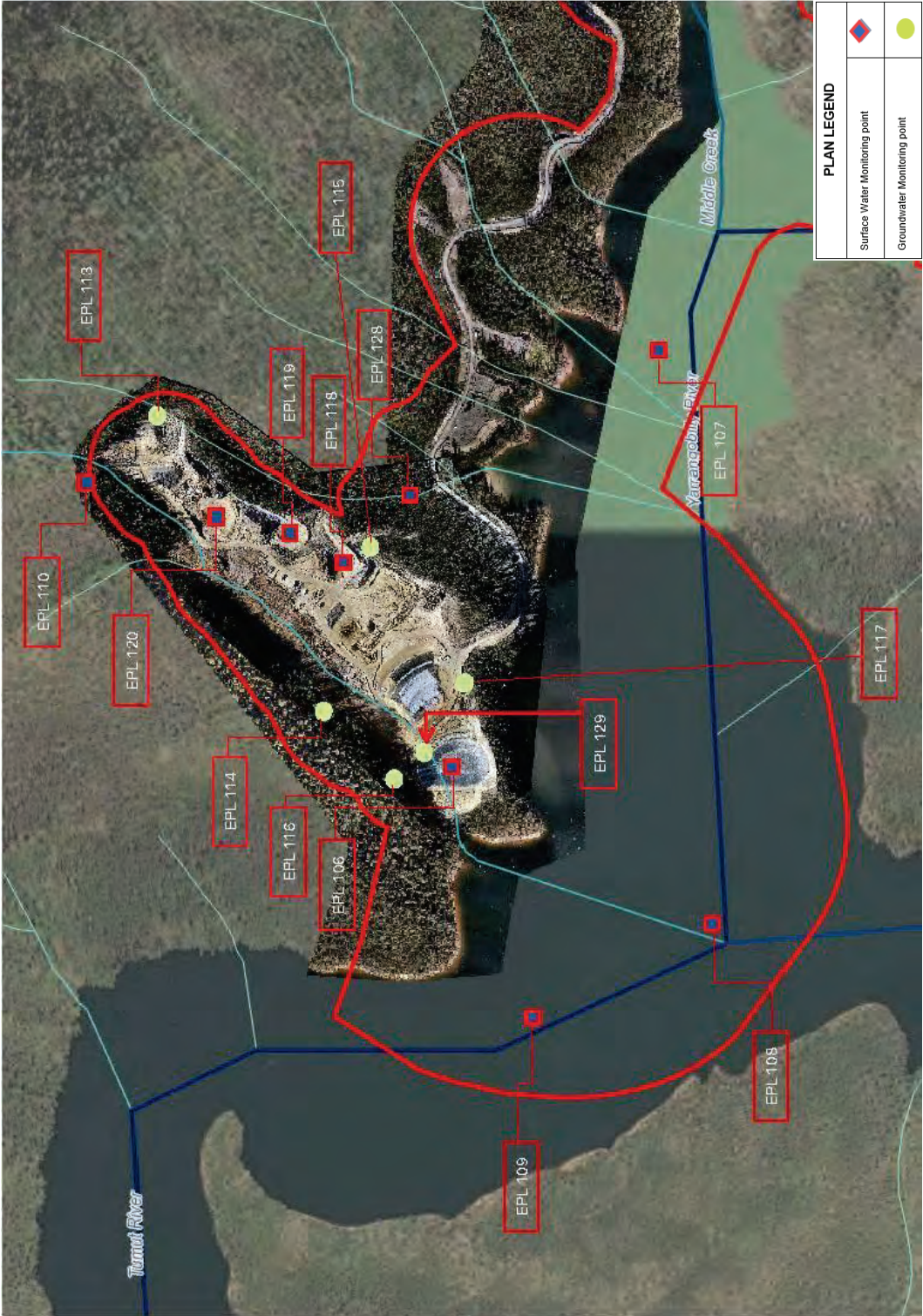


Figure 3-10: Ravine Bay PSE LDP Monitoring Locations

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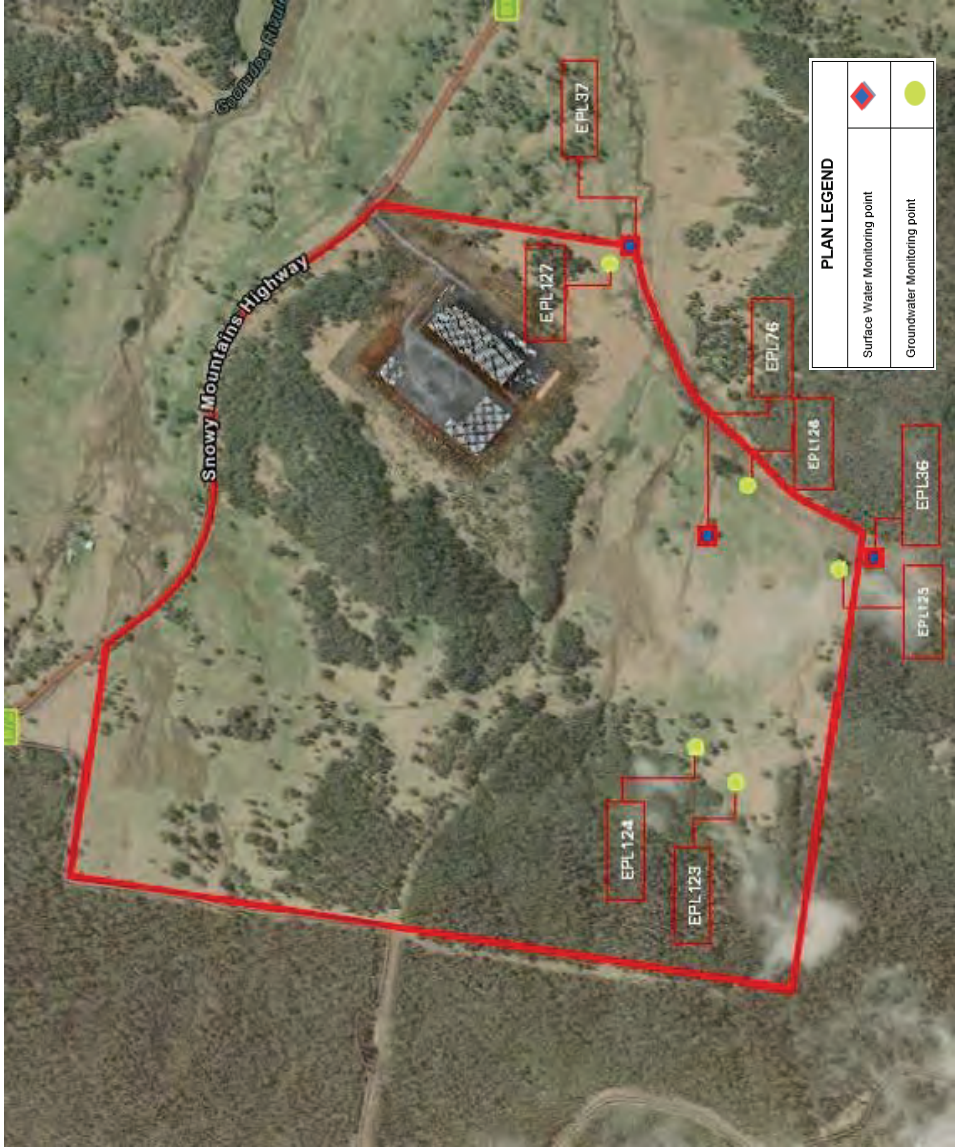


Figure 3-10: Rock Forest PSE LDP Monitoring Locations

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4. ASSESSMENT OF WATER QUALITY

Assessment of relevant performance criteria for discharges (from sediment basins and process water and wastewater treatment plants) and receiving water sites are described below. Reporting of water quality data, analyses and TARPS will be in accordance with EPL21266.

4.1. Receiving waters

Receiving water monitoring results will be compared with the relevant WQOs as presented in Table 2-2:. Where WQOs are exceeded or where turbidity, pH or EC results are 20% outside the rolling average of all previous samples, at receiving water sites that are located downstream of any Main Works activities, TARP-1 will be triggered to investigate the possible cause (see Section 6).

The results of the comparisons and any associated TARPS will be reported to EPA as part of standard reporting, and will be used to better understand and refine the water management approach, as necessary.

As noted in Section 2.1, it may not be possible at this stage to derive SSTVs using baseline water quality data due to the impact on water quality of the January 2020 bushfire, although the need for and ability to derive SSTVs will continue to be reviewed during Main Works construction activities. In needing to continue to use default WQOs, it is known that the baseline water quality data collected to date has shown that natural background concentrations of several analytes exceed their default WQOs either on a frequent or occasional basis. The baseline dataset, which can be considered to include the data collected during the Exploratory Works phase prior to significant rainfall events in February 2020 (given the water quality during Exploratory Works had, to this point, not differed to that collected prior to the commencement of Exploratory Works), has been predominately collected during baseflow conditions, however, there are an increasing amount of data for wet weather conditions.

During wet weather conditions, streams flows will predominantly comprise surface water runoff (rather than groundwater fed base flow) and may have different water chemistry. As sediment-laden runoff from existing access tracks and other disturbed areas (non-construction related) is known to occur in Lobs Hole and will also occur in other Main Works construction areas, it is likely that turbidity levels may exceed WQOs in some minor watercourses and potentially the Yarrangobilly River. Also, elevated concentrations of phosphorus and some metals can be associated with sediment-laden runoff and may, therefore, also exceed WQOs. Hence, regular exceedances of some analytes are expected to occur due to natural or non-anthropogenic catchment processes that are not associated with Main Works.

4.2. Discharge waters

Monitoring of combined treated wastewater and process water streams prior to discharge will be compared with the discharge characteristics presented in Table 2-3 and Table 2-4 (EPL 41). Also, the combined discharge water quality data will be able to be compared with water quality monitoring data collected as part of the operation of the individual water treatment plants. This comparison would form part of a TARP for the combined treated wastewater and process water discharge, to inform the source of any exceedances of the combined discharge characteristics. Monitoring of stormwater discharges from non-licensed discharge points (typically, sediment basins) will be in accordance with TARP-2 (see Section 6). The results of the comparisons and any associated TARPS will be reported to EPA as part of standard reporting, and will be used to better understand

and refine the water management approach, as necessary. The discharge water quality data may also be used for receiving water TARP-1 investigations, to help identify sources of WQO exceedances.

4.2.1. Verification monitoring program for treated wastewater and process water discharge

A Mixing Zone Verification Program will be undertaken for the treated wastewater and process water discharge points in both Talbingo and Tantangara reservoirs in accordance with EPL conditions E1.1 – E1.5. The purpose of these programs will be to validate the modelled mixing zone estimates from the revised Water and Process Water Mixing Zone Assessment (RHDHV, 2021).

The revised mixing zone assessment found that dilutions to meet target water quality were generally achieved within 10s of metres of the outfall, but that for some ambient conditions, the mixing zone could be between 50 and 100 m.

In accordance with the project EPL, a plan for the Mixing Zone Verification Program, must be submitted to the EPA at least 4-weeks prior to the first discharge of each of the sewerage treatment plants and process water treatment plants. The plan must include:

- (a) Sampling locations;*
- (b) Sampling frequency and duration;*
- (c) Sampling depth; and*
- (d) Sampling parameters.*

Within 6 weeks of the first discharge from the treatment plants, a written progress report must be submitted. Upon completion of the Mixing Zone Verification Program, the licensee must submit a written final report detailing the result of the Mixing Zone Verification Program. Progress and final reports must include:

- a. a statement of the ambient NSW Water Quality Objectives (WQOs) of the receiving waters (Talbingo/Tantangara Reservoir) relevant to the discharge, including the associated indicators and guideline values or criteria for the identified environmental values;*
- b. a description of the ambient water quality of Talbingo/Tantangara Reservoir in relation to the relevant WQOs, to determine whether the WQOs are being achieved;*
- c. ambient conditions (e.g. currents, temperature, density, storage level and thermal stratification processes);*
- d. discharge and release conditions including but not limited to:*
 - i. rate of discharge;*
 - ii. timing;*
 - iii. total volume;*
 - iv. water quality of discharge;*
- e. a description of the mixing zone, including the extent and shape of the mixing zone;*

- f. a comparison of point e. above with the modelled predications from Attachment F Waste and Process Water Mixing Zone Assessment (7 February 2020) of the “Snowy 2.0 - Main Works - Response to Submissions Main Report - Appendix J Revised Water Management Report” including discussion of the mixing zone modelling and whether the relevant guideline values are being met at the edge of the near-field mixing zone; and*
- g. a continuous improvement plan for managing wastewater discharge over time, so as to reduce the extent and impact of the mixing zone*

The Mixing Zone Verification Program is proposed to commence approximately 2 weeks prior to the discharge of treated water to the reservoirs, and will consist of weekly sampling for 6 weeks (i.e. 2 weeks pre-discharge, 4 weeks post-discharge) followed by monthly sampling for a further period of 11 months, for a combined duration of one year. Each time an additional treatment plant is commissioned and connected to the trunk services mains outfall, an additional set of weekly sampling for 2 weeks will be undertaken (unless the period coincides with a monthly sampling period, in which case only one additional weekly sampling event will be undertaken). All samples will be subject to comprehensive analysis. The monitoring results will be compared with the modelling predictions based on the relevant environmental and discharge conditions (i.e. reservoir level and flow rate, degree of stratification, and treated effluent composition and discharge rate). The initial 4x weekly and subsequent 2x weekly sampling frequencies will provide assurances that the outfall is consistently meeting WQOs within the modelled mixing zone (i.e. typically <10 m but depending on conditions, up to 100 m) shortly after commencement of discharge or addition of another treatment plant. The monthly sampling over 11 months will enable further validation of the modelling at a range of environmental conditions, such as winds, reservoir water level, flow rate and stratification.

Verification monitoring sites will be established at 10 m, 50 m and 100 m downstream of the outfalls in both Talbingo and Tantangara reservoirs. A control site at approximately 50–100 m upstream of each of the outfalls will also be established (i.e. 4 verification monitoring sites per outfall). Final site locations will be determined once the exact locations of the outfalls are known.

The number of sites and frequency of sampling may be revised depending on results. For example, if monitoring under worst case conditions demonstrates that acceptable dilution is achieved within 10 m, it may be appropriate to remove one or both of the 50 m and 100 m sites. Additionally, if monitoring over a period less than the proposed one year covers the necessary range of environmental conditions and verifies the modelling predictions, it may be appropriate to reduce the frequency or duration of the program.

Any changes to the details of the Mixing Zone Verification Program, will be communicated to the EPA and reflected in subsequent updates to the Surface Water Management Plan.

5. REVIEW AND RESPONSE

Monitoring will be undertaken using a combination of methods and will require varying levels of processing and review before it can be used to inform assessment and decision making. Monitoring data collected in situ (i.e. via portable field meters) are generally available same day, enabling rapid responses to identified exceedances. Monitoring data from samples sent for laboratory analysis are generally available within two weeks of sampling and, hence, such data are unable to be used to inform rapid responses. However, the data from laboratory analyses can be used to inform a detailed understanding of water quality impacts and impact mechanisms, which can then be applied to establish targeted improvements to the water management system.

As discussed in Section 2.1, baseline monitoring to date has only characterised water quality during baseflow and after, but not during, wet weather events. There is also potential for exceedances of additional analytes during wet weather conditions. Hence, regular exceedances of some analytes are expected to occur due to natural catchment processes that are not associated with Main Works. Subsequently, TARPs have been developed to investigate and identify the source of each exceedance and, if necessary, establish actions to either improve water management or further investigate the exceedance (see section 6).

The water quality monitoring program will be periodically reviewed. It is noted that additional or varied/reduced monitoring sites, frequencies and analytes may be warranted following detailed design and during construction as risk requires or where it can be demonstrated that negligible risk remains. Changes to the frequencies, parameters and development of SSTVs would be approved by SHL prior to amendment and updated in subsequent revisions of the water quality monitoring program and SWMP. SHL will refer any such changes to the regulator.

Additional requirements and responsibilities in relation to inspections are documented in Section 8 of the EMS.

6. TRIGGER ACTION RESPONSE PLANS

Trigger Action Response Plans (TARPs) have been developed to enable appropriate investigations and management responses to WQO exceedances. They detail a standardised response procedure in the event that a WQOs is exceeded during a monitoring event for surface water quality monitoring.

TARPs have been developed for the following situations:

- TARP-1: monthly routine monitoring identifies receiving water quality exceedance against the relevant WQOs (Table 2-2) or variation (20%) from the rolling average; and
- TARP-2: if stormwater controls (i.e. sediment basins) overtop. Stormwater controls be will be bench-marked against predicted stormwater discharge characteristics (Table 2-5) and the relevant WQOs (Table 2-2)

The TARP processes are described in more detail in the Section 6.3 of the SWMP (Section 6.3), while all TARPs are provided in Annexure B of the SWMP.

7. REPORTING

FGJV will report to SHL and other agencies on surface water management aspects related to the Project. During construction, surface water monitoring data will be collected, tabulated and assessed against thresholds. Reporting will occur in accordance with Section 6.7 of the SWMP.

8. REFERENCES

ANZECC/ARMCANZ (2000). Australian and New Zealand guidelines for fresh and marine water quality. National Water Quality Management Strategy Paper No 4. Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra, Australia.

ANZG (2018). Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra, ACT, Australia. <https://www.waterquality.gov.au/anz-guidelines>.

DECCW (2006). New South Wales water quality and river flow objectives. Department of Environment, Climate Change and Water, NSW, Australia. <https://www.environment.nsw.gov.au/ieol/>.

EMM (2020). Snowy 2.0 Main Works Preferred Infrastructure Report and Response to Submissions.

ATTACHMENT A. OVERVIEW OF THE IMPACTS OF BUSHFIRES ON WATER QUALITY

Overview of the impacts of bushfires on water quality

Background

Severe bushfires in the Kosciuszko National Park in January 2020 prompted the Proponent of the Snowy 2.0 Project, SHL, and its Contractor, FGJV, to ask how such fires can affect water quality in order to inform water quality management and monitoring programs for the construction delivery of the Snowy 2.0 Project. This attachment provides a brief overview of the impact of high severity/intensity bushfires on water quality.

Limited albeit informative research on the impact of bushfires on water quality has been undertaken over the past 20+ years. Relatively recent comprehensive reviews on the topic have been undertaken by Smith *et al.* (2011) and Tulau (2015), both of which focused on south-eastern Australia. The summary provided herein draws largely from these reviews. The key issues can be categorised in terms of (i) the factors that contribute to water quality impacts following fire, and (ii) the nature of water quality impacts.

Factors that contribute to water quality impacts following fire

Key factors that contribute to water quality impacts following fire are the fire regime (including severity and intensity) and rainfall. Associated with these are a number of processes can cause water quality impacts following fire. Some key aspects include:

- Fire can affect the quantity and quality of water produced at the catchment scale by the destruction or modification of vegetation, litter and the organic horizons of soils, and by altering certain physical characteristics of the soil that are related to runoff-infiltration characteristics;
- The magnitude and distribution of rainfall soon after fire, and before vegetation cover is re-established, is a key driver of post-fire erosion and water quality impacts;
- As a result of various processes, runoff from land to waterways generally increases post-fire, and can persist for ~2-10 years. The higher the burn severity, the higher the immediate post-fire increase in runoff and stream flows. More severe fires may also induce changes in various physical properties of the soil (e.g. soil structure, porosity and infiltration, water holding capacity) that affect soil erodibility and infiltration-runoff ratios.
- Consistent with the above-mentioned increase in, and timeframe of, increased runoff, erosion rates increase post-fire and generally take up to a decade or more to return to near pre-disturbance conditions. In the medium- to longer-term, and as the vegetation begins to re-grow and establish, the hydrological effects can start to move in the opposite direction, whereby catchment flows are reduced to below pre-fire levels due to high water requirements of the growing vegetation. However, this response may not occur in all landscapes, and will be dependent on numerous biophysical factors, including fire severity/intensity, vegetation type and its response to fire, and the rainfall zone.
- Debris flows, which are a fast-moving mass of unconsolidated, saturated debris, are thought to be a significant contributor to water quality impacts post-fire, particularly in severely burnt, steep upland catchments following high intensity rainfall events.
- Fire can change the levels of chemical constituents in soils and may make some constituents more readily available for transport into waterways. For example, ash represents a

concentrated and readily mobilised and transported source of soluble inorganic material, including nutrients, major ions and trace elements. Ash can represent a significant source of contaminants to waterways, especially in the first-year post-fire.

- Burning of riparian zones can result in increased runoff and associated sediment and contaminant transport into waterways, increased streambank erosion, as well as increased light penetration and associated increased water temperatures of waterways.
- Use of large quantities of fire retardant/suppressant, which typically contains high levels of phosphorus and/or nitrogen, can add an additional nutrient burden to waterways, although this may still be minor relative to that contributed by the burnt catchment.
- In relation to water quality impacts within reservoirs, the extent of post-fire water quality changes will reflect the type and magnitude of pollutant loads entering the reservoir relative to its capacity to attenuate impacts. Some studies have shown significant and prolonged (up to two year) water quality impacts in reservoirs, while others have shown negligible to minor impacts, post-fire.

Nature of water quality impacts

The increased runoff and stream flows experienced post-fire increases the potential for movement of sediment and any associated nutrients and other elements (e.g. major ions, trace elements). Sediment may be derived from increased erosion of hillslopes or scouring of gullies, drainage lines and stream banks. Poor water quality has the potential to affect numerous environmental values (e.g. human consumption, recreation, cultural and spiritual, agriculture, aquatic ecosystems, industrial use), although impacts to aquatic ecosystems are the primary focus of this overview. Key contaminants of concern to waterways post-fire are briefly discussed, below

Suspended sediment

Suspended sediment loads immediately post-fire (i.e. up to one year) are highly variable, and range from just over 1x to more than 1000x higher than pre-fire loads. The magnitude of change is dependent on fire extent and severity, post-fire rainfall patterns, erosion processes, topography, sources of suspended sediment and scale effects. Intense summer storms represent the most significant events of concern for suspended sediment inputs to waterways post-fire. The increases in suspended loads are generally reflected in increased concentrations. Maximum values typically occur briefly, during stormflow events, but elevated levels may persist for longer timescales due to increased erodibility of the landscape as well as increases in stores of sediment within the waterway, which can be remobilised by subsequent flow events. The length of time that such remobilisation and associated water quality impacts can occur depends on the extent of sediment stored in the waterway as well as the pattern of rainfall and associated stream flows. Increased suspended sediment and turbidity can be measurable and prolonged more than 100 km downstream of burnt areas. Sediment will deposit in low flow zones and standing waterbodies such as reservoirs, which can result in smothering effects and altered bathymetry. Suspended sediment (and organic matter) associated with post-fire debris flows may also contribute to reduced dissolved oxygen levels in waterways.

Nutrients

As with suspended sediment, bushfires tend to increase nitrogen and phosphorus inputs to waterways, including reservoirs, with the extent of increase being highly variable, and largely linked

to a similar set of factors as for suspended sediment, as well as the vegetation type. The timing of nutrient inputs is also variable, and probably largely linked to rainfall regime and various catchment processes. The key contributing sources of nitrogen and phosphorus to waterways after severe fire are likely to be suspended sediment, ash and dissolved in runoff water. In standing water or low flow environments, including reservoirs, increased nutrient concentrations, combined with potentially higher temperatures, can result in nuisance plant growth, including algal and cyanobacterial (blue-green algae) blooms. Notably, and as with many other chemical constituents, significant amounts of nitrogen, phosphorus and organic matter present in the vegetation and soil may be lost to the atmosphere, via combustion and volatilisation, depending on fire intensity.

There are few Australian data on the effect of bushfires on organic carbon in waterways. The data that exist, as well as data from North America indicate that increases may be observed but are generally minor. Organic carbon inputs to waterways appear to depend on the magnitude and timing of storm events after fire, and may be highest in burnt forest environments susceptible to large increases in overland flow and erosion (e.g. steep terrain). Fire severity is known to affect terrestrial organic carbon levels and, therefore, may also affect aquatic organic carbon levels. Higher severity fires result in volatilisation of most of the organic matter, whereas lower severity fires leave behind significant organic matter (e.g. leaves) that can be washed into waterways and facilitate microbial activity, potentially leading to anoxic conditions with associated consequences (e.g. mobilisation of metals such as manganese and iron, fish kills, effects on macroinvertebrates). However, organic matter can also ameliorate toxicity of metals and, as such, may have a beneficial effect in the waterways.

Trace elements

Trace elements are mobilised following the combustion of organic matter (vegetation, soil organic matter) and heating of soil. The limited information on effects of bushfires on trace elements suggests that metal and metalloid loads and concentrations can be increased post-fire. For the Snowy 2.0 Project, this could mean even higher background concentrations of aluminium and copper (and other metals) in local watercourses and the reservoirs. The legacy copper mining areas may become an even greater source of copper (and other metals) to the waterways given the likely increased erodibility of the soils. However, higher stream discharge due to increased runoff can also dilute the concentration of contaminants if the contaminants are supply limited.

Other contaminants

There are insufficient data on the effects of bushfires on major ions concentrations in waterways. Although some North American data exist, they are from conifer forests and may bear no relevance to native south-east Australian forests. However, it is plausible that salts from soils and vegetation would be mobilised following fire and be transported to waterways.

High severity fires can result in the natural production of pyrogenic compounds such as polycyclic aromatic hydrocarbons (PAHs), polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs) and polychlorinated biphenyls (PCBs). Limited data from overseas suggests that such compounds can be elevated post-fire, but return to background levels after relatively short periods (i.e. months). However, there appears to be no data for Australia.

As noted above, fire retardants/suppressants can introduce nutrients and other chemicals into aquatic ecosystems. There are limited data on their significance to post-fire water quality. Boulton et al. (2003) found that the use of fire suppressants could result in short-term increases in nitrogen and phosphorus concentrations, but that this did not result in significant impacts to aquatic

macroinvertebrate communities. The impact of fire retardants/suppressants on water quality is likely to be minor relative to the other impacts of bushfires on water quality but still warrants recognition.

References

Boulton AJ, Moss GL & Smithyman D 2003. Short-term effects of aerially-applied fire-suppressant foams on water chemistry and macroinvertebrate in streams after natural wild-fire on Kangaroo Island, South Australia. *Hydrobiologia* 498, 177-189.

Smith H, Cawson J, Sheridan G & Lane P 2011. Desktop review – Impact of bushfires on water quality. For the Australian Government Department of Sustainability, Environment, Water, Population and Communities. Forests and Water Group, Department of Forest and Ecosystem Science, Melbourne School of Land and Environment, The University of Melbourne, Melbourne, VIC.

Tulau MJ 2015. Fire and Soils. A review of the potential impacts of different fire regimes on soil erosion and sedimentation, nutrient and carbon cycling, and impacts on water quantity and quality. State of NSW and Office of Environment and Heritage, Sydney, NSW.

ANNEXURE B – TRIGGER ACTION RESPONSE PLAN



webuild | clough | lane

MANAGEMENT PLAN

SNOWY 2.0 MAIN WORKS – SURFACE WATER TRIGGER ACTION RESPONSE PLAN 1

S2-FGJV-ENV-PLN-0145

REV H.

JULY, 2025

ABSTRACT

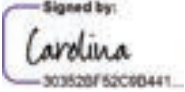
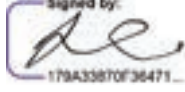
The key objective of this Plan is to detail management measures of the trigger action response in the event analytes in the receiving water exceed the water quality objectives for the project.

Revision Record

H	28.07.2025	Updated for currency	S. Lang	E.Porter	F. Lazzarin D. Drummond
Rev.	Date	Reason for Issue	Responsible	Accountable	Endorsed



Document Verification**RACIE Record**

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C onsulted:	See distribution list on Page 3.	
I nformed:	See distribution list on Page 3.	
E ndorsed:	Name: Fabrizio Lazzarin Job Title: Project Director Signed:  Date: 06 February 2026	Name: David Drummond Job Title: QSHS Director Signed:  Date: 06 February 2026 JUSTIN TANNOCK

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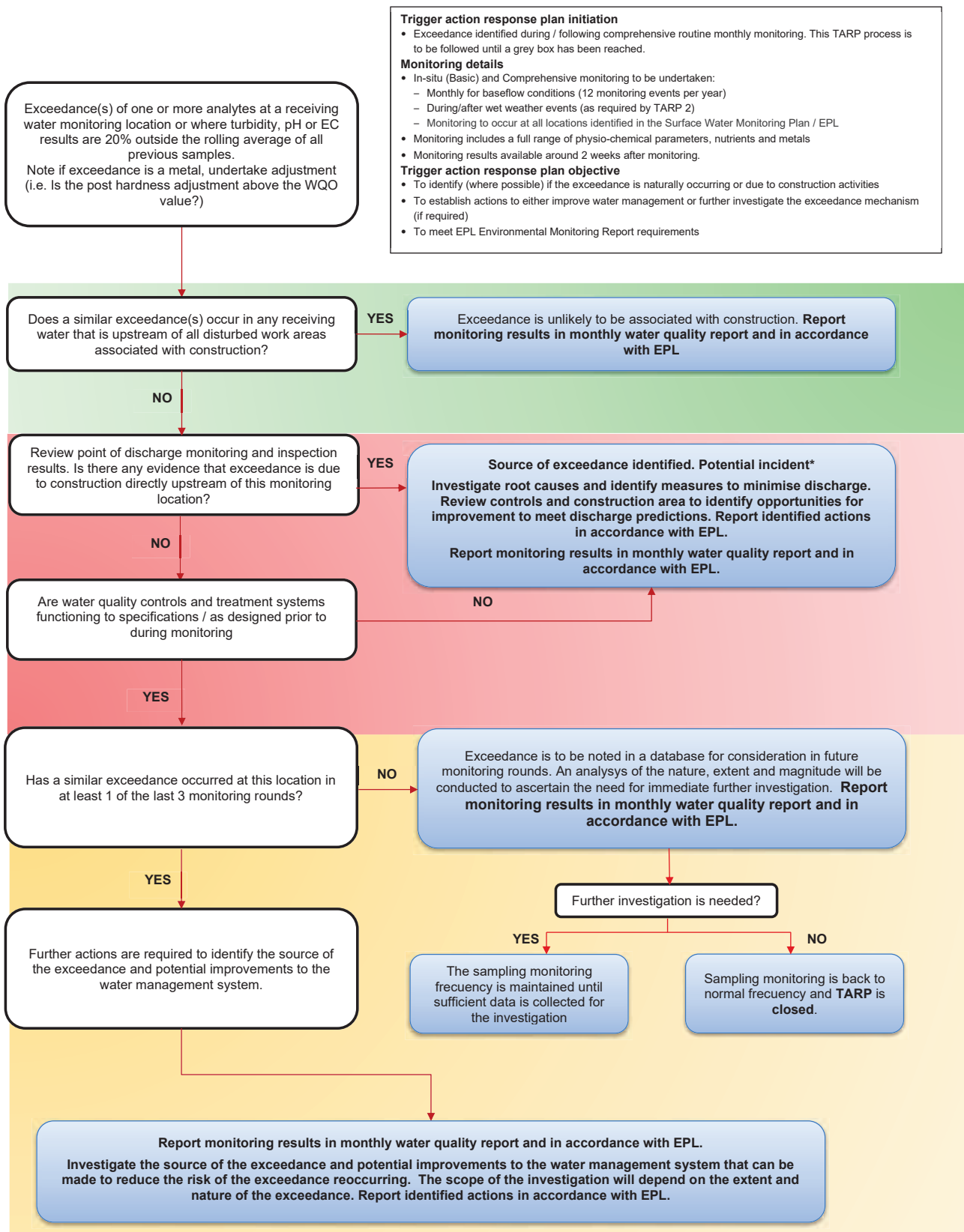
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E	06.08.2020	Revised to address stakeholder comments
F	19.09.2020	Revised to address DAWE and DPIE comments
G	13.09.2022	Revised to address annual audit findings
H	28.07.2025	Updated for currency

Trigger Action Response Plan 1 – Receiving Waters Monitoring Exceedance



* In the event of the occurrence of an incident, the Future Generation Environment Manager will immediately inform SHL who will contact DPHI, NPWS and EPA in accordance with the requirements of Schedule 4 Condition 6 of the Infrastructure Approval and the EPL (21266)



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MANAGEMENT PLAN

Snowy 2.0 Main Works – Surface Water Trigger Action Response Plan 2

S2-FGJV-ENV-PLN-0146

REV H.

DECEMBER, 2025

ABSTRACT

The key objective of this Plan is to detail management measures of the trigger action response in the event of a stormwater overtopping event.

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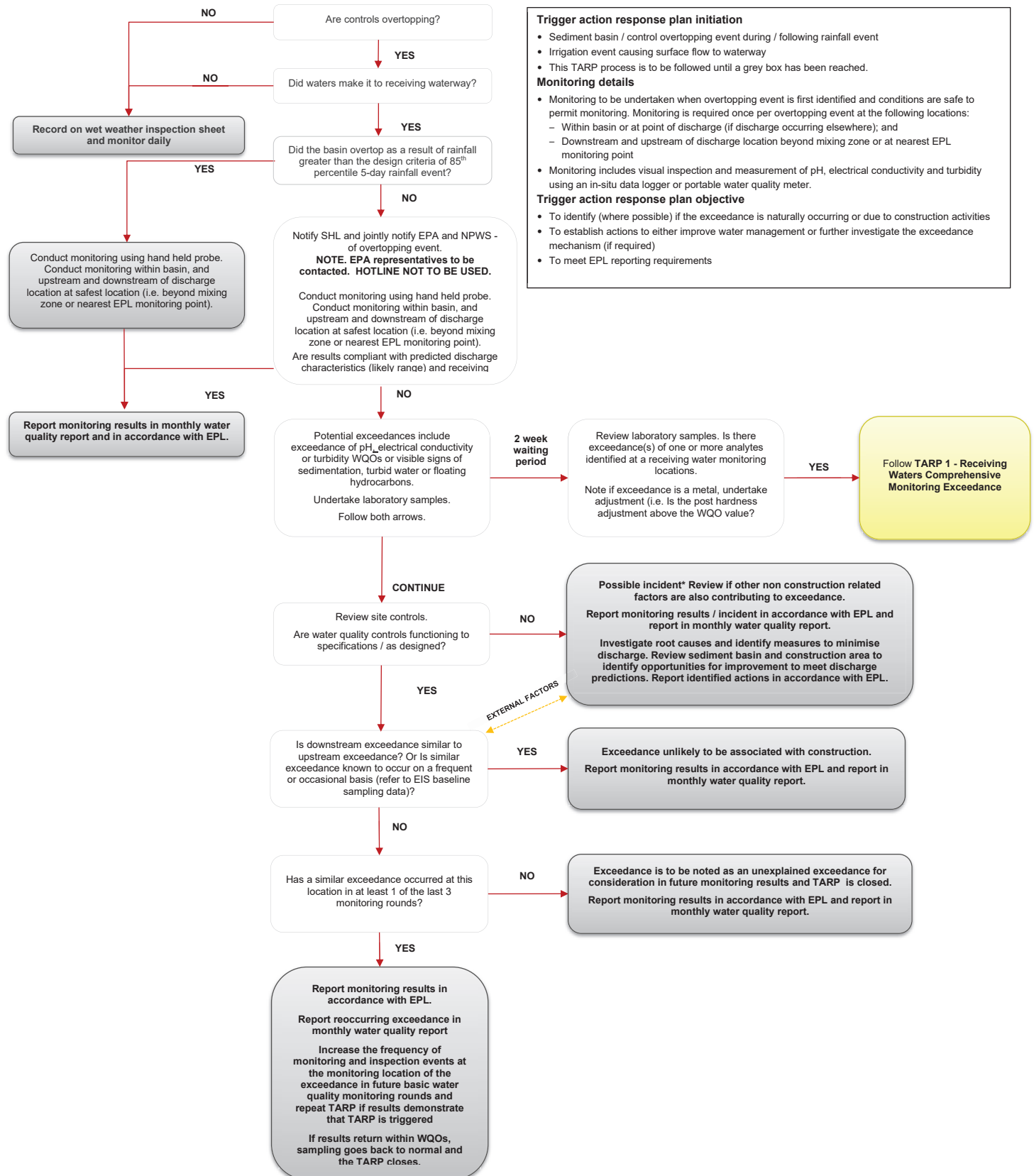
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G	13.09.2022	Revised to address EPA process with regard to TARP process
H	12.12.2025	Updated for currency

Trigger Action Response Plan 2 – Stormwater Overtopping Event



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* In the event of the occurrence of an incident, the Future Generation Environment Manager will immediately inform SHL who will contact DPHI, NPWS and EPA in accordance with the requirements of Schedule 4 Condition 6 of the Infrastructure Approval and the EPL (21266)

ANNEXURE C – SPILL RESPONSE PROCEDURE



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PROCEDURE

SNOWY 2.0 MAIN WORKS – SPILL RESPONSE PROCEDURE

S2-FGJV-ENV-PRO-0039

REV. E

DECEMBER, 2025

ABSTRACT

This document outlines the essential steps for a safe, swift, and effective response to spills of hazardous or non-hazardous materials. It details procedures for containment, control, clean-up, and reporting, aiming to minimise environmental impact, protect personnel, and ensure compliance with regulatory requirements.

Revision Record

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D	19.09.2020	Final
E	28.07.2025	Updated for currency

Introduction

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This procedure has been developed and will be implemented in accordance with the requirements of the Environmental Management Strategy (EMS) and corresponding approval requirements.

Objective

The objective of this procedure is to:

- Detail the requirements for managing, containing and cleaning-up spills on-site including but not limited to chemical, fuel or oil spills or leaks that originate from the project work area that have the potential to contamination soil and or water;
- To aid in minimising the emergency response time and in-turn minimise the potential impact to the environment; and
- Meet the requirements in schedule 3, condition 30 of the Infrastructure Approval.

In the event of a spill the emergency response procedure provided on the following page will be implemented. All spills will be reported to the appropriate officer and immediately deploying spill containment and/ or absorption kits to restrict its spread.

Control Measures

Preventative Spill Measures

In order to minimise the potential environmental impacts to water and soil from spills the following will be undertaken by Future Generation:

- training in use of spill containment materials, their locations and spill response will be undertaken proactively as required particularly for personnel who are working within or near to aquatic environments such as dredging works;
- minimising vehicle and plant accessibility to waterways by maintaining the 50-metre exclusion zone around Yarrangobilly River (excluding some areas such as required water crossings);
- where possible, refuelling, washing and maintenance of vehicles and mechanical plant will occur at least 50 metres from waterbodies;
- plant and equipment will undergo regular checks and subsequent repair for potential leakages or worn hydraulic hoses;
- all chemicals including fuels and oils will be stored when not in use in bunded areas; and
- all chemicals and hydrocarbons will be stored and handled as per manufacturer's instructions;

Regular inspection of chemical storage and usage will be undertaken to assess compliance of the above measures.

Reactive Spill Measures

This includes response to any spills during the following activities which have a higher likelihood or consequence of spill occurrence:

- vegetation clearing and stripping of soils;
- refuelling, wash down and or maintenance of plant and equipment including marine equipment used for in reservoir geotechnical investigations;
- operation of equipment that require fuel, chemicals, lubricants or similar including pumps and water treatment plants;

- working within particularly sensitive environments including marine dredging, subaqueous material placement, in reservoir geotechnical investigation, waterway crossings or diversions.

The impacts of the spill should be isolated and the Emergency Spill Response Flowchart implemented.

Spill containment material such as those listed in Table C 1 referred to as 'spill kits' will be kept, stocked on site at any location where there is significant risk/consequence of a spill including at refuelling areas, workshops, chemical storage and within the vicinity of waterways including on all marine vessels at all times.

The spill kits will be appropriately sized according to the volume of chemicals and fuels being stored or used as well as based on the potential for proliferation such as silt curtain lengths based on dredging extent (as required). All staff would be made aware of the location of the spill kit and trained in its use. Table C 1 provides examples of appropriate application of material types.

The Environment Team is available for assistance and advice in purchasing the correct spill containment materials. Spill kit inspections and required restocking and are to be undertaken on regular intervals such as during weekly site inspections in accordance with the EMS.

Table C 1: Spill containment materials

Name	Description
Hydrophobic booms	• Used to contain and absorb floating contaminants typically in aquatic environments including hydrocarbons. • Consider the need to install floating booms before starting works if there is potential for contamination in a waterbody • If the booms alone cannot absorb the contaminant then consider using absorbent material such as granules to soak up the spilled liquid on land or deploy additional surrounding booms or silt curtains when within a waterway
Silt curtains	• Used to minimise impacts due to contaminants within waterbody including sediments • Consider the need to install silt curtain(s) and the extent of the curtain(s) prior to commencing ground disturbance works including dredging in or near waterbodies • If one curtain alone cannot contain the contaminant then consider deploying additional curtains around the outer perimeter
Pads, Pillows and socks	• Used to clean-up (absorb) small to medium liquid spills on land rather than containing. Thin absorbent mats place over spills. Cushion shaped products containing absorbent fibres, used directly under a leak or drip. Absorbent socks placed at the low point of a spill • Consider the need to have a spill kit containing these at the source of the activity and extras in-stock on site • If these materials are not enough to clean-up the spill, consider using absorbent granular materials or equivalent
Drain Covers	• Used to filter or absorb contaminants as they enter a drainage system. Covers such as drain wardens placed over stormwater inlets and pit grates to filter sediments and, when installed with hydrophobic pillow, absorb hydrocarbons prior to entering to stormwater system • Covers should be installed within the pit/drain prior to works commencing. Consider regular checks and cleaning of drain covers to extend its life. • Consider installation of physical bunding, diversions away from drains or plastic pit gel covers if drain covers are frequently becoming laden with contaminant(s)

Name	Description
Sorbents	• Used to clean-up, sorbents are materials that soak up the spill such as saw dust and peat mixture. Spread the sorbent over the contaminant after control materials have been applied. Recover the contaminant/sorbent mixture using shovels/excavator bucket or similar • Sorbents can be used from small to large spills • Consider if a large quantity of sorbent needs to be used then manual recovery may be a more suitable method
Manual Recovery	• Used to physically remove the contaminant either by excavating the contaminant and adjacent soil on land or vacuum truck removal for contaminant and adjacent liquid/sludge in waterbodies • Control materials should be installed prior to manual recovery to prevent spread during recovery task
Drip trays and washout bunds	• Used to contain incidental leaks during plant and equipment maintenance and equipment washout post activities such as concrete works • Containers should be maintained and liquids/sludge collected should be regular removed appropriately • Consider if these containers are not sufficient to contain leaks/washout then construction of permanent bunding may be suitable

Incident Management

Incidents are managed in accordance with the Section 7 of the EMS and the Pollution Incident Response Management Plan (PIRMP). The investigation will include a review of events leading up to the incident and a review of what improved practices may be required.

In the event of the occurrence of an incident as defined under the Infrastructure Approval, the Future Generation Environment Manager will immediately inform Snowy Hydro (verbally) who will contact Department of Planning, Industry and Environment in accordance with the requirements of Schedule 4, Condition 5 of the Infrastructure Approval.

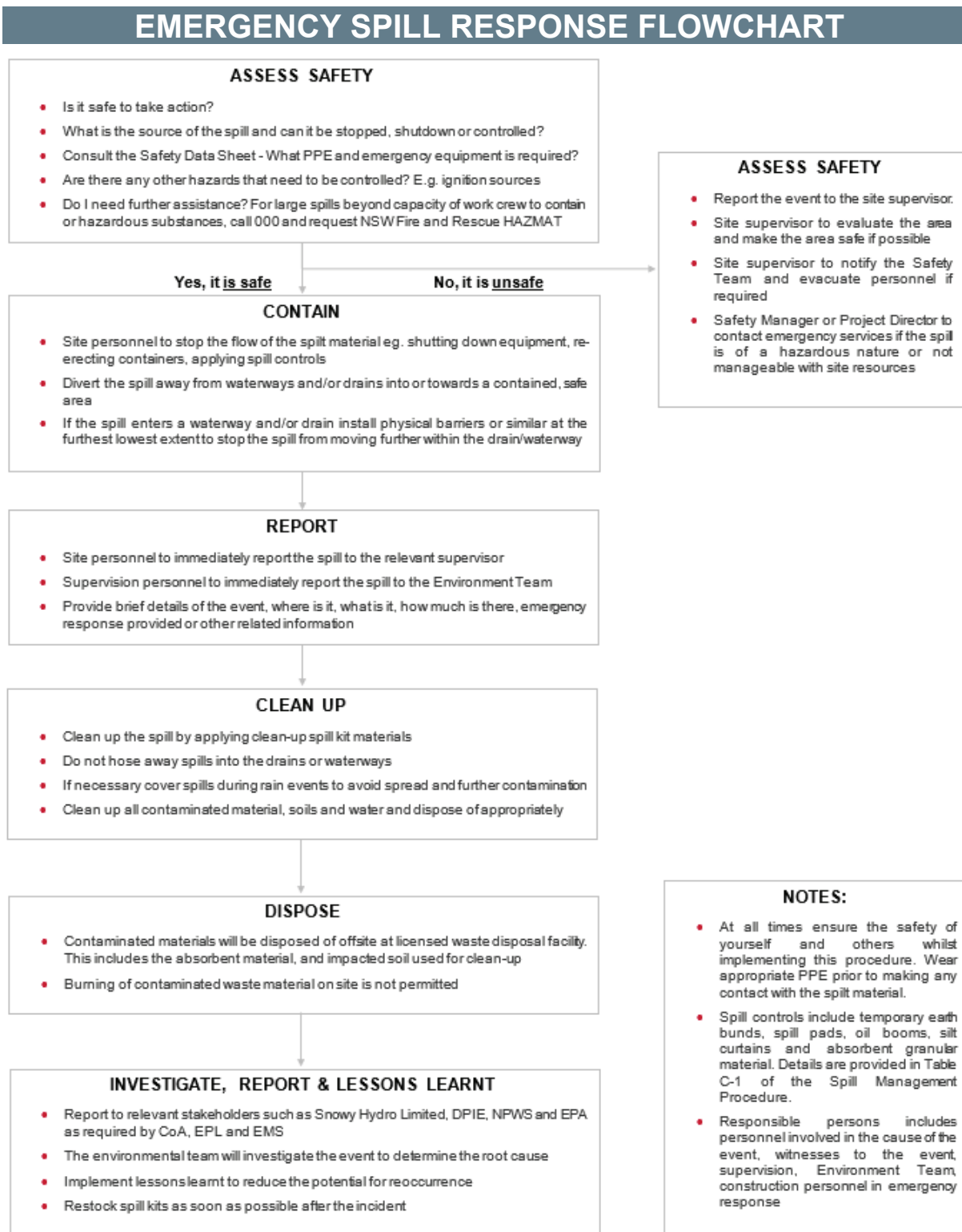
Corrective actions will be implemented to reflect the root cause of the event. This may include:

- additional spill response training; and
- installation of physical barriers or diversions;

In accordance with Part 5.7 the *Protection of the Environment Operations Act 1997*, the Environment Manager or Project Director will enact the Pollution Incident Response Management Plan (PIRMP) should the incident be deemed to have:

- resulted in actual or potential for material environmental harm, or
- the associated clean-up costs exceed \$10,000.

Figure C 1: Emergency Spill Response Flow Chart



ANNEXURE D – ON-LAND AND IN-RESERVOIR GEOTECHNICAL WORKS

Geotechnical Works

Process for in-reservoir and on land drilling

The below details provide information relating to the proposed procedure for undertaking geotechnical works both on the reservoir (in-reservoir) and on land. These measures are detailed and therefore may need to be modified to address any site-specific requirements as they arise.

Overwater drilling will be further defined through works specific packages including the pre-during and post works requirements whereby links to Management Plans in development will be further refined.

Environmental Clearance

Prior to commencing work activities, the project will ensure approvals and systems developed during the planning stages are complete.

Environmental inspections will be undertaken in accordance with EMS requirements, prior to establishment to identify acceptable clearing routes.

Track and Pad Preparation

The FGJV Permit to clear will be obtained where clearing is required. This includes geotechnical barge launching works which will be further detailed by the awarded sub-contractor.

The method to for track and pad establishment will include:

- pre-establishment vegetation inspections by the ecologists in accordance with EMS and Biodiversity Management Plan (BMP);
- disturbance boundary and / or clearing limits to be delineated with flagging in accordance with the Pre-clearing Procedure in Appendix C of the BMP;
- clearing of vegetation in approved locations and drill pads to occur using forestry mulcher, chainsaws and excavator crew;
- removed cover and woody debris / branches, to be pushed to the edges of the access track and drill pad sites for later use during site rehabilitation;
- placement of geofabric, track mats and / or gravel at track depression to maintain safe access and minimise impact on gully soils;
- installation of required sediments control measures along the tracks and around the drill pad sites;
- install track signage to allow UHF call up and communication protocol;
- minor earthworks and importation of sheeting gravel to level and stabilise drill sites;

Water supply for drill sites outside of Marica track will generally consist of direct supply to on-site storage tanks using water carts.

Mobilisation of Drilling Equipment

The following points provide a summary of the key activities associated with mobilising equipment to site;

- drill rigs will be floated to the laydown areas where they will be taken to site using existing and constructed access trails. Laydown areas identified for use during mobilisation include:
 - Coppermine and Marica Laydown (for work on Marica Track);

- Tantangara Quarry (for work near Tantangara);
- Lobs Hole (for work near Talbingo Intake);
- Tantangara Foreshores (for overwater work in Tantangara);
- O'Hares Rest (for overwater work in Talbingo);
- drilling support equipment including rods, pumps, water tanks, mud tanks, spill kits, site compound, lighting, mobile generators and other equipment necessary for the operation of the drill rig will also be mobilised to laydowns and transferred to site pads accordingly;
- access (by personnel and for delivery and removal of equipment etc) will be via the existing and newly established tracks and the Snowy Mountains Highway.

Vehicle hygiene for all new plant, machinery and vehicles will be checked prior to accessing the site for the first time as per the Weed and Pest Inspection Form.

For all plant and machinery coming directly from the Tantangara area known to contain the invasive weed species Ox Eye Daisy specific wash-down will occur prior to re-entering the National Park to ensure the removal of seeds and potential seed-harboring material.

Where possible, all ancillary equipment and personnel will be mobilised to site using light / tracked vehicles.

If a nominated laydown location is determined to be unsuitable or redundant, this Plan will be updated following the appropriate consultation processes.

Drilling Activities and Downhole Testing – Land Based

Drilling activities, including borehole establishment and in situ testing and will typically include the following:

1. Excavate surface sump at drill collar and line with suitable plastic liner to seal collar.
2. Install HW casing to suitable depth and seal in place with gypset or similar.
3. Core drilling of boreholes using triple tube coring methods. Most boreholes will be starting with PQ-3, size hole, then telescope to HQ-3 and where necessary to NQ-3.
4. Drill mud management - Containment of excess drilling fluids and cuttings in above-ground re-circulation tanks, excess fluids would be stored in portable industrial bulk containers (IBCs).
5. Clean water flushing of boreholes upon reaching target depths.
6. In situ down hole testing as required:
 - In-situ Stress Test via overcore (IST)
 - Dilatometer testing
 - Hydro-fracture and hydro-jacking pressure testing
 - Drill Stem permeability testing (DST)
7. Clean water flushing of boreholes upon reaching target depths.
8. Downhole borehole survey using acoustic televue cameras and probes.
9. Survey of the as-built borehole location using GPS or suitable survey techniques.
10. Ongoing maintenance of the equipment and site as required.

An indicative site layout for the drill sites is shown below in Figure 1 and Figure 2.

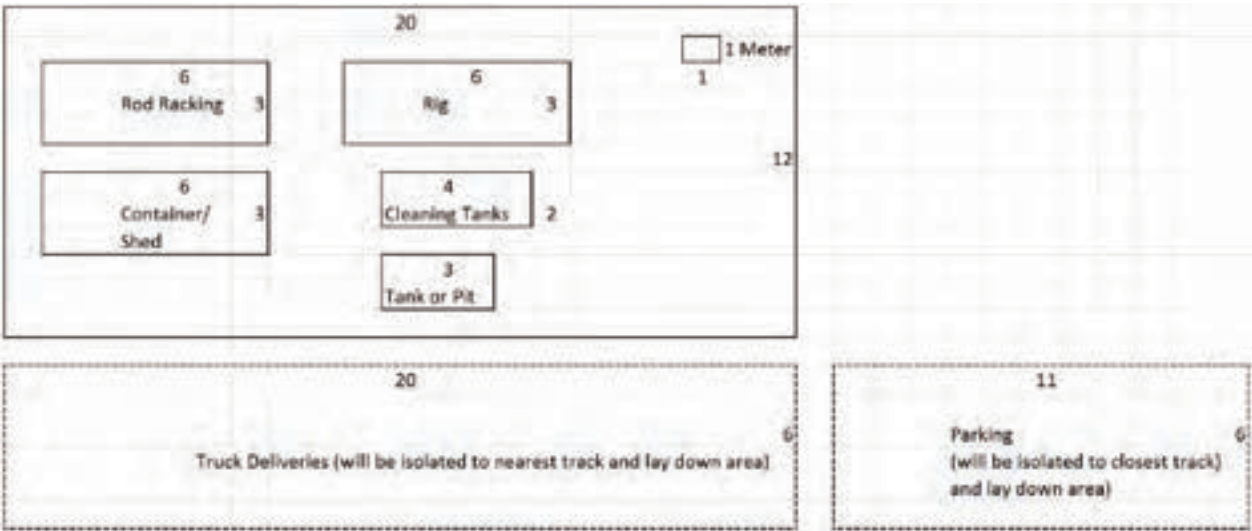


Figure 1 Indicative site layout

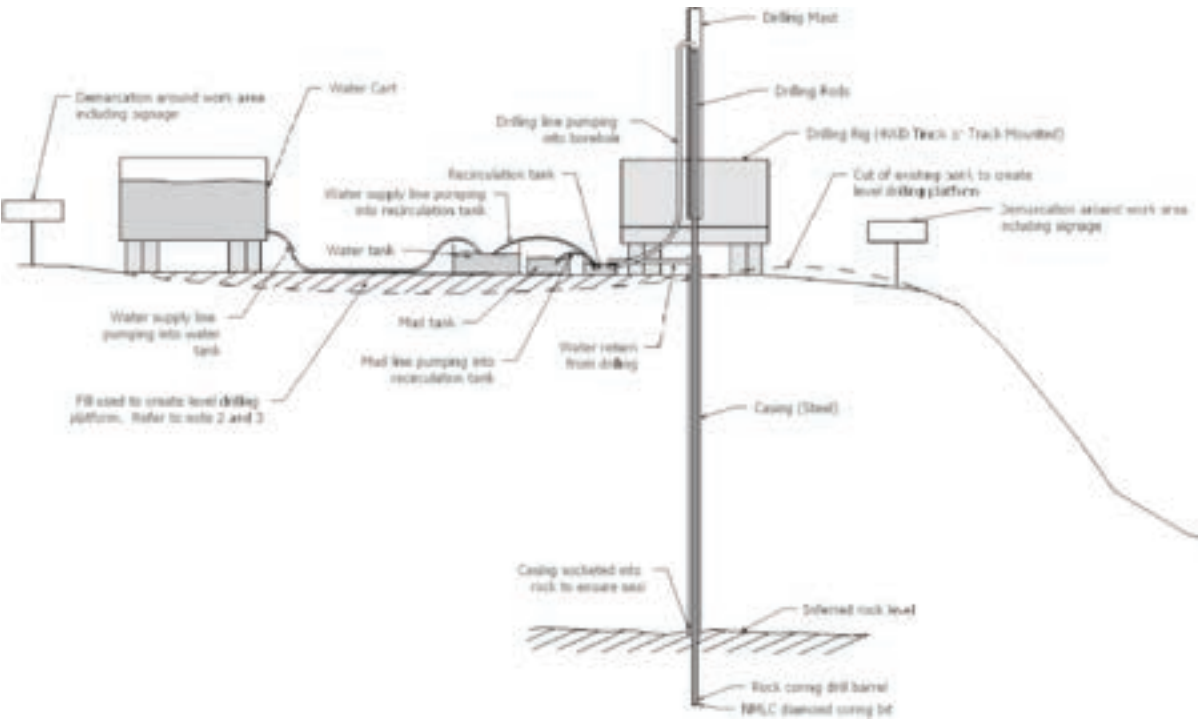


Figure 2 Indicative site layout (cross-section)

Auxiliary Support Services

Water Supply

Drilling activities require consistent fresh water supply circulate drilling muds through the borehole to return rock cuttings.

Water will be supplied using water carts by extraction and transfer directly to the drill sites.

Core Sample Transport

Removal of drill core (contained in light steel core trays) and other equipment will be undertaken as required on a daily basis. Transport of core trays will be done using a dedicated core transfer team in 4WD utes.

Drill Mud and Waste Disposal

Excess drilling muds and all drilling waste will be collected from drill sites using vacuum tankers and transferred to a holding facility. From this the waste will be characterised. Where muds do not contain naturally occurring asbestos (NOA) and suitable PSE (on land) are active, muds may be dewatered and remaining spoil, placed in PSEs. Where muds contain NOA or there are no suitable PSEs active muds will be disposed at a suitably licensed (NSW EPA) waste management facility in accordance with the NSW EPA *Waste Classification Guidelines* (2014).

Water based drilling mud removal will be determined by the awarded third party whereby best practice risk mitigation measures will form a significant portion of the specific procedure.

Borehole Instrumentation and Decommissioning

Following successful completion of borehole drilling and in situ testing and sampling, the following borehole decommissioning activities will occur:

- for boreholes with nominated VWP logging instrumentation, a series of grout tubes, sensors and cabling will be hung inside the borehole. The borehole will be grouted using displacement grouting techniques, and the sensor cables will be wired to a data logger box for completion;
- for boreholes with no instrumentation to be installed, the borehole will be decommissioned by grouting in accordance with Minimum Construction Requirements for Water Bores in Australia.

Equipment Demobilisation

On completion of drilling activities and borehole installations and decommissioning, all equipment used during the works will be demobilised staged in the same laydown areas used during mobilisation.

Track and Pad Rehabilitation

Drill sites where any ground disturbance or clearing have occurred will be rehabilitated in accordance with Exploratory Works Modification 1 requirements, unless further approvals supersede Modification 1 requirements; i.e. The tracks or pads are planned to be used for future approved works.

The drill pads will be rehabilitated in accordance with the following principles:

- successful rehabilitation is based on the principle of “No Bare Ground” after rehabilitation works have been carried out;
- implementation of strict vehicle hygiene protocol, such as washing down of equipment and vehicle wash bays before entering KNP;

- utilisation of cleared or mulched vegetation in the rehabilitation activities.

The approach to rehabilitation will aim to use existing ecological resources at the sites and to minimise the use of additional materials such as seed, tubestock and mulch. This approach to rehabilitation was used throughout the Feasibility stage geotechnical investigation program and has been undertaken successfully to date.

Following completion of all site activities, a visual inspection of the site by SHL and NPWS personnel will be undertaken to ensure that the location of the drilling activities has been reinstated to an acceptable standard.

Overwater Drilling

Overwater drilling activities, including in situ testing and borehole decommissioning are to include the following activities.

- mobilise and secure 'jack up' or floating barge to reservoir floor using concrete anchors that will be removed at completion of work;
- install a small anchor on the shore line or to deployed concrete anchor blocks to allow stabilisation of the barge;
- drill boreholes using auger and rotary wash bore drilling techniques through soils and weathered rock including collection of disturbed samples;
- rock core drilling using triple tube diamond coring techniques to the nominated target depth at each borehole location;
- during drilling works excess drilling fluids and cuttings will be captured in re-circulation tanks at the borehole location. Any excess fluids would be stored in portable IBC containers and disposed to NSW EPA licensed facility;
- in situ permeability testing using water pressure tests;
- clean water flushing of boreholes upon reaching target depths;
- downhole borehole survey using acoustic televue cameras and gyrometers;
- coordinate survey of the as-built borehole location using GPS or suitable survey techniques.

At all times while the barge is moored it will comply with NSW Maritime safety requirements to ensure it is visible for other waterway users and will not pose a hazard to the public. A cross-sectional plan showing indicative site layout and operations of water based (barge) drilling is provided in Figure 3.

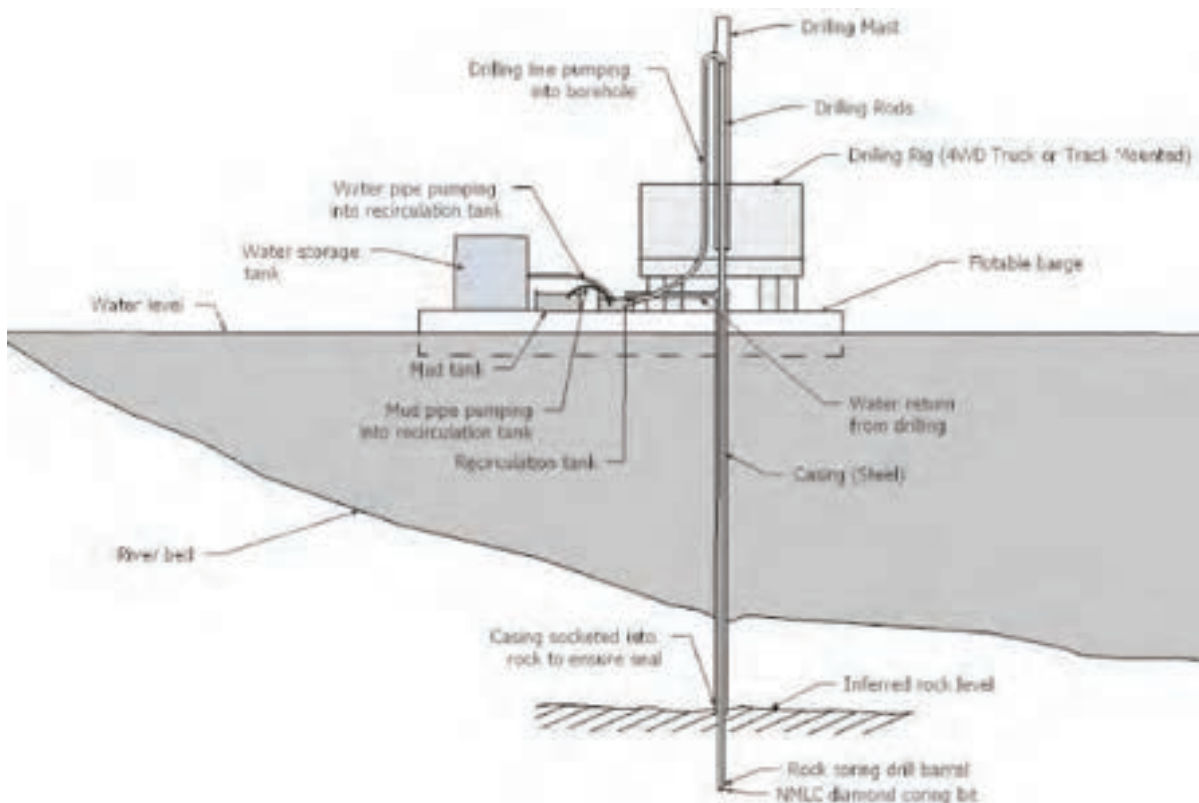


Figure 3 Typical barge geotechnical drilling set-up (cross section)

In-Reservoir Refuelling

During geotechnical works, some geotechnical drilling will be required to occur on Tantangara and Talbingo Reservoirs. The geotechnical drills will be based on barges and refuelling will be required to enable the works to occur.

The following steps are recommended to occur prior to and during refuelling. Mitigation measures to limit the risk of hydrocarbon contamination will include the use of booms, marine enclosure curtains (if applicable), on barge exclusion zones and activity-based risk assessments.

Prior to refuelling

- Lock or shut all valves or taps which are not required to be used during refuelling.
- Ensure that spill kits are available on the barge and are suitably stocked.
- Ensure that personnel are aware of how to utilise the spill kit.
- Ensure that any safety requirements are met (as a priority).
- Ensure that relevant MSDSs are available for use (either in soft or hard copy).
- Where possible, locate machinery as close as possible to the refuelling point.
- Where located on the barge, ensure that any scuppers or drains are blocked.

During refuelling

- Carefully deploy the fuel hose.
- Lock shut all valves or taps which are not required for use.

- Where refuelled by fuel truck from shore, the vessel / barge being refuelled is positioned as close as possible to the quay/crane pad.
- Carefully deploy the fuel hose.
- Allowances must be made for the relative movement of the barge.
- Ensure spill kits and fire extinguishers are suitably positioned for each refuelling situation.
- Install a watch system on board both the vessel and the shore to watch for leaks and spills.
- Terminate the fuel transfer system immediately if a leak or spill occurs.
- Any spills are to be reported in accordance with the Spill Response Procedure (Annexure C).

ANNEXURE E – OPERATION OF THE DISCHARGE POINTS



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PROCEDURE

SNOWY 2.0 MAIN WORKS – OPERATION OF DISCHARGE POINTS

S2-FGJV-ENV-PRO-0034

REV E

JANUARY, 2026

ABSTRACT

This plan has been developed as part of the SWMP and outlines the measures for the operation of the discharge points.

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E	04.02.2026	Updated to address SHL comments	S. Lang	E. Porter	D. Drummond
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A	06.08.2020	For inclusion in SWMP
B	19.09.2020	Final
C	13.09.2022	Updated for currency and to reflect EPL requirements
D	28.07.2025	Updated for currency
E	04.02.2026	Updated to address SHL comments

1. INTRODUCTION

This specific plan has been developed as part of the SWMP and outlines the measures for the operation of the discharge points.

1.1. Objective

The objective of this specific plan is to:

- detail the requirements for managing the discharge points in Talbingo and Tantangara reservoirs; and
- meet the requirements in schedule 3, condition 30(k) and 31(c) of the Infrastructure Approval.

2. CONTEXT

Licensed discharge locations in accordance with the Project EPL 21266 will exist in both Talbingo and Tantangara reservoirs for the effluent waste streams from the wastewater and process water treatment plants. These two waste streams will be treated and combined prior to discharge to the receiving environments such that there will be only one discharge point in each reservoir.

A mixing zone assessment was undertaken by Royal Haskoning DHV (RTS Appendix J Attachment F) to determine the near-field dilutions associated with process and wastewater discharges to Tantangara and Talbingo reservoirs and estimate the size of mixing zone required to dilute key analytes (electrical conductivity, total nitrogen and total phosphorus) to ambient water quality conditions.

A revised mixing zone assessment was undertaken in July 2021 (RHDHV, 2021) to reflect engineering design refinements and resulting changes to the proposed volumes of water to be treated and discharged to the reservoirs. The revised mixing zone assessment provided updated estimates of the near-field mixing and dilution characteristics for key constituents.

The revised mixing zone assessment found that dilutions to meet target water quality were achieved within tens of metres of the outfall, but that for some ambient conditions the mixing zone could be between 50 and 100 m. The assessment also identified that the magnitude of water quality change associated with treated wastewater and process water discharge and subaqueous spoil placement is expected to be greater:

- in summer/autumn due to lower seasonal streamflow into the reservoir; and
- during drought conditions due to lower streamflow into the reservoir.

3. CONTROL MEASURES

This section identifies the measures that will be implemented to minimise surface water impacts and achieve the outcomes of the revised mixing zone assessment. All measures are included in Table 5-3 of the SWMP (SW22 to SW35, SW68 and SW72).

3.1. Preventative Measures

Water is treated to discharge specifications

Predicted discharge characteristics for the combined waste discharge stream prior to it being discharged are shown in Table F-1. These characteristics are based on the water quality of the combined waste streams estimated for the revised mixing zone assessment (RHDHV, 2021). They reflect the median water quality values reported in revised Waste and Process Water Mixing Zone Assessment, adjusted to account for the relative proportions of each of the waste streams contributing to the combined discharge.

Discharge characteristics will be updated where detailed design specifications indicate different characteristics, noting that specifications need to be such that the WQOs will be met in the receiving environment wherever possible. Updating of the discharge characteristics will be done in consultation with SHL and regulators.

Table F-1: Predicted major water quality characteristics of combined treated wastewater and process water discharge (source: RHDHV, 2021)

Analyte	Units	Discharge characteristics ¹		Comments
		Talbingo	Tantangara	
Electrical conductivity	µS/cm	700	168	The treatment processes will not remove dissolved solids. Hence, water salinity will not be reduced by the treatment process.
pH	-	6.5-8.5	6.5-8.5	Alkalinity and pH will be adjusted as part of the treatment processes
Turbidity	NTU	<25	<25	Suspended solids and turbidity will be substantially reduced as part of treatment processes
Total nitrogen	mg-N/L	0.26	0.25	Nutrients will be substantially reduced by the treatment processes.
Total phosphorus	mg-P/L	0.023	0.02	

Note 1. Values represent an average of the likely medians for treated wastewater and process water, weighted according to the proportional volume of each discharge contributing to the combined discharge, as reported in Attachment F of the revised Water Management Report (EMM 2020).

Where in-line sensors (typically pH and turbidity) or monitoring identify WTPs performance drift outside of the required discharge characteristics, measures will be implemented to return the WTPs performance back into the required range. In these instances, water will be retreated to meet appropriate discharge criteria, re-used on site (e.g. dust suppression) or disposed offsite at an appropriate licenced liquid waste facility.

In April 2021, the Talbingo wastewater and process water monitoring and discharge locations were included in the Project EPL, following EPA review of the Lobs Hole Sewerage Treatment Plant Design Report and the revised Waste and Process Water Mixing Zone Assessment (RHDHV, 2021). In January 2022, the Project EPL was varied to increase discharge volume limit at point 43 from 1.66 ML/day to 4.32 ML/day and to include a discharge flow rate limit of 50 L/s, and the inclusion of a correlation assessment in order to monitor faecal coliforms.

In May 2022, the Tantangara wastewater and process water monitoring and discharge locations were included in the Project EPL and include a discharge flow rate limit of 50 L/s.

Discharge Outlet

The location of the combined treated wastewater and process water discharge outlets in Talbingo and Tantangara Reservoirs are shown in Figure F-1. The Talbingo outfall location is located below the minimum operating levels (MOL) (Easting 624309.84, Northing 6040464.31), whilst the Tantangara outfall location will operate close to MOL (Easting 649721.4865, Northing 6037543.3341), consistent with the mixing zone assessment assumptions (RTS Appendix J Attachment F).



Figure F-1: Reservoir discharge outlets

To enhance the mixing efficiency of the combined treated discharge with reservoir water, an outfall diffuser outlet is used which contains port (or diffuser) holes that are angled upwards into the water column. This arrangement is shown in Figure F-2 and will minimise the potential for the reservoir bed to inhibit mixing.

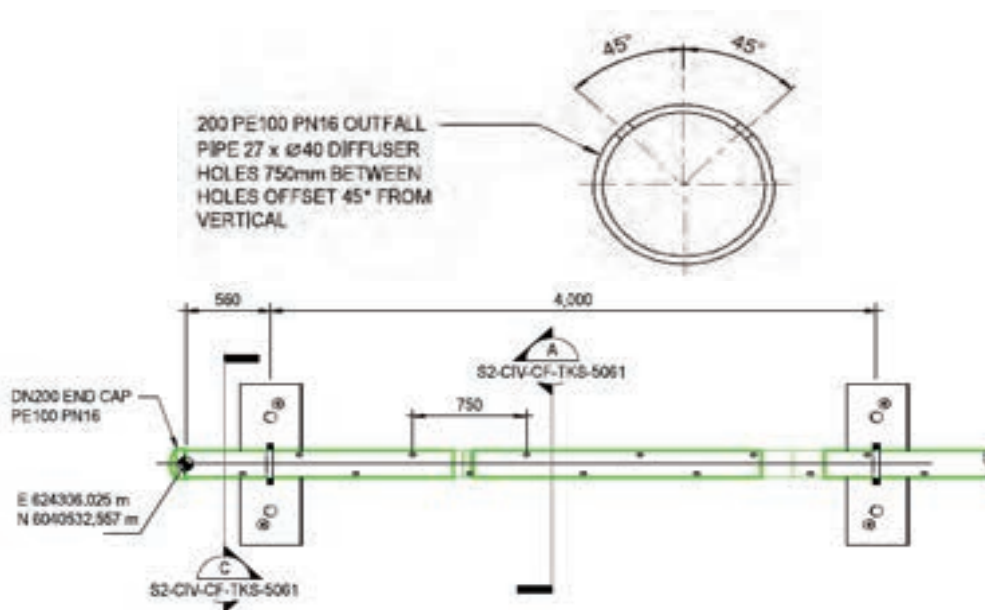


Figure F-2: Discharge Outfall Configuration

As dilution increases with plume velocity from the diffuser outlet, discharge velocity of the treated combined water will be controlled such that low velocity discharges (less than 4 L/s) are avoided. Treated wastewater and process water will be held in storage prior to the final release into the reservoirs. Pumps will be initiated to direct the treated water to the diffuser outlets and configured to avoid low discharge velocity (less than 4 L/s).

3.2. Reactive Measures

Discharge and Verification Monitoring

As identified in Section 3.2 of the Surface Water Monitoring Program (SWMP Annexure A):

- treated discharge waters will be monitored daily (basic parameters) and monthly (comprehensive parameters) to validate discharge characteristics; and
- a Mixing Zone Verification Program will be undertaken to verify that WQOs are consistently met at the edge of the near-field mixing zone for the discharge point, in accordance with EPL conditions E1.1 – E1.5).

In the event that monitoring identifies an exceedance, TARP 1 (Receiving Water Comprehensive Monitoring Exceedance) in SWMP Annexure B will be initiated.

Incident management

Incidents are managed in accordance with the Section 7 of the EMS and the Pollution Incident Response Management Plan (PIRMP). The investigation will include a review of events leading up to the incident and a review of what improved practices may be required.

In the event of the occurrence of an incident as defined under the Infrastructure Approval, the FGJV Environment Manager will immediately inform SHL (verbally) who will contact DPE, NPWS and EPA in accordance with the requirements of Schedule 4, Condition 6 of the Infrastructure Approval and EPL 21266.

Corrective actions will be implemented to reflect the root cause of the event.

In accordance with Part 5.7 the *Protection of the Environment Operations Act 1997*, the Environment Manager or Project Director will enact the Pollution Incident Response Management Plan (PIRMP) should the incident be deemed to have:

- resulted in actual or potential for material environmental harm, or
- the associated clean-up costs exceed \$10,000.

3.3. Trial discharge limits (EPL 21266 Condition L2.5)

Following the approval of the Snowy 2.0 “Waste and Process Water Mixing Zone Assessment (MZA), the EPA has granted a 15 month trial period for increased concentration limits for specific pollutants. This trial is valid until 31 December 2026.

Note: Operation of discharge points during this trial period must be supported by: * Mixing Zone Validation: A program to validate the modelling and assumptions in the MZA must be submitted to the EPA by 26 November 2025. * Nutrient Loading Monitoring: Continuous assessment of Total Nitrogen and Total Phosphorus concentrations and loads within the reservoirs. * Validation Reporting: A final Validation Report must be submitted to the EPA no later than 30 October 2026.

Table 3-1: Updated Concentration Limits Table

Pollutant	Units	Percentile Limit	
		90 th	100 th
Total Nitrogen	mg/L	1.5	3.0
Ammonia	mg/L	0.1	0.3
Total Phosphorus	mg/L	0.3	0.5

Pollutant	Units	Percentile Limit	
		90 th	100 th
Biochemical Oxygen Demand (BOD)	mg/L	1.0	2.0
Oil and Grease	mg/L	2.0	5.0
Total Suspended Solids (TSS)	mg/L	3.5	5.0

Note: The limits for Total Nitrogen, Ammonia, Total Phosphorus, and BOD are trial limits only and expire on 31 December 2026

APPENDIX B – GROUNDWATER MANAGEMENT PLAN

Christina McNally
Senior Environmental Advisor – Post Approvals
Snowy Hydro Limited
Sent via Major Projects Portal

22/07/2026

Subject: Snowy 2.0 Main Works – Groundwater Management Plan

Dear Mrs McNally,

I refer to the revised Groundwater Management Plan submitted in accordance with Schedule 3, Condition 31 of the Infrastructure Approval for the Snowy 2.0 Main Works project (SSI-9687).

I note the Groundwater Management Plan has been prepared:

- in consultation with the Environment Protection Authority (EPA), National Parks and Wildlife Service (NPWS), NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) - Water Group and NSW Department of Primary Industries (DPI) - Fisheries; and
- contains the information required by the conditions of the Infrastructure Approval.

The Department has carefully reviewed the document and is satisfied that it meets the requirements of the relevant conditions in the Infrastructure Approval (SSI-9687).

Accordingly, as nominee of the Planning Secretary, I approve the Groundwater Management Plan (Revision O dated 23 January 2026).

Please ensure future revisions of the Groundwater Management Plan include:

- predictions and outcomes of the updated numerical groundwater flow modelling currently being undertaken;
- a summary of stream flow and baseflow monitoring regimes (for inclusion in updated numerical groundwater flow modelling) for creeks and associated trigger action response plans extracted from the detail in the SWMP; and
- any variations made to the Environment Protection Licence (EPL) and resulting changes to the monitoring program.

Note: A revised GWMP is to be submitted within three months of the Planning Secretary's approval of the updated numerical groundwater flow modelling.

You are reminded that if there are any inconsistencies between the Groundwater Management Plan and the conditions of approval, the conditions prevail.



webuild | clough | lane

MANAGEMENT PLAN

SNOWY 2.0 MAIN WORKS – GROUNDWATER MANAGEMENT PLAN

S2-FGJV-ENV-PLN-0012

REV O

JANUARY, 2026

ABSTRACT

The key objective of this Plan is to detail management measures and inform site procedures for implementation so that water impacts are minimised and within the scope permitted by the Infrastructure Approval

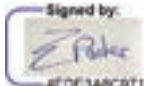
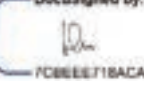
Revision Record

Rev.	Date	Reason for Issue	Responsible	Accountable	Endorsed
O	23.01.2026	Updated to include Water Group comments	S. Lang	E. Porter	F. Lazzarin D. Drummond



Document Verification

RACIE Record

R esponsible:	Name: Scott Lang Job Title: Environmental Coordinator Signed:  p.p. Date: 05.02.2026
A ccountable:	Name: Ellen Porter Job Title: Environmental Manager Signed:  Date: 05 February 2026
C onsulted:	See distribution list on Page 3.
I nformed:	See distribution list on Page 3.
E ndorsed:	Name: Fabrizio Lazzarin Job Title: Project Director Signed:  Date: 06 February 2026 Name: David Drummond Job Title: QHSE Director Name: JUSTIN TANNOCK Job Title: QHSE Director PP Signed:  Date: 05 February 2026

RACIE Terms

R	Responsible The person who actually produces the document.
A	Accountable The person who has the answer for success or failure of the quality and timeliness of the document.
C	Consulted Those who must be consulted before the document is published.
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Revision Tracking

Rev.	Date	Description of Revision
A	29.11.2019	Initial draft for SHL review
B	22.05.2020	Update to reflect conditions of approval and revised environmental management measures
C	15.06.2020	Revised to address SHL comments. For consultation.
D	25.06.2020	Update to address Commonwealth conditions of approval
E	06.08.2020	Revised to address stakeholder comments
F	19.09.2020	Revised to address DCCEEW and DPIE – Water Group comments
G	15.10.2020	Revised to address NRAR clarification
H	28.10.2022	Revised to address annual audit findings, currency, and to update prior to in-reservoir placement of spoil.
I	14.02.2023	Updated to reflect SHL comments on Rev H.
J	25.10.2024	Updated to include Modification 3 details.
K	04.02.2025	Updated to include SHL Comments
L	08.08.2025	General document and appendices updated
M	26.10.2025	Updated to include DCCEEW and NPWS
N	06.12.2025	Updated to include EPA comments and in accordance with Schedule 4 condition 4b of the CoA
O	23.01.2026	Updated to include Water Groups comments

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ABBREVIATIONS, ACROYNMS, INITIALISMS AND DEFINITIONS

Acronym	Definition
AFL	Agreement for Lease
AHD	Australian Height Datum
AIP	<i>Aquifer Interference Policy</i>
CoA	<i>Infrastructure Conditions of Approval (SSI 9687)</i>
Construction envelope	The maximum extent within which the disturbance area corridor can move to allow the final siting of infrastructure through the detailed design process
CPHR	Conservation Programs, Heritage and Regulation (formerly BCD)
DCCEEW	Commonwealth Department of Climate Change, Energy, Environment and Water
Disturbance footprint	The disturbance footprint as described in the PIR-RTS is the indicative corridor inside the larger construction envelope, where construction works required to build Snowy 2.0 can be carried out.
DOI	Department of Industry
DPHI	NSW Department of Planning, Housing and Infrastructure
EIS	Environmental Impact Statement
EMS	Environmental Management Strategy
EPA	NSW Environment Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EP&A Regulation	<i>Environmental Planning and Assessment Regulation 2000</i>
EPL	Environmental Protection Licence
Exploratory Works	The development of an exploratory tunnel and associated infrastructure described in the Environmental Impact Statement for the Snowy 2.0 Exploratory Works (CSSI 9208) dated July 2018, and modified by the: • <i>Submissions Report</i> dated October 2018 and additional information provided to the Department on 17 October 2018, 19 November 2018 and 23 January 2019; • <i>Modification Report</i> dated 6 June 2019 and associated Submissions Report dated 2 September 2019 and amendment letter date 4 October 2019; and • <i>Modification Report</i> dated 17 October 2019 and associated Submissions Report dated 10 January 2020
FGJV	Future Generation Joint Venture
Future Generation-PMS	Project Management System
GDE	Groundwater Dependent Ecosystem – ecosystems that require access to groundwater to meet all or some of their water requirements so as to maintain the communities of plants and animals, ecological processes they support, and ecosystem services they provide.
GMP	Groundwater Management Plan (S2-FGJV-ENV-PLN-0012) (This Plan)
IBRA	Interim Biogeographic Regionalisation for Australia
Incident	An occurrence or set of circumstances that causes or threatens to cause material harm and which may or may not be or cause a non-compliance
Kosciusko National Park	A National Park protected under the <i>National Parks and Wildlife Act 1974</i> (NSW) and managed by NSW National Parks and Wildlife Service. It covers an area of 673,543 hectares and forms part of Australia's only Alpine area
KNP	Kosciusko National Park

Acronym	Definition
Lobs Hole site	The development in the vicinity of Lobs Hole, including the GFO1 emplacement area; construction facilities (Main Yard), including workers' accommodation camp and temporary spoil emplacement areas; Main Access Tunnel and Emergency Cable and Ventilation Tunnel portals; and ancillary infrastructure including access roads, substation, cable yard and utilities.
LFB	Lachlan Fold Belt
LPF	Long Plain Fault
LPFZ	Long Plain Fault Zone
Main Works	The development of an underground power station and associated infrastructure described in the Environmental Impact Statement for the Snowy 2.0 Main Works (CSSI 9687) dated September 2019, and modified by the: • <i>Preferred Infrastructure Report and Response to Submissions – Snowy 2.0 Main Works</i>, dated February 2020; and • Additional information provided to the Department by EMM on 24 March 2020 and 7 April 2020
Marica site	The development in the vicinity of Marica, including the headrace surge shaft; ventilation shaft; construction facility workers' camp; and ancillary infrastructure including access roads and utilities.
MDB	Murray-Darling Basin
NSW DPI	The NSW Department of Primary Industries within Regional NSW
NPWS	National Park and Wildlife Services
NRAR	NSW Natural Resources Access Regulator
Plateau site	The development in the vicinity of the Plateau, including the instream barrier in Tantangara Creek and ancillary infrastructure including access roads and utilities.
Plateau area	The Plateau area; located to the east of the Snowy Mountains Highway and spanning the area between the highway and Tantangara Reservoir, is typical of elevated alpine environments, dominated by low energy streams, gentle rolling hills and mostly flat floodplains. The Plateau area includes the Plateau and Tantangara work site.
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
POEO Regulation	<i>Protection of the Environment (General) Regulation 2009</i>
Project	Snowy 2.0 Main Works
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. The project area does not represent a footprint for the construction works but rather indicates an area that was investigated during environmental assessments.
Ravine area	The Ravine area; located mostly to the west of the Snowy Mountains Highway, is characterised by deep gorges and steep sloping ridges, the product of incision from river flow, historic glaciation and structural movement. The Ravine area includes the Talbingo, Lobs Hole and Marica work sites.
REMM	Revised Environmental Management Measures
Rock Forest site	The development on the Rock Forest property, including the Rock Forest emplacement area, logistics laydown area and ancillary infrastructure including access roads.
SC	South Coast
Submissions Report or RTS	<i>Main Works Preferred Infrastructure Report and Response to Submissions</i>
SHC Act	Snowy Hydro Corporatisation Act 1997

Acronym	Definition
SHL	Snowy Hydro Limited
Snowy Scheme	Snowy Mountains Hydro-electric Scheme
SSI	State Significant Infrastructure under EP&A Act (Infrastructure Approval 9687)
SWMP	Surface Water Management Plan (S2-FGJV-ENV-PLN-0011) (Appendix A)
Talbingo Reservoir site	The development in and around the Talbingo Reservoir, including the Ravine Bay emplacement area; development at Middle Bay, including the water intake and associated structures, barge launch ramp, and construction facilities; and ancillary infrastructure, including access roads and utilities.
Tantangara Reservoir site	The development in and around the Tantangara Reservoir, including the Tantangara emplacement area; water intake and associated infrastructure; barge launch infrastructure; construction and laydown facilities, including workers' camp; fish screens; and ancillary infrastructure, including access roads and utilities.
TARP	Trigger Action Response Plan
TBM	Tunnel boring machine
VWP	Vibrating wire piezometer – a deep, sealed bore that records groundwater pressure
WAL	Water Access License
Water Group	The Water Group within the Department
WM Act	<i>Water Management Act 2000</i>
WM Regulation	<i>Water Management (General) Regulation 2011</i>
WMP	Water Management Plan (S2-FGJV-ENV-PLN-0010)
WSP	Water Sharing Plan
WTP	Water Treatment Plant

1. INTRODUCTION

1.1. Project Description

1.1.1. Overview

Snowy Hydro Limited (SHL) is constructing a pumped hydro-electric expansion of the Snowy Mountains Hydro-electric Scheme (Snowy Scheme), called Snowy 2.0.

Snowy 2.0 is a pumped hydro-electric project that will link the existing Tantangara and Talbingo reservoirs through a series of new underground tunnels and a hydro-electric power station. Most of the project's facilities will be built underground, with approximately 27 kilometres of concrete-lined tunnels constructed to link the two reservoirs and a further 20 kilometres of tunnels required to support the facility. Intake and outlet structures will be built at both Tantangara and Talbingo Reservoirs.

Snowy 2.0 will increase the generation capacity of the Snowy Scheme by an additional 2,200 megawatt (MW), and at full capacity will provide approximately 350,000 megawatt hour (MWh) of large-scale energy storage to the National Electricity Market (NEM). This will be enough to ensure the stability and reliability of the NEM, even during prolonged periods of adverse weather conditions.

Webuild, Clough and Lane have formed the Future Generation Joint Venture (FGJV) and have been engaged to deliver Snowy 2.0.

The Snowy 2.0 Project five primary work sites, displayed in Figure 1-2. The individual site names are listed below:

- Lobs Hole;
- Lobs Hole Ravine Road;
- Marica;
- Rock Forest;
- Talbingo; and
- Tantangara.

1.1.2. Construction Activities and Program

The Snowy 2.0 Project includes, but is not limited to, construction of the following:

- Pre-construction preparatory activities including dilapidation studies, survey, investigations, access etc;
- Accommodation camps;
- Construction pads;
- Barge access infrastructure;
- An underground pumped hydro-electric power station complex;
- Water intake structures at Tantangara and Talbingo reservoirs;
- Power waterway tunnels, chambers and shafts;
- Access tunnels;
- New and upgraded roads to allow ongoing access and maintenance;
- 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;
- permanent water supply to the underground power station; and
- Post-construction revegetation and rehabilitation.

The Snowy 2.0 construction program is summarised in Figure 1-1.

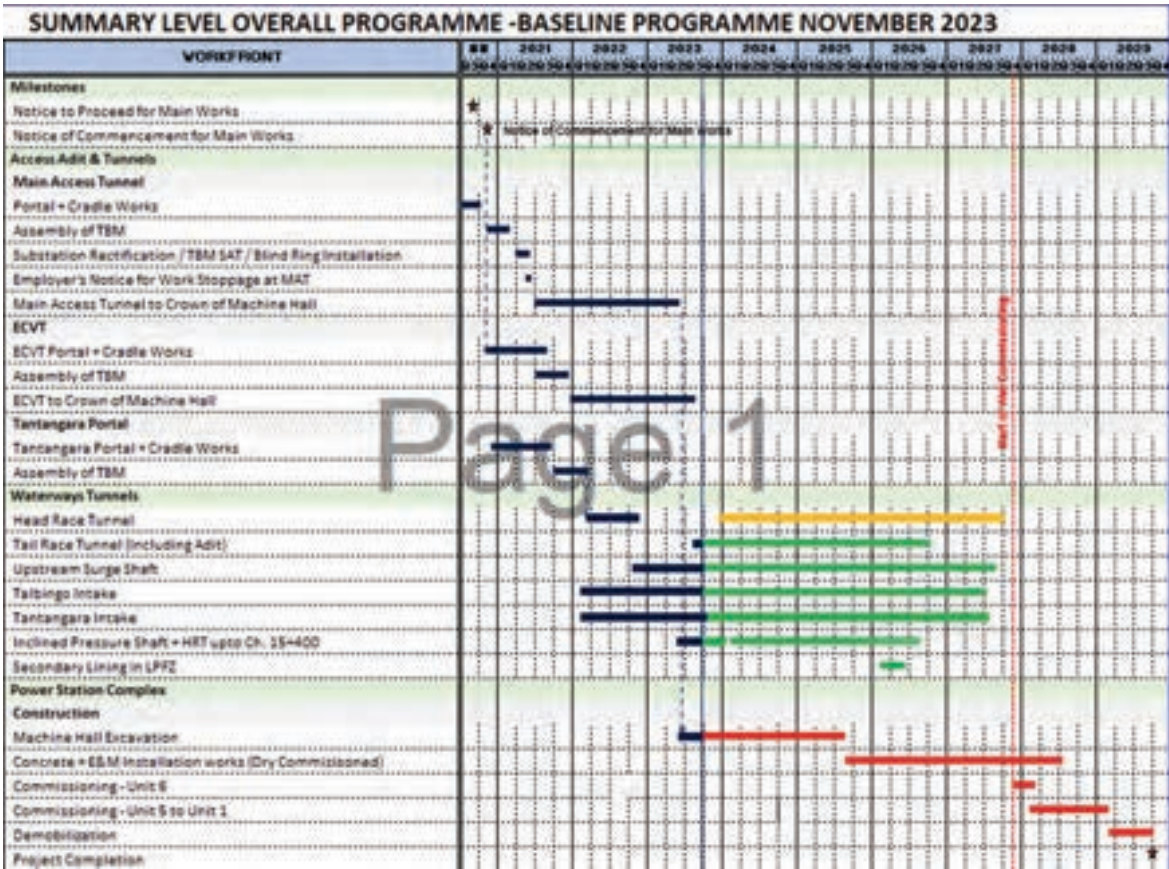


Figure 1-1: Timing of Snowy 2.0

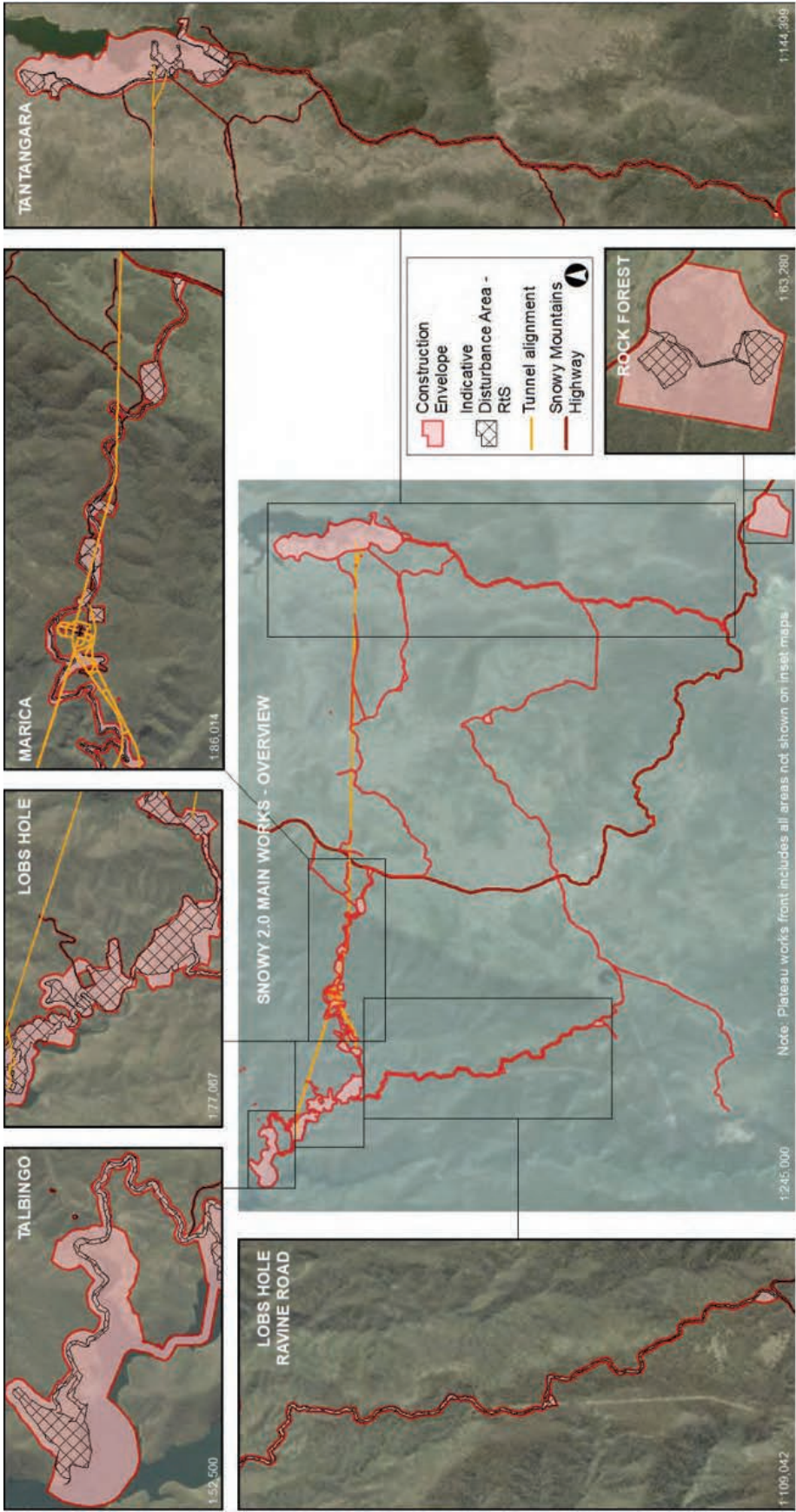


Figure 1-2: Snowy 2.0 Main Works Work Site

1.2. Project Approval

On 7 March 2018 the NSW Minister for Planning declared Snowy 2.0 to be State significant infrastructure (SSI) and Critical State Significant Infrastructure (CSSI) under the Environmental Planning and Assessment Act 1979 (EP&A Act, 1979) on the basis that it is critical to the State for environmental, economic or social reasons.

An environmental impact statement for the first stage of Snowy 2.0, the Exploratory Works for Snowy 2.0 (Exploratory Work EIS) was submitted to the then Department of Planning and Environment in July 2018 and publicly exhibited between 23 July 2018 and 20 August 2018. Approval for the first stage of Snowy 2.0 was granted for Exploratory Works by the Minister for Planning on 7 February 2019. The purpose of Exploratory Works is primarily to gain a greater understanding of the underground geological conditions at the new power station. In accordance with Section 5.25 of the EP&A Act 1979, the infrastructure approval for the Exploratory Works was modified on 2 December 2019 and on 27 March 2020.

An environmental impact statement for the second stage of Snowy 2.0, the Main Works for Snowy 2.0 (Main Work EIS) was submitted to Department of Planning, Housing and Infrastructure (DPHI) in September 2019 and was publicly exhibited between 26 September 2019 and 7 November 2019. A total of 222 submissions were received during the public exhibition period, including 10 from government agencies, 30 from special interest groups and 182 from the general public. In February 2020, the Response to Submissions (RTS or Submissions Report) was issued to DPHI to address the public and agency submissions (Snowy 2.0 Main Works - Preferred Infrastructure Report and Response to Submissions, February 2020).

Following consideration of the Main Works EIS and RTS, approval was granted by the Minister for Planning and Public Spaces on 20 May 2020, through issue of Infrastructure Approval SSI 9687.

Further to the Infrastructure Approval, the Main Works RTS includes revised environmental management measures (REMMs) within Appendix C which will also be implemented for the project.

On 27 January 2022, a modification to SSI-9687 (SSI-9687-Mod-1) was granted under Section 2.22 and Clause 20 of Schedule 1 of the EP&A Act, 1979. The scope of the modification included horizontal directional drilling (HDD) to establish water and electricity services between the Lobs Hole and Marica areas of the Project.

On 29 November 2023, a second modification to SSI-9687 (SSI-9687-MOD-2) was granted under Section 5.25 of the EP&A Act 1979, approving the undertaking of sinkhole rectification works near the Tantangara Adit Portal, inclusive of geotechnical investigations and remediation works.

A subsequent planning application (SSI-9687-MOD-3) was approved on 16 December 2024 to permit the construction of an additional adit and launching of a fourth tunnel boring machine at Marica West to facilitate excavation of a section of the Headrace Tunnel (HRT) through the Long Plain Fault Zone (LPFZ). The LPFZ is the most geologically complex section of the HRT and represented a significant risk to the overall project completion date. The application was approved in accordance with Section 5.25 of the EP&A Act, 1979.

In addition to the State approval, a referral (EPBC 2018/8322) was prepared and lodged with the Commonwealth Department of Climate Change, Energy, Environment and Water (DCCEEW) under the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act, 1999). The Commonwealth Minister's delegate determined on 5 December 2018 that Snowy 2.0 Main Works is a "controlled action" under the EPBC Act, 1999. The EPBC Act referral decision determined that the project will be assessed by accredited assessment under Part 5, Division 5.2 of the EP&A Act, 1979.

1.3. Disturbance Area

A key refinement following public exhibition of the Main Works EIS was a change to and clarification of disturbance area terminology. The revised disturbance area terminology as per the SSI-9687 Instrument, RTS and this Plan is outlined in Table 1-1, with an example of the terminology shown for Lobs Hole Ravine Road in Figure 1-3.

Table 1-1: Disturbance Terminology

Term	Definition	Reasoning
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.	The project area does not represent a footprint for the construction works, but rather indicates an area that was investigated during environmental assessments.
Construction envelope	The envelope within which the disturbance area of the development may be located.	As detailed design continues, final siting of the infrastructure (i.e. the disturbance area) may move within the assessed construction envelope subject to recommended environmental management measures and provided it does not exceed the limits defined by the construction envelope.
Disturbance area	The area within the construction envelope where development may be carried out; the precise location of the disturbance area will be fixed within the construction envelope following final design.	



Figure 1-3: Disturbance Area and Construction Envelope

1.4. Works within the Construction Envelope

Where project works are required to occur in locations outside of the disturbance boundary, FGJV will review the proposed area of clearing against the limits included within Condition 5 of Schedule 2. The review will be undertaken to ensure that the maximum disturbance area and maximum native vegetation clearing remains within the total areas nominated within the condition. These area limits are included within Table 1-2.

All vegetation clearing which occurs on the project will be monitored regularly to record the extent of clearing which has occurred, and to ensure that the clearing limits are not exceeded.

Table 1-2: Maximum Disturbance Area and Native Vegetation Clearing

Matter	Exploratory Works	Main Works	Total
Maximum Disturbance Area	126 Hectare (ha)	504 ha	630 ha
Maximum Native Vegetation Clearing	107 ha	425 ha	532 ha

1.5. Environmental Management System

The overall environmental management system for the Project is described in the Environmental Management Strategy (EMS). The EMS forms part of the Project Management System (Future Generation-PMS) and will include any requirements specified in the contract documents, where appropriate. All Future Generation-PMS procedures will support, interface or directly relate to the development and execution of the plan.

The management plans and post-approval documents for the project include those listed within Figure 1-4.

This Groundwater Management Plan (GMP or Plan) is an appendix to the Water Management Plan (WMP) which has been prepared for the Snowy 2.0 Project. It does not address the operational phase of the project.

This Plan forms part of FGJV’s environmental management framework.

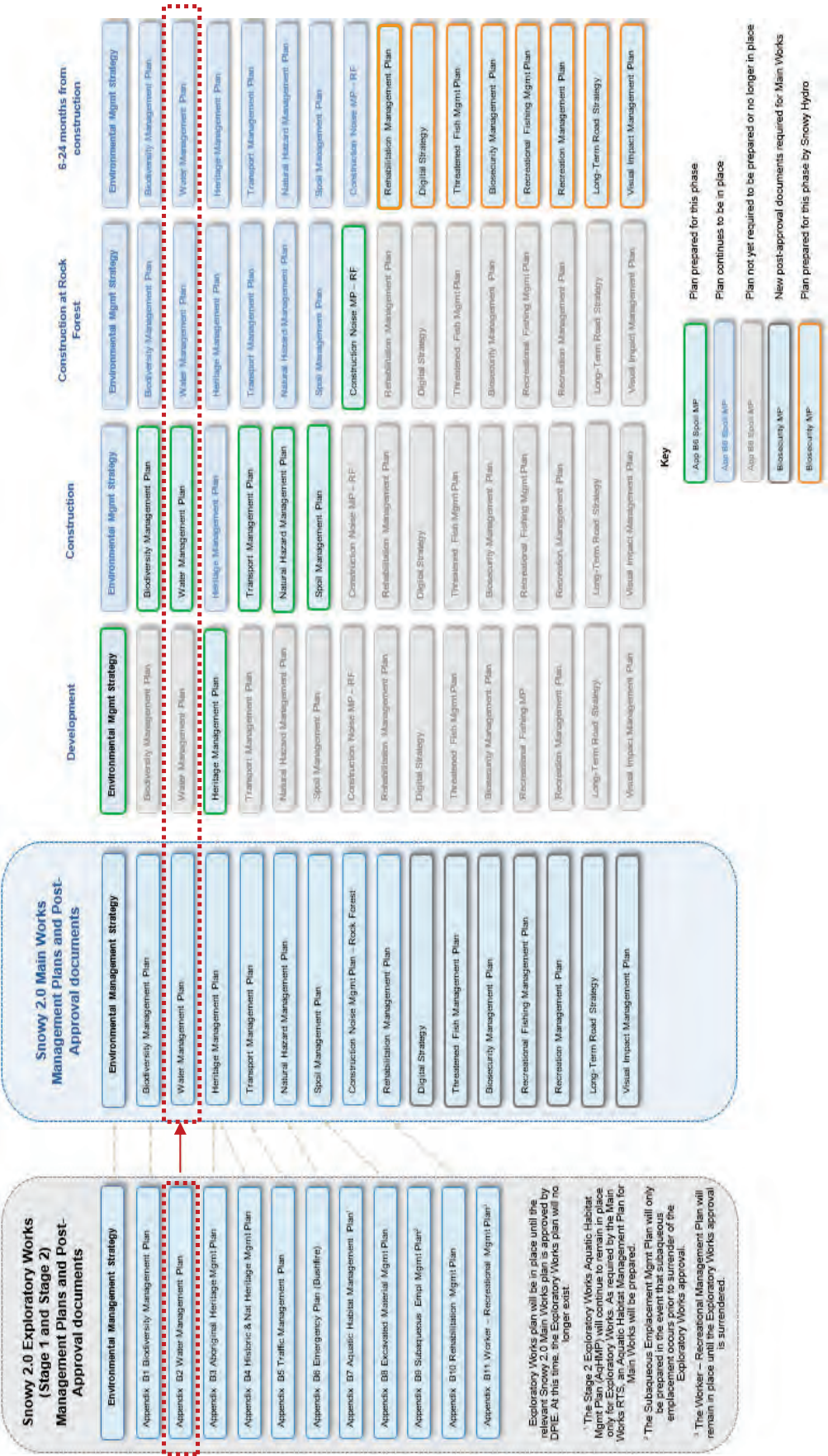


Figure 1-4: Management Plans and Post-Approval Documents

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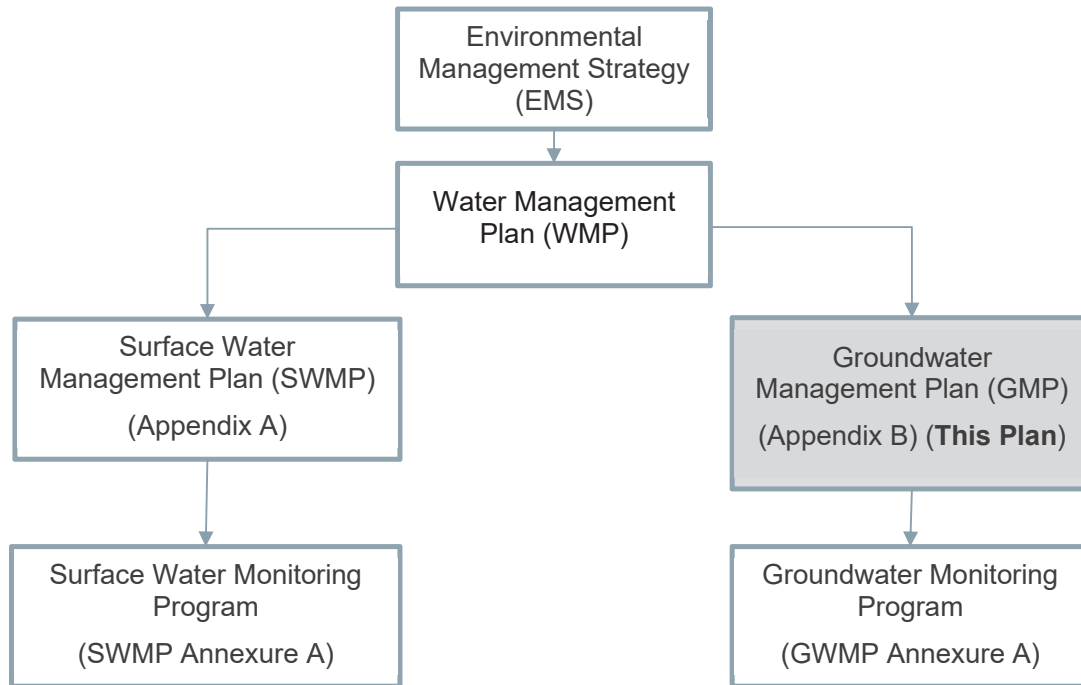


Figure 1-5: Water Management Plan Structure

1.6. Purpose and Objective of This Plan

This plan has been prepared to address the construction environment management requirements detailed in the:

- Main Works Snowy 2.0 - Environmental Impact Statement, September 2019;
- Revised Environmental Management Measures within the Main Works RTS, February 2020;
- Infrastructure Approval SSI 9687, May 2020;
- Main Works Snowy 2.0 – Modification 1 Assessment Report, January 2022;
- Main Works Snowy 2.0 – Modification 2 Assessment Report, November 2023;
- Main Works Snowy 2.0 – Modification 3 Assessment Report, December 2025; and
- Environmental Protection Licence 21266, latest variation, May 2024.

The objectives of the GMP are to ensure that impacts on groundwater quality are minimised and within the scope permitted by the CoA. To achieve this, SHL and FGJV will implement:

- Appropriate measures to address relevant conditions;
- Appropriate measures during construction to avoid or minimise potential impacts to surface water quality;
- A water quality monitoring program to assess the effectiveness of management controls;
- Construction activities in a manner to minimise flood impacts and risks; and
- Corrective actions and contingency measures during construction when triggered.

Specific on-site management measures identified in this plan will be incorporated into site documents where relevant. These site-specific documents will be prepared for construction activities and will detail the management measures which are to be implemented on the ground.

1.7. Staging

Some distinct activities require greater detail prior to commencement. Consequently, this Plan will be updated, in consultation with relevant government agencies, and submitted to DPHI for approval prior to the commencement of specific activities as detailed in Table 1-3.

Table 1-3: Activities Requiring GMP Updates

Activities	Timing
Operation of Snowy 2.0 Project, including dewatering of the tailrace tunnel during operations.	Operation will be addressed through a separate SHL framework or document.

1.8. Plan Preparation

Amendments to the current plan reflect the updates to lining requirements within all Project emplacement areas, Environmental Protection Licence (EPL) variations including the latest one issued on 26 September 2025, Leachate Detection Procedures, and the additional requirements as stated in the Modification 3 Assessment Report December 2024.

As a dynamic document, this Management Plan will be subject to further revisions should any additional EPL variations or other regulatory changes be enacted. FGJV are committed to maintaining its accuracy and ensuring it consistently reflects the most current environmental requirements.

1.9. Consultation

In accordance with Schedule 3, Condition 31 of the Infrastructure Approval and revised environmental management measure (REMM) WM01, the WMP (which includes this GMP) is to be prepared in consultation with:

- NSW Environment Protection Agency (NSW EPA);
- National Parks and Wildlife Services (NPWS);
- Department of Climate Change, Energy, The Environment and Water (DCCEEW);
- Department of Planning, Housing and Infrastructure (DPHI);
- Department of Planning Industry and Environment– Water (Water Group);
- Conservation Programs, Heritage and Regulation (CPHR) ;
- Natural Resources Access Regulator (NRAR); and
- NSW Department of Primary Industries (NSW DPI).

Table 1-4: GMP Plan Consultation Record

Date	Consultation	Outcomes
26/03/2020	Water Group	Agency briefing (online PowerPoint) and discussion of previous meetings held with SHL during RTS assessment.
30/04/2020	NSW EPA, NPWS, DPHI, CPHR (formerly BCD), DPIE Water Group	Agency briefing (online PowerPoint) providing overview of document structure and surface water management approach.
07/05/2020	NSW EPA, NPWS, CPHR, DPIE Water Group	Agency briefing (online PowerPoint) providing overview of the development of the surface water monitoring program and groundwater monitoring program.
15/06/2020	NPWS, EPA, Water Group, NRAR, NSW DPI	GMP (Revision C) including monitoring program issued to stakeholders for review and comment
08/07/2020	DCCEEW	Agency briefing (online PowerPoint) providing overview of document structure and water management approach.
03/08/2020	NRAR, Water Group	Amendment to groundwater monitoring network.
24/08/2020	DCCEEW	General clarifications on WMP
September 2022	NPWS, NSW EPA, Water Group, NRAR, NSW DPI	Agency review of minor comments.
November 2024	NPWS, NSW EPA, Water Group, NRAR, NSW DPI	Amendments to include Modification 3 details.
2 April 2025	NPWS, CPHR, Water Group, NRAR	Agency briefing on groundwater management plan update and timing, risk prioritisation commitments, and timing of regional model update
9 April 2025	NSW EPA	Agency briefing on groundwater management plan update and timing, risk prioritisation commitments, and timing of regional model update
6 May 2025	NSW DPI	Agency briefing on groundwater management plan update and timing, risk prioritisation commitments, and timing of regional model update
22 September 2025	NSW EPA	The Management Plan has been updated to incorporate EPA comments in Revision N. Below is the summary: - Annexure A Groundwater Monitoring Program, Table 1-1 has been updated to reflect the minimum monthly sampling requirements. - TARP's has been updated to include timeframes and process testing aligned to the EPL.
25 September 2025	DCCEEW and NPWS	The Management Plan has been updated to incorporate DCCEEW and NPSW comments in Revision M. Below is the summary: - Table 4.2 has been updated to confirm the expected inflow volumes until mid-2025.
23 December 2025	NSW EPA, DCCEEW and NPWS	Management Plan was updated to address commentary provided by DCCEEW and NPWS.
23 January 2026	Water Group	Revision N of this Management Plan was updated to address commentary provided by Water Group.

1.9.1. Ongoing Consultation

FGJV will consult with stakeholders identified in Schedule 3, Condition 31 of the Infrastructure Approval for updates to this WMP.

Where additional monitoring infrastructure is proposed outside the construction envelope FGJV will review environmental constraints and consult with relevant stakeholders.

A separate document is proposed to be provided to DPHI and DCCEEW which details the consultation process, along with FGJV responses to stakeholder comments and how feedback has been implemented during the action.

2. ENVIRONMENTAL REQUIREMENTS

2.1. Legislation and Guidelines

Legislation relevant to groundwater management includes:

- Environmental Planning and Assessment Act 1979 (EP&A Act);
- Environmental Planning and Assessment Regulation 2000 (EP&A Regulation);
- Protection of the Environment Operations Act 1997 (POEO Act);
- Protection of the Environment (General) Regulation 2009 (POEO General Regulation);
- Water Management Act 2000 (WM Act);
- Water Management Amendment Act 2014 (WMA Act);
- Water Management (General) Regulation 2011 (WM General Regulation);
- Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources (2012);
- Water Sharing Plan for the NSW Murray-Darling Basin Fractured Rock Groundwater Sources (2011);
- Water Sharing Plan for the South Coast Groundwater Sources (2016); and
- Snowy Hydro Corporatisation Act 1997 (SHC Act).

Relevant provisions of the above legislation are explained in the register of legal and other requirements included in Appendix A1 of the EMS.

The main guidelines, specifications and policy documents relevant to this Plan include:

- Australian & New Zealand Guidelines for Fresh and Marine Water Quality ANZECC and ARMCANZ 2018);
- Australian Drinking Water Guidelines (Natural Resource Management Ministerial Council (NRMCC), 2011);
- Groundwater Dependent Ecosystems Risk Assessment Guidelines (NOW 2012d);
- NSW State Groundwater Quantity Management Policy (2001 (unpublished));
- NSW State Groundwater Quality Protection Policy (DLWC 1998);
- NSW State Groundwater Dependent Ecosystem Policy (DLWC 2002);
- Australian Groundwater Modelling Guidelines (National Water Commission 2012);

- National Water Quality Management Strategy Guidelines for Groundwater Quality Protection in Australia (NWQMS 2013);
- Department of Primary Industries Guidelines for Controlled Activities (2012);
- Environment Protection Authority (EPA): Approved methods for Sampling and Analysis of Water Pollutants in NSW (EPA 2004);
- Department of Planning and Environment (DPR): Guideline for riparian corridors on waterfront land (DPE 2012);
- Department of Water and Energy (DWE): NSW Water Extraction Monitoring Policy (DWE 2007); and
- NSW Office of Water (NoW) NSW Aquifer Interference Policy (NoW 2012).

Other reference documents include:

- Snowy 2.0 Environmental Impact Statement Volume 3, Appendix J, Water Assessment Annexure A, September 2019;
- Snowy 2.0 Main Work–s - Preferred Infrastructure Report and Response to Submissions, Appendix I, Revised Water Modelling Report, February 2020; and
- Snowy 2.0 Main Work–s - Preferred Infrastructure Report and Response to Submissions, Appendix J, Revised Water Management Report, February 2020.

2.2. Conditions of Approval

Table 2-1 details the CoA that are relevant to groundwater and demonstrates where these conditions are addressed.

Table 2-1: Relevant Conditions of Approval

Condition	Requirement	Where addressed
SCHEDULE 3		
Spoil Management – Spoil Management Requirements		
Schedule 3, Condition 4 (h)	The Proponent must: (h) minimise the water quality impacts of the temporary and permanent emplacement areas.	Spoil Management Plan (SMP) Project Leachate Detection Procedures
Flora and Fauna - Potential Additional Offsets - Alpine Sphagnum Bogs and Associated Fens		
Schedule 3, Condition 15	The Proponent must ensure that the development does not cause any exceedances of the following performance measures in the Alpine Sphagnum Bogs and Associated Fens above the Gooandra Volcanics and Kelly's Plains Volcanics: (a) negligible change to the shallow groundwater regime supporting the bogs and associated fens when compared to a suitable control site; and (b) negligible change in the ecosystem functionality of the bogs and associated fens.	GMP
Schedule 3, Condition 16	If the Planning Secretary determines that the development has caused exceedances of the performance measures in condition 15 above, the Proponent must pay additional funds to the NPWS within 3 months of the determination to offset the groundwater-related impacts of the development on the Alpine Sphagnum Bogs and Associated Fens. The Planning Secretary will determine the amount of funds the proponent must pay following consultation with the NPWS, DAWE and the Proponent; and having regard to: (a) The significance of the impacts on the bogs and associated fens;	Biodiversity Management Plan

Condition	Requirement	Where addressed
	(b) The relevant values from the Biodiversity Offset Payment calculator; and (c) The likely cost of carrying out the conservation actions required to offset these impacts on the bogs and associate fens.	
Water – Water Supply		
Schedule 3, Condition 28	The Proponent must ensure it has sufficient water for each stage of the development; and if necessary, adjust the scale of development on site to match its available water supply.	WMP SWMP GMP
Water – Water Pollution		
Schedule 3, Condition 29	Unless an environment protection licence authorises otherwise, the Proponent must comply with Section 120 of the POEO Act.	SWMP GMP Project Leachate Detection Procedures
Water – Water Management Requirements		
Schedule 3, Condition 30	The Proponent must: (e) minimise groundwater take from the Gooandra Volcanics and Kelly's Plain Volcanics using pre and post grouting of the tunnel, to minimise the loss of stream flows in the waterways above these geological formations, including Gooandra Creek and the headwaters of the Eucumbene River. (o) minimise the groundwater quality impacts of the development, particularly through the design of the temporary and permanent spoil emplacement areas and all water storages on site.	GMP GMP SMP Project Leachate Detection Procedures
Water - Water Management Plan		
Schedule 3, Condition 31	Prior to the commencement of construction, the Proponent must prepare a Water Management Plan for the development to the satisfaction of the Planning Secretary. This plan must: (a) be prepared by a suitably qualified and experienced person in consultation with the EPA, NPWS, the Water Group, NRAR and NSW DPI; (b) include a Site Water Balance for the development and a program to review and update this water balance each calendar year; and (d) include a Groundwater Management Plan with: • detailed baseline data of groundwater levels, yield and quality on the aquifers that could be affected by the development, and a program to augment this baseline data over time; • a program to validate and calibrate the groundwater model for the development as new information is collected; • detailed criteria for determining the groundwater impacts of the development, including criteria for triggering remedial action (if necessary); • a description of the measures that would be implemented to comply with the management requirements in Condition 30 above; • a program to monitor and report on: – groundwater inflows to the tunnel; – water take from the groundwater bores and connected water sources; and – the impacts of the development on: ○ regional and local (including alluvial) aquifers; and ○ base flow to surface water sources.	WMP WMP GMP Project Leachate Detection Procedures Sampling and Monitoring Procedure

Condition	Requirement	Where addressed
Schedule 3, Condition 38	The Proponent must implement the approved Water Management Plan for the development.	GMP

2.3. Revised Environmental Management Measures

During preparation of the Main Works Submission Reports, Revised Environmental Management Measures (REMMs) were developed and are included in Appendix C of the Main Works RTS, February 2020.

The Main Works REMMs relevant to groundwater are listed in Table 2-2.

Table 2-2: Revised Environmental Management Measures

Impact	Reference	Environmental Management Measures	Where addressed
General	WM01	A Water Management Plan will be developed for Snowy 2.0 Main Works that includes:	WMP
		• proposed mitigation and management measures for all construction water management categories;	WMP SWMP GMP
		• a surface and groundwater monitoring program;	GMP SWMP
		• water quality trigger action response plan;	GMP SWMP
		• reporting requirements;	WMP SWMP GMP
		• corrective actions;	GMP SWMP
		• contingencies; and	GMP SWMP
		• responsibilities for all management measures.	GMP SWMP
General	WM02	A water monitoring program will be developed as part of the water management plan to monitor quality and quantity impacts to surface water, groundwater and reservoirs. The water monitoring program will incorporate and update the existing monitoring network and detail monitoring frequencies and water quality constituents.	GMP SWMP Water Monitoring Procedure Project Leachate Detection Procedures
Groundwater modelling	WM06	The groundwater model developed for Snowy 2.0 Main Works will be validated and, if necessary, recalibrated to new groundwater monitoring data as the monitoring record increases throughout construction. It is recommended that assessment of the monitoring record and groundwater affecting activities, along with model updates, be undertaken at least annually throughout construction and into operation until it is evident that the update frequency can be reduced.	GMP
Groundwater inflow / drawdown	WM07	Where discrete high flow features are intercepted, pre-grouting and secondary grouting from the tunnel boring machines (TBMs) may be undertaken to enable tunnel construction.	GMP
Impacts to GDEs	ECO3	A GDE monitoring program will be implemented to assess actual impacts against predicted. If actual impacts are greater than predicted, adaptive management will be implemented.	GMP

2.4. EPBC Approval

The EPBC Act approval for Snowy 2.0 Main Works was granted by DCCEEW in 2020. This approval was provided for the impact of the Snowy 2.0 Main Works Project on national heritage values of a national heritage place (Sections 15B and 15C of the EPBC Act), listed threatened species and communities (Section 18, Section 18A of the EPBC Act) and listed migratory species (Section 20, Section 20A of the EPBC Act).

Table 2-3 details the EPBC Act Approval conditions which are relevant to water and demonstrates where these conditions are addressed.

Table 2-3: Commonwealth Conditions of Approval

Condition	Requirement	Where addressed
17	To minimise impacts on water resources, the approval holder must comply with Conditions 30 – 32 of the NSW approval relating to water management	Refer to Table 2-1
18	The approval holder must prepare the Water Management Plan required by Condition 31 of the NSW approval in consultation with the Department, before it is approved by the NSW Planning Secretary	WMP SWMP GMP
19	The Water Management Plan must include provisions to make monitoring data (excluding sensitive ecological data) available as part of the monitoring, evaluation and reporting programs required by Conditions 31c and 31d of the NSW approval	Section 6.8
20	Once the Water Management Plan is approved by the NSW Planning Secretary, the approval holder must implement the plan for the duration of the approval, unless otherwise agreed by the Minister in writing.	This Plan will be implemented for the development.

2.5. Licences and Permits

2.5.1. Environment Protection Licence

Environment Protection Licence 21266 (EPL) was issued the governing schedule activity of Electricity Generation.

The water quality requirements in the Project EPL are adhered to and includes surface and groundwater monitoring. At times, the water monitoring requirements of the EPL may differ to that detailed within this Plan, particularly in the event of variations to the EPL. Differences may include changes to the monitoring locations; changes to the frequency of monitoring; or changes to the parameters which are required to be monitored.

Should differences arise, the monitoring requirements of the EPL will take precedence. This will occur until such time that the revised WMP is updated and approved.

NSW EPA has issued variations to EPL 21266 on numerous occasions. A list of EPL 21266 variations is provided below:

- March 2020: Variation of EPL monitoring locations and location descriptions and removal of requested analytes;
- April 2020: Variation of EPL monitoring locations and change to sampling requirements;
- October 2020: Varied to reflect the commencement of Main Works, including change to the premises boundary, primary fee-based scheduled activity, ancillary activities, scheduled development works and a range of administrative, limit, monitoring, reporting and special conditions;
- November 2020: Removal of groundwater monitoring bore EPL 3 and amendment of the frequency of groundwater monitoring from monthly to quarterly;
- December 2020: Variation to surface water monitoring locations and amended to include approved scheduled development works;
- April 2021: Variation to allow the discharge of treated effluent from the Lobs Hole sewage treatment plant and process water treatment plant;
- August 2021: Variation to move the diffuser location to avoid environmental impact;

- January 2022: Variation to increase discharge volume limit at Point 43 from 1.66 ML/day to 4.32 ML/day and to include a discharge flow rate limit of 50 L/s, and the inclusion of a correlation assessment in order to monitor faecal coliforms;
- February 2022: Inclusion of a The EPA considers it appropriate to capture a Pollution Reduction Program (PRP) to facilitate improved water and contaminant management at the MAT spoil stockpile area;
- May 2022: Variation to allow for the discharge of treated sewerage and processed water at Tantangara with additional new water discharge and monitoring points within the Tantangara Reservoir;
- 31 May 2022: Variation to remove the PRP following project commitments;
- July 2022: Approval of updated Spoil Management Plan (SMP) and inclusion of O5.1 – O5.8 operational conditions relating to spoil characterisation, treatment, emplacement, leachate management and contingencies;
- October 2022: Variation to scheduled development works, updated surface and groundwater water monitoring points, updated sampling methodology for select locations, inclusion of the Diffuse Source Water Pollution Management PRP and the addition of the Generator Emission Improvements Program;
- June 2023: Variation to include updated monitoring locations, include Spoil Contingency Plan details, updated Environmental Monitoring Report requirements, updated Quarterly Spoil Monitoring Report requirements and updates to both the Diffuse Source Water Pollution Management and Generator Emissions Improvement Plan; and
- March 2024: Variation to include updated monitoring locations and analytical requirements, volume monitoring requirements, the removal of the Diffuse Source Water Pollution Management and the Generator Emissions Improvement Plan, addition of Process Water Treatment Plant Pollution Study, addition of lining and capping of Ravine Bay and Tantangara Permanent Spoil Emplacement Areas.
- December 2024: Variation to include reference to works associated with the Marica Adit and the spoil emplacement areas Ravine Bay and Rock Forest, update the location description for all monitoring points and inclusion of additional monitoring points, the revision of 90 percentile limit for biological oxygen demand from 1mg/L to 2mg/L as 1mg/L is below the limit of detection, amend the sampling method for several pollutants from grab sample to in-situ due to limitations in the transportation of samples, addition of conditions relating to the development of and compliance with a Nitrogen Management Plan.
- July 2025: Variation to include updated monitoring locations and analytical requirements, volume monitoring requirements, addition of Pollution Studies and Reduction Programs, addition of lining and capping of Rock Forest Permanent Spoil Emplacement Area.

2.5.2. Agreement for Lease

SHL has established an Agreement for Lease (AFL) with NPWS. A Construction Lease and Works Access Licence will be established with NPWS in order to carry the works in accordance with Main Works, CSSI 9687 and the approved management plans.

2.5.3. Water Access Licencing

Section 60A of the Water Management Act 2000 requires that a water access licence be obtained to extract water from a water source.

Water required for construction purposes includes the Project activities below:

- Interception activities (i.e. intercepted groundwater during tunnelling);

- Potable uses for human consumption associated with the accommodation camp; and
- Process water via the services pipeline from Talbingo and Tantangara Reservoirs for tunnelling and construction activities.

SHL has previously secured four groundwater access licences (WAL42408, WAL42960, WAL43328 and WAL43329) and two surface water specific purpose access licences (WAL42407 and WAL43544). These licences allow for direct and indirect take of water from the Lachlan Fold Belt (LFB) Murray Darling Basin (MDB) Groundwater Source and direct take from the Upper Tumut water source (i.e. from Talbingo Reservoir).

SHL subsequently secured groundwater licences via Controlled Allocation Order for additional share entitlement from the LFB MDB Groundwater Source (RO13-19-093), the LFB South Coast Groundwater Source (RO13-19-192) and a surface water specific purpose access licence (to take water from Tantangara Reservoir) for the Main Works Project. The additional allocation covers the peak predicted annual take modelled for the Project.

These Water Access Licences were processed by the Natural Resources Access Regulator (NRAR) and registered with NSW Land Registry Services (LRS). Actual take will be reported to NRAR on an annual basis in accordance with licence conditions.

Modification 3 includes the requirement to install an additional potable water bore at Marica Site, to accommodate the increased user demands. Appendix C of the Modification Submission Report 3 further identifies the requirement for SHL to seek an additional 41 megalitres per year of entitlements to account for the anticipated groundwater ingress during tunnelling works. These are expected to be obtained through trading schemes.

It is noted the additional potable supply bore will not be constructed until an Environmental Impact Assessment is reviewed and granted by DCCEW Water Group.

Table 2-4: Water Access Licences

Water Access Licence	Project	Water source	Share (ML)
WAL42407 – Specific Purpose Access Licence	Exploratory Works	Upper Tumut water source	227 per year
WAL42408 – Groundwater Licence	Exploratory Works	Lachlan Fold Belt MDB	0
WAL42960 – Groundwater Licence	Exploratory Works	Lachlan Fold Belt MDB	354 per year
WAL43328 – Groundwater Licence	Main Works	Lachlan Fold Belt MDB	3,375
WAL43329 – Groundwater Licence	Main Works	Lachlan Fold Belt South Coast	1,722
WAL43544 - Specific Purpose Access Licence	Main Works	Tantangara Water Source	532 per year

3. EXISTING ENVIRONMENT

The following section identifies the factors influencing groundwater within the Project area and has been summarised from the following EIS documents to provide pertinent detail relating to the Project:

- Main Works EIS Section 6.2 (Water) and Section 6.5 (Land);
- Main Works EIS Appendix J (Water assessment); and
- Main Works EIS Appendix O.1 (Palaeozoic Geodiversity Assessment) and Appendix O.2 (Cenozoic Geodiversity Assessment).

Hydrogeology across the project area has been informed by a groundwater monitoring network, designed specifically to investigate the hydrogeological conditions of the project area; developed as part of the EIS approval.

3.1. Topography and Landscape

The Snowy 2.0 Project is mostly located within the Kosciusko National Park (KNP) and spans the NSW Western Slopes, South Eastern Highlands and Australian Alps Interim Biogeographic Regionalisation for Australia (IBRA) regions. The geomorphic history of the project area is complex and has resulted in a landscape of disrupted drainage patterns, swampy basins and erosion surfaces (SHL 2017). This complexity is seen in the diverse landforms present in the area, ranging from valleys to mountain ranges. For the most part, the project area can be broken into two distinctive terrains the incised Ravine area and the Plateau area.

The Ravine Area: located mostly to the west of the Snowy Mountains Highway, is characterised by deep gorges and steep sloping ridges, the product of incision from river flow, historic glaciation and structural movement. The Ravine area includes the Talbingo, Lobs Hole and Marica work zones.

The Plateau: located to the east of the Snowy Mountains Highway and spanning the area between the highway and Tantangara Reservoir, is typical of elevated alpine environments, dominated by low energy streams, gentle rolling hills and mostly flat floodplains. The Plateau area includes the Plateau and Tantangara work zones.

The landscape varies from 545 m AHD in the Ravine area (Lobs Hole) leading up the valleys (Marica/ Plateau zones) to the Plateau topped Tantangara zone at 1,524 m AHD.

The Rock Forest work zone is located on farmland southeast of the KNP.

3.2. Climate

The Project area has an alpine climate characterised by cool summers and cold, damp and snowy winters. The highest and most consistent precipitation occurs during winter to early spring, with precipitation amounts increasing with elevation. Summer and autumn are generally drier and experience greater inter-annual variation in monthly rainfall. Summer rainfall is generally of higher intensity and of shorter duration than that in winter. Climate data for the project area has been sourced from regional Bureau of Meteorology (BoM) and SHL sources.

A summary of climate data for the Ravine and Plateau areas is provided in Table 3-1. Precipitation comprises rainfall and snowfall; the term rainfall has been used throughout the water assessment to maintain consistency with other sections of the Main Works EIS.

Table 3-1: Climate Summary

Parameter	Ravine area	Plateau area
Temperature ¹		
Mean annual maximum	21.3 C	12.6 C
Mean annual minimum	9.1 C	5.1 C
Annual rainfall ²		
Highest	1315 mm/year	1,902 mm/year
Median	878 mm/year	1,158 mm/year
Lowest	382 mm/year	525 mm/year
Mean Class A pan evaporation ³		
Annual	1,256 mm/year	
Lowest monthly	27 mm/month	
Highest monthly	206 mm/month	

1. Representative temperature for the Ravine and Plateau has been sourced from SHL operated Talbingo gauge and BoM operated Cabramurra SMHEA AWS (72161) gauge.

2. Representative rainfall for the Ravine and Plateau areas have been sourced from SHL operated Ravine gauge and BoM operated Yarrangobilly Caves (72141) gauge.
3. Representative pan evaporation sourced from Climate Atlas maps (BoM website).

3.3. Rainfall

The 10th, 50th and 90th percentile monthly rainfall have been calculated by BoM from the closest reliable weather station with adequate temporal records cited at Yarrangobilly Caves (Station No. 72141) and are presented in Figure 3-1. Mean monthly pan evaporation sourced from the BoM website are also shown in Figure 3-1. The long-term record indicates that rainfall generally significantly exceeds evaporation over the winter months (May to October) and recharge to shallow systems might be expected during this period. A soil moisture deficit is likely to occur from December to March, when monthly evaporation exceeds the 90th percentile rainfall and these months are likely to result in seasonal drops in connected water tables.

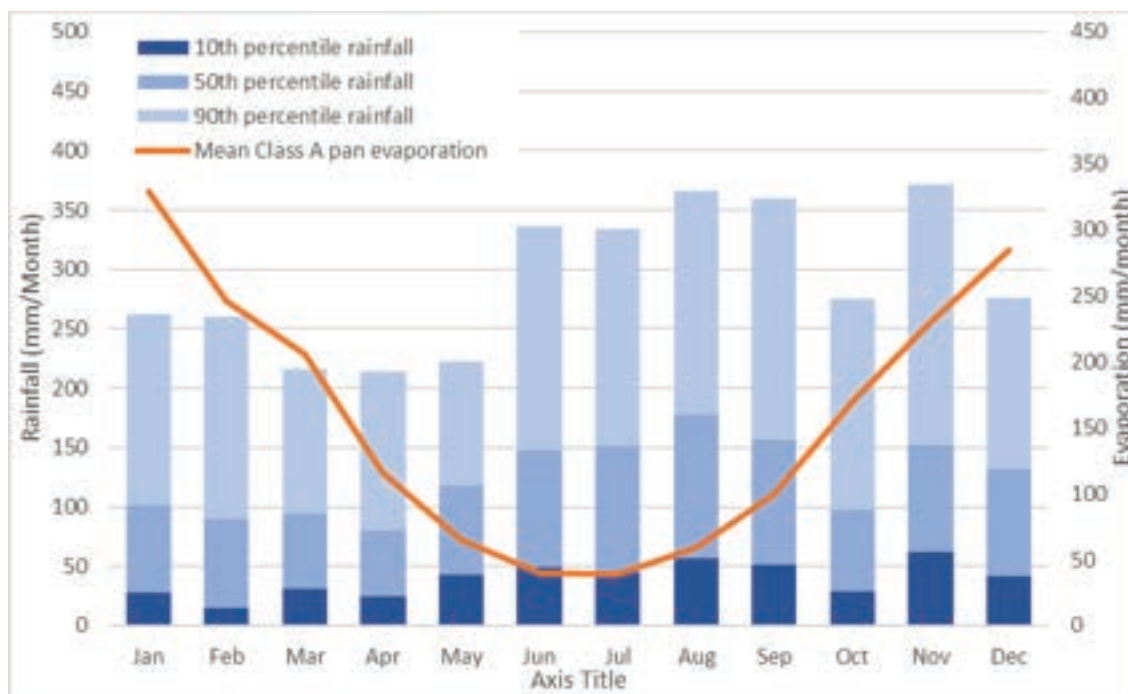


Figure 3-1: Monthly rainfall variability (BoM: 72141) and mean monthly pan evaporation

Monthly rainfall totals recorded at Yarrangobilly Caves (BoM station 72141) from 2002 to November 2022 are shown in Figure 3-2. The deviation of rainfall totals over the previous 12-month period has been calculated and compared to annualised monthly average rainfall to identify and characterise periods of extended dry and wet conditions. A positive value relates to wetter than average conditions while a negative value relates to drier than average conditions. These deficits and excess in rainfall can also correspond to long-term groundwater level and streamflow trends. The trends in Figure 3-2 indicate that:

- Below average rainfall occurred between mid-2002 to late 2003, mid-2004 to early 2005, mid-2006 to late 2010, early 2013 to mid-2016 and mid-2017 to mid-2019. The most significant below average rainfall conditions occurred between mid-2006 and late 2010;
- Above average rainfall occurred between April 2005 to May 2006, late 2010 to early 2013, mid-2016 to mid-2017, and 2020 to 2022; and
- Above average rainfall has also been experienced in late 2021 and throughout 2022.

The cyclic and seasonal variability is critical in the evaluation of groundwater dependent ecosystem (GDE) functionality and provides context for baseline data collected during the EIS period.

It is noted that data collected for this EIS during 2018 and early 2019 was collected during drier than average conditions.

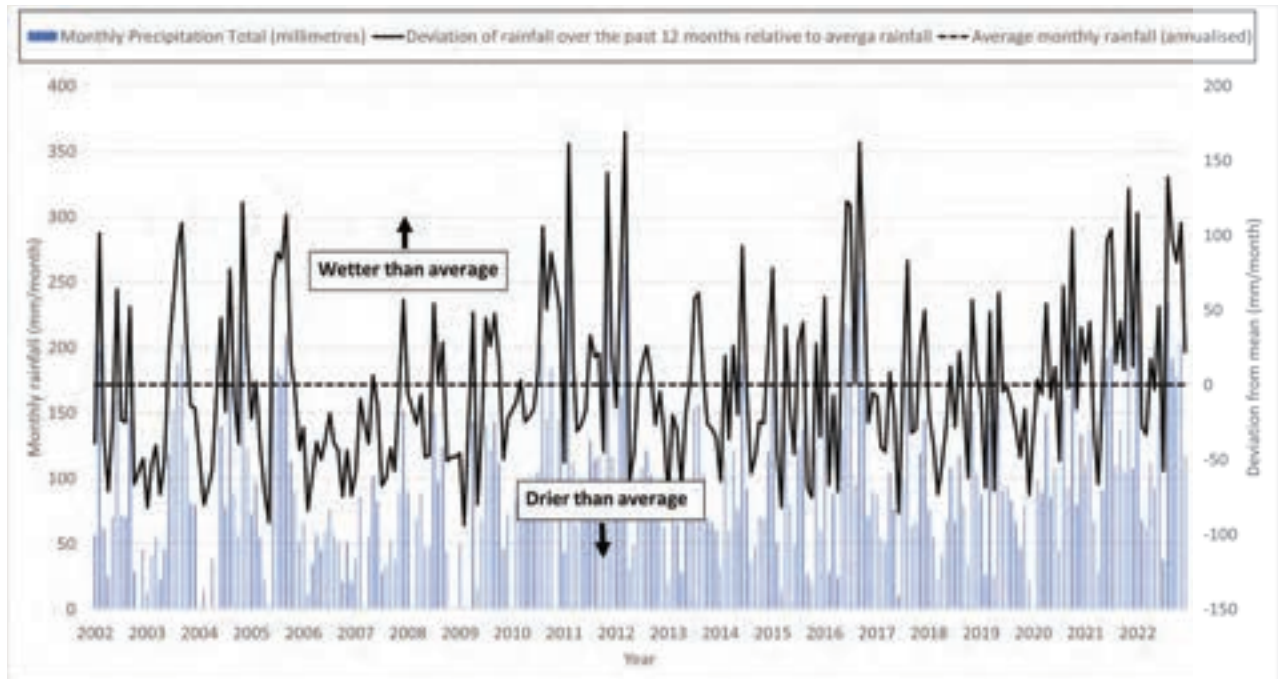


Figure 3-2: Long-term Yarrangobilly Caves (BoM: 72141) rainfall record

3.3.1. La Nina

La Nina is a weather event that causes greater than average rainfalls through Spring and Summer. This has been experienced in NSW after the bushfires in 2020 and on into 2021 with the Bureau of Meteorology (BOM) recording the 5th highest annual rainfall on record for 2021 (records began in 1900), where the Project experienced approximately 1287 mm of rainfall.

3.4. Bushfire

In January 2020, during the Main Works EIS application, significant bushfires occurred within the Project area and northern section of Kosciuszko National Park. The project site at Lobs Hole was severely impacted with much of the groundcover and trees burned, leaving the catchment area with bare soil and no ground protection. Other parts of the Main Works project area including the Plateau, Marica and Tantangara were also impacted by the bushfire to varying degrees.

The bushfires have led to a reduction in ground cover and increase in burnt ash material within and adjacent to the construction envelope. It is likely that, for some time, the existing pre-fire baseline water data that has been gathered and discussed in the Surface Water Management Plan and Groundwater Management Plan will differ to the post-fire water quality.

3.5. Geology

The Project area is located within the south-eastern portion of the LFB of NSW. It comprises a suite of Ordovician to Devonian sedimentary, igneous and metamorphic rocks that have been laid down, compacted and deformed across multiple orogenic periods (Figure 3-3).

The geology between Talbingo and Tantangara reservoirs is structurally deformed with numerous tight folds and several major faults. The region is associated with a strong north-south axial trend and strike which has a dominant control on topography and groundwater movement.

The project intercepts two major structural blocks. These two structural blocks form distinct geological terrains: the dominantly Silurian Tumut Block in the west (the incised Ravine area), and the dominantly Ordovician Tantangara Block in the east (the raised Plateau area). The terrains are geologically and topographically separated by an escarpment caused by movement on the Long Plain Fault (LPF).

The key geological formations for each block are listed in Table 3-2 and illustrated schematically in Figure 3-3.

Table 3-2: Key Geological Formations

Ravine	Plateau
Boraig Group, Byron Range Group, Ravine Beds and Yarrangobilly Limestone.	Tertiary Basalt, Kelly’s Plain Volcanics, Boggy Plain Suite, Peppercorn Formation, Tantangara Formation, Temperance Formation, Shaw Hill Gabbro and the Gooandra Volcanics

Also of note, there are eight karst areas in the KNP, all of which are developed in Silurian or Devonian limestones. These include Yarrangobilly Caves, a known GDE and karst area, and Coolemans Plain karst area. Both are recognised in the KNP Plan of Management (DEC 2014) for their cultural and natural significance.

This complex geology, and resulting topography, has resulted in a diverse soil landscape. Soils vary significantly in relation to altitude, temperature and rainfall. In particular, development of relatively fragile Alpine Humus Soils on the Plateau, across all geological materials, is recognised for the Alpine Shagnum Bogs and Associated Fens ecological communities that they support.

The EIS identified two high-risk geological formations: the Gooandra Volcanics and Kellys Plain Volcanics, both of which are located in the Plateau structural block, the Gooandra to the west adjacent to the escarpment and Kellys Plain to the east adjacent to the Tantangara Reservoir. These formations have demonstrated (through pumping tests) vertical hydraulic connections between shallow and deeper horizons within each geological unit.

The Ravine area can be further delimited into the eastern and western units, with units becoming more calcareous to the west. This has implications on the groundwater transmissivity and water quality as summarised in Sections 3.6 and Section 3.10.

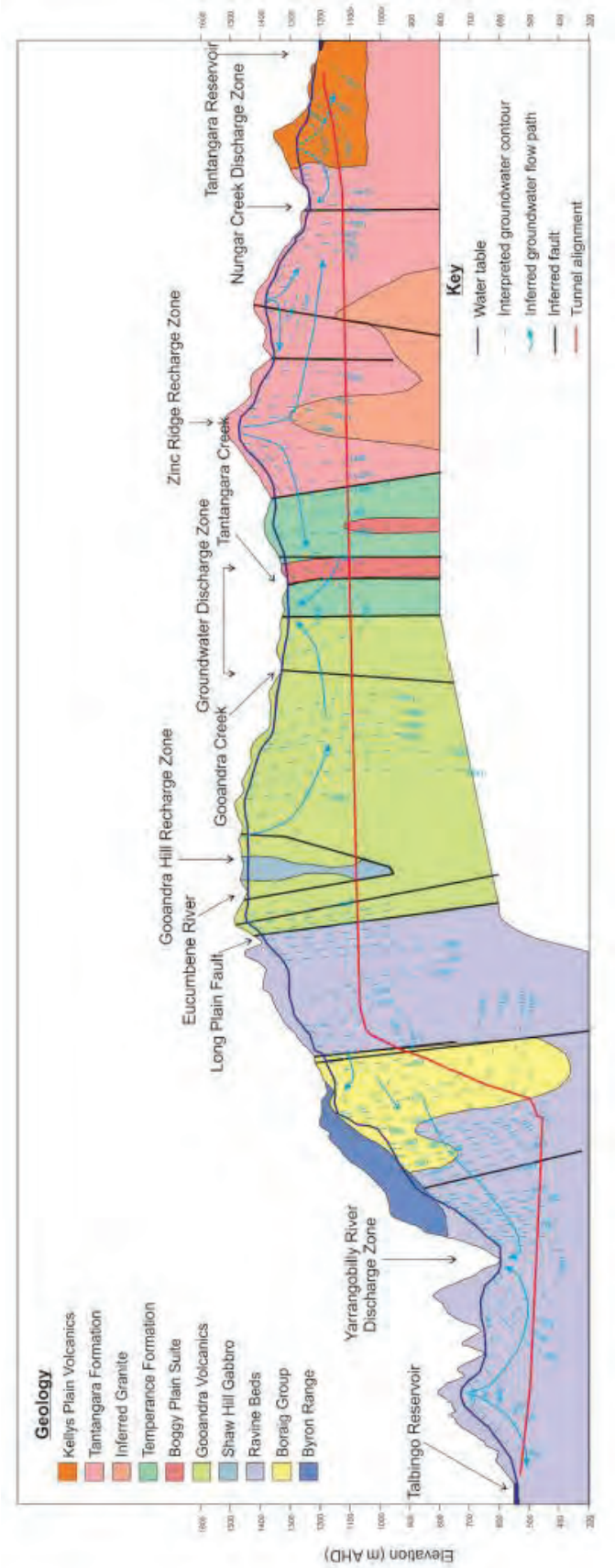


Figure 3-3: Interpreted groundwater recharge, discharge and flow patterns along the tunnel alignment

3.6. Hydrogeology and groundwater units

As defined above, most of the project area is located between the Talbingo and Tantangara reservoirs, within the Tumut (Ravine) and Tantangara (Plateau) structural blocks.

The groundwater-bearing units within the project area are defined as:

- a localised highly permeable shallow groundwater system associated with the thin basalt caps present across the Plateau area;
- a low permeability fractured rock groundwater system associated with the weathered and oxidised shallow component of the geology across the Plateau area; and
- a low permeability regional fractured rock groundwater system associated with the volcanic and metasedimentary rocks across the Plateau and Ravine areas.

The hydrogeological units of the project thus transgress the geological units and may be defined as:

- Alluvium, colluvium and surficial weathered rock: These shallow units are generally highly transmissive and are recharged by moderate to high rainfall events; flooding in alluvial areas and from snow melt;
- Shallow, weathered fractured rock: These units have low to moderate permeability and are recharged by moderate to high rainfall events and snow melt when saturated soil moisture conditions are exceeded; and
- Deep, fractured rock: Permeability is generally lowest in the central section of the Plateau and higher in the east and west. These units are recharged by infiltration of rainfall migrating through shallow groundwater systems. Groundwater flow can be downward in recharge areas and upward in discharge areas.

Localised groundwater systems are also associated with unconsolidated Quaternary alluvium and colluvium deposited along major creeks and river valleys, and in depressions across the Plateau and Ravine areas.

The deeper fractured volcanic and metasedimentary rocks form the main hydrogeological units in the project area. Shallow paleochannel aquifers occur between basalt flows. The groundwater in these units is accessed by various environmental users, including alpine bog/fen vegetation and deep-rooted Eucalypt species. Where it discharges it provides baseflow to gaining creeks and rivers. Groundwater within the fractured rock unit is generally fresh but low yielding when accessed by bores.

The volcanics intercepted by the project across the western Plateau area have been extensively deformed through structural movement and exhibit enhanced secondary porosity and vertical connection.

The metasedimentary units located across the remainder of the Plateau area (mostly closer to Tantangara Reservoir) and within the Ravine area are generally more massive with reduced permeabilities.

3.7. Groundwater Processes

An overview of groundwater recharge, flow and discharge processes are outlined in Table 3-3.

Table 3-3: Summary of Groundwater Processes

Parameter	Ravine	Plateau
Groundwater recharge	The Ravine groundwater system is largely recharged by rainfall and through flooding of the Yarrangobilly River (and storages), and the lateral movement of groundwater from higher elevations, such as from the Plateau and elevated Ravine Bed outcrops.	Groundwater recharge is predominantly from rainfall and snowmelt. Recharge is higher when the soil and weathered rock is saturated which generally occurs during winter and spring or after significant rainfall events.
Groundwater flow	Groundwater flow processes include: - groundwater flow away from the LPFZ which represents a regional high point and is considered a flow boundary with regional groundwater flow from the LPF moving east to the Plateau and west to the Ravine. - the bulk of groundwater movement and permeability in the shallow and deep groundwater systems determined by secondary (fracture) porosity, while permeability in the alluvium and colluvium are predominately via primary (matrix) porosity. - localised groundwater flow and direction largely controlled by stratigraphy, dip of the strata, faulting, fractures and topography.	Groundwater flow processes include: - groundwater flow within the colluvium/alluvium and paleochannels (when saturated) via primary porosity and within the shallow and deeper fractured rock via secondary porosity (i.e. fractures, joints and bedding planes); - regional groundwater flow towards the east, influenced by stratigraphy, dip of the strata, faulting, fractures and topography; - downward gradients mostly observed between shallow and deeper groundwater systems in recharge areas and upward gradients in discharge areas; and - steeper vertical gradients where creeks/ivers are incised and escarpments occur.
Groundwater discharge	Groundwater discharge processes include: - drainage to the Yarrangobilly River and its tributaries; - evapotranspiration from overlying vegetation intercepting shallow groundwater systems; - seepage/springs and evaporation along escarpments; and - regional groundwater throughflow toward Talbingo Reservoir.	Groundwater discharge processes include: - drainage to surface water (as baseflow to tributaries); - evaporation from the water table where it is shallow (as seeps, springs and escarpments); - evapotranspiration from overlying GDEs (such as some alpine bogs and fens) and vegetation intercepting shallow groundwater systems; and - regional groundwater throughflow toward Tantangara Reservoir in the east.

3.8. Groundwater Dependent Ecosystems

3.8.1. High Priority GDE

The relevant water sharing plans do not identify any High Priority GDEs within the Project area. High priority GDEs are defined as those with high ecological value as determined in the relevant Water Sharing Plans.

The nearest High Priority GDE is the Yarrangobilly Caves which is located approximately 5 km north of the nearest infrastructure feature of the Project and is listed in the Water Sharing Plan (WSP) for the LFB MDB Fractured Rock groundwater source.

3.8.2. Type 1 (Sub-surface) GDE (Stygofauna)

A stygofauna assessment by Macquarie University (2019) was undertaken as part of the RTS assessment and identified a total of five specimens, from two families, likely to be obligate (fully groundwater-dependent) stygofauna representatives, from one of the 11 fractured rock sites (TMB02A) and two of the five Alpine bog and fen sites (GH01, GH02). A further 80 specimens from five groups, with potential to be obligate stygofauna representatives, were collected from four of the 11 fractured rock sites and four of the five Alpine bog and fen sites

Limited stygofauna studies have been undertaken within fractured rock aquifers of the region, thus there is limited data for comparison. The stygofauna found in the aquifers in the Snowy 2.0 Project area are noted to be similar to those encountered in other fractured rock systems in NSW.

3.8.3. Type 2 (Aquatic) GDE

Aquatic GDEs are dependent on baseflow in non-perennial rivers and creeks. Across the Project region, all rivers comprise both runoff and baseflow components as shallow groundwater tables are consistently above creek bed elevations. All creeks are therefore considered to support Type 2 GDEs. In particular, Plant Community Type (PCT) 300 occurs along drainage lines on mid-slopes across the Project area and PCTs 285, 299 and 302 occur in riparian zones and gullies where there is likely to be some near-surface expression of groundwater (Main Works EIS, Appendix M.1-01 – Part A9).

3.8.4. Type 3 (Terrestrial) GDE

Terrestrial GDEs include vegetation that accesses groundwater to maintain ecosystem function. These are classified according to their proportional (temporal) dependence on groundwater. This classification is conceptually described and shown in Figure 3-5.

Plant communities with varying degrees of groundwater dependence within the project area are listed in Table 3-4 and shown in Figure 3-5.

Table 3-4: Terrestrial GDEs

Groundwater Dependence	Mapped Plant Community Type (PCT)
Entirely/obligate dependence on groundwater	- PCT 637 - Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion; - PCT 1225 - Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion.
Facultative – proportional dependence on groundwater	- PCT 285 - Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion; - PCT 299 - Riparian Ribbon Gum - Robertsons Peppermint - Apple Box riverine very tall open forest of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion; and - PCT 302 - Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion.
Facultative – opportunistic dependence on groundwater	- PCT 300 - Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment; - PCT 303 - Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion and western South Eastern Highlands Bioregion; and - PCT 679 - Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion.

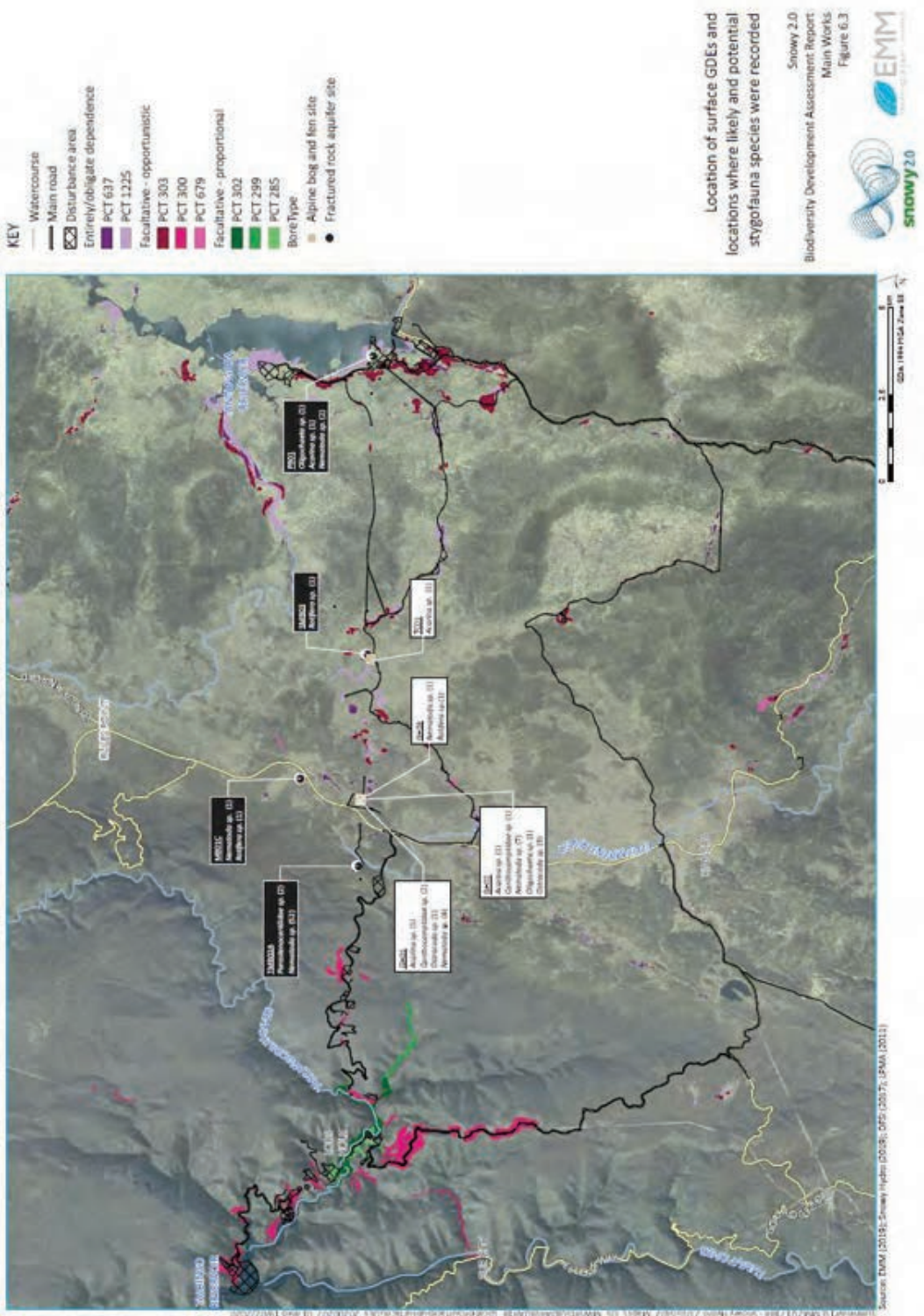


Figure 3-4: Location of Terrestrial GDEs

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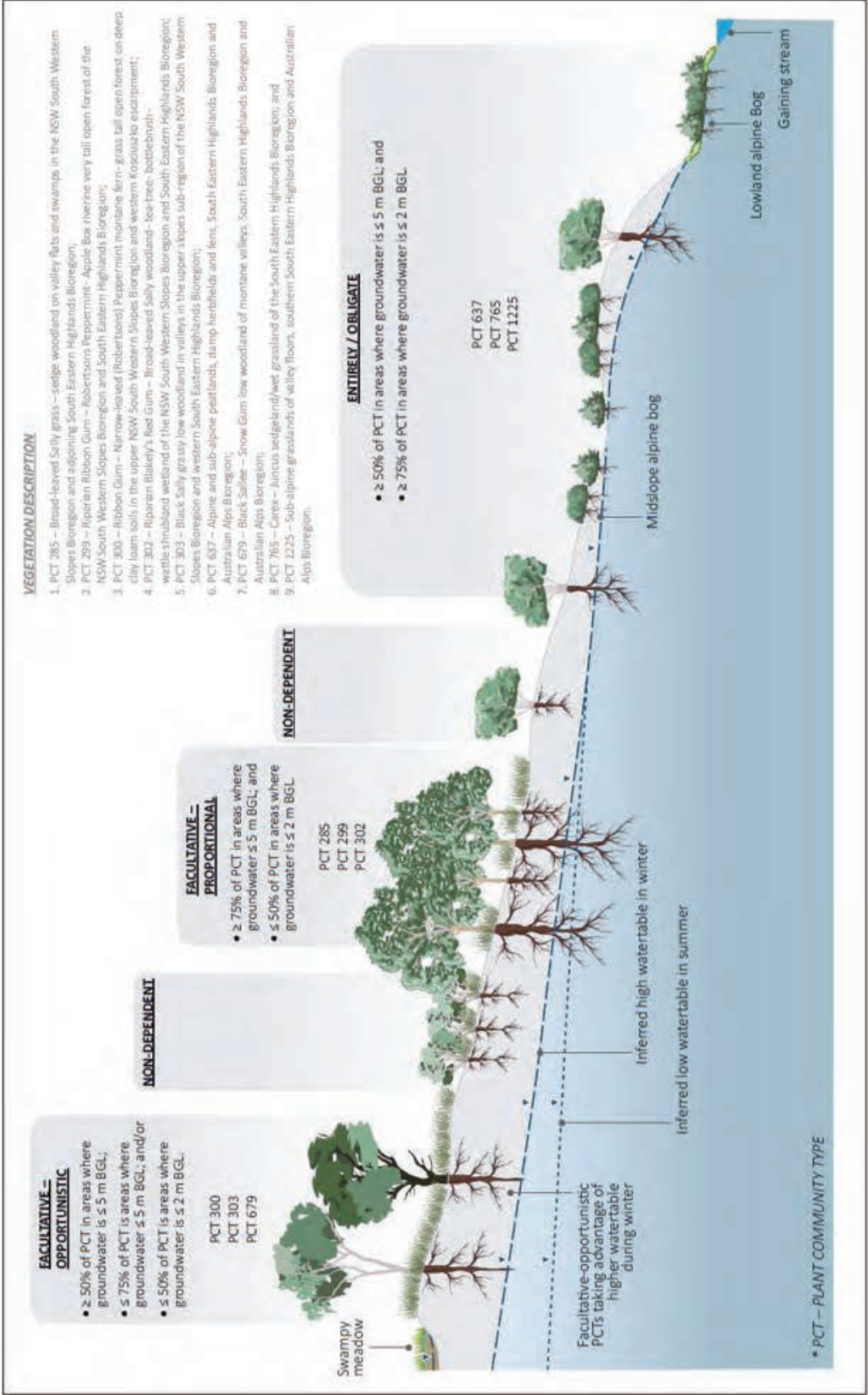


Figure 3-5: Conceptual Diagram for Terrestrial GDEs

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3.9. Groundwater Levels and Flow

3.9.1. The Plateau

Groundwater levels within the Plateau are influenced by the relief and generally mirror the topography. Groundwater levels are above the creek beds and therefore groundwater provides baseflow to all streams (gaining streams).

Along the proposed headrace tunnel (HRT) transect, groundwater levels vary from approximately 1,470 m AHD in the elevated areas adjacent to the LPF in the west, to approximately 1,170 m AHD in the lower elevated area near Tantangara Creek. Overall, groundwater levels observed along the proposed tunnel alignment indicate that groundwater flow direction is generally west to east from the LPF.

Groundwater levels within monitoring bores and deduced from water pressures measured in the vibrating wire piezometers (VWPs) have generally shown fluctuations of less than 10 m during the monitoring period. Groundwater levels within the Gooandra Volcanics, Tertiary basalt, Tantangara Formation, Temperance Formation, Boraig Group, Kellys Plain Volcanics and Boggy Plain Suite generally show a moderate to strong response to rainfall events.

Vertical leakage within the Gooandra Volcanics, Tantangara Formation and Temperance Formation is variable and potentially complex with the direction of vertical leakage (i.e. upwards versus downwards) varying with location and depth within these units, but demonstrating connectivity between the shallow weathered rocks and deeper fractured rocks of the same formations.

Differences between groundwater levels within the Tertiary basalt and underlying Gooandra Volcanics suggests that the Tertiary basalt aquifer is a perched aquifer system.

Further detail regarding groundwater levels and flow within the Plateau area is provided in Section 9.2.1 of the EIS water characterisation report.

3.9.2. Ravine Area

Groundwater levels within the Ravine are influenced by the steep relief that exists across the area and generally mirrors the topography. In monitored locations within the project area, groundwater levels are above creeks and streams, therefore suggesting creeks and streams are gaining systems.

Along the proposed HRT transect, groundwater levels within the Ravine Beds vary from approximately 1,325 m AHD in the topographically elevated terrain adjacent to the LPF in the east, to approximately 570 m AHD in the topographically lower terrain near Lobs Hole. Groundwater flow direction is generally from east to west, with the LPF area acting as a groundwater divide between the Ravine and Plateau areas.

Groundwater levels within monitoring bores and VWPs have generally shown fluctuations of less than 10 m during the monitoring period. Groundwater levels within the Ravine do not typically show an obvious response to rainfall events or flow events within the Yarrangobilly River.

Vertical leakage within the Ravine Beds is downwards with groundwater in the upper horizons of the unit recharging the deeper horizons.

Nested monitoring bores within the Boraig Group have similar groundwater elevation and trends which suggests that the top 70 m or so of Boraig Group sediments are hydraulically connected.

Groundwater levels within the Ravine Beds and Boraig Group show similar elevations and trends at one nested location (TMB01A/TMB02B) which suggests that there may be some degree of hydraulic connection between the Boraig Group and Ravine Beds at this location.

Further discussion on groundwater levels and flow within the Ravine area is provided in Section 9.3.1 of the EIS water characterisation report.

3.10. Hydraulic properties

Hydraulic tests, in the form of packer, drill stem and pump-out testing, were carried out to provide site-specific information on the hydraulic properties of the Plateau and Ravine groundwater systems. Hydraulic properties have been estimated for most of the geological formations intercepted by the tunnel alignment. Derived hydraulic properties allow estimation of groundwater ingress to the tunnel and are used in the groundwater numerical modelling to estimate potential impacts to groundwater systems and hence to groundwater-dependent users and ecosystems. Details are provided in the Water Characterisation Reports (EIS, Appendix J).

Hydraulic conductivity assessments have been conducted on numerous Project soil emplacement areas within the Project. FGJV intends to assess permeability for each emplacement area on the Project.

3.10.1. The Plateau

Hydraulic properties within the Plateau are summarised as follows:

- pump-out tests conducted in bores installed within the Gooandra Volcanics and Kellys Plain Volcanics demonstrated vertical hydraulic connection between shallow and deeper horizons, with vertical hydraulic conductivities comparable to horizontal hydraulic conductivities
- pump-out tests conducted in bores installed within the Temperance Formation and Boggy Plain Suite demonstrated no apparent vertical hydraulic connection between shallow and deeper horizons and low horizontal hydraulic conductivities (10^{-5} to 10^{-7} m/day); and
- horizontal hydraulic conductivity is generally decreasing with increasing depth in all the geological units tested.

A summary of hydraulic properties for the Plateau region are outlined in Table 9.1 of the EIS Water Characterisation report.

3.10.2. Ravine Area

Hydraulic properties within the Ravine area are summarised as follows:

- estimated horizontal hydraulic conductivity in the Ravine Beds West (10^{-3} m/day) are generally higher when compared to the Ravine Beds East (10^{-4} m/day);
- a pump-out test conducted within the Ravine Beds West demonstrated a low to moderate degree of vertical hydraulic connection (10^{-4} m/day) between shallow and deeper horizons ; and
- horizontal hydraulic conductivity generally decreases with increasing depth in all the geological units tested.

A summary of hydraulic properties for the Ravine region are outlined in Table 9.3 of the EIS Water Characterisation report.

3.11. Groundwater Quality

Aquifer chemistry monitoring results to date are included in the Baseline Data presented as an Attachment to this plan and is summarised in Table 3-5 and below.

Table 3-5: Summary of Baseline Data

Parameter	Plateau	Ravine
Total Dissolved Solids (TDS)	Ranges from 14 mg/L (Gooandra Volcanics) to 1,610 mg/L (Temperance Formation)	Ranges from 52 mg/L (Boraig Group) to 1,540 mg/L (Ravine Beds West);
pH	Ranges from 3.5 to 13.0. pH is generally lowest in the bogs and fens and highest within the Kellys Plain Volcanics	Ranges from 4.7 to 8.1. pH is generally highest in the Ravine Beds West when compared to the other monitored geological units.
Major ions	Bicarbonate concentrations in all geological units are generally higher than other major ions with a maximum of 205 mg/L in the Temperance Formation. Calcium, magnesium, chloride, sodium and sulphate are generally less than 100 mg/L.	Bicarbonate concentrations in all geological units are generally higher than other major ions with a maximum of 1,170 mg/L in the Ravine Beds West. Calcium, magnesium, chloride, sodium and sulphate are generally less than 100 mg/L
Metals	Metal concentrations are generally low across all bores, though with aluminium, arsenic, chromium, copper and zinc measured above water quality objectives. Median values remain at or close to the objective concentrations. Concentrations decrease towards the east and only copper and zinc register above Water Quality Objective (WQO) levels in the Kellys Plain Volcanics. Iron can be high in the shallow groundwaters supporting the Plateau bogs and fens.	Metal concentrations are low (close to or below limits of detection) across all bores, though slight exceedances of water quality objectives are occasionally recorded for most analysed metals except manganese, with zinc, aluminium, arsenic and iron commonly recorded at levels above detection limits. In the west, aluminium, arsenic and boron are observed at elevated levels. Aluminium and iron are commonly reported at levels greater than 1 part per million (ppm) in the alluvium and colluvium sediments along the river valleys.

The Plateau aquifers' baseline water chemistry indicated:

- Samples collected from all Plateau aquifers exceeded dissolved oxygen, ammonia, oxidised nitrogen, total nitrogen, total phosphorous and copper WQOs;
- Samples collected from most formations (Gooandra Volcanics, Temperance Formation, Boggy Plain Suite, Tantangara Formation, Tertiary Basalt) also exceeded several metals including aluminium, arsenic, boron, chromium, cobalt, copper, iron, lead, vanadium and zinc WQOs;
- Kellys Plain Volcanics only had one metal exceedance (copper); and
- Acidic conditions in waters associated with bogs and fens.

The Ravine area's baseline water chemistry indicated:

- Samples collected from all bores exceeded dissolved oxygen, electrical conductivity, ammonia, oxidised nitrogen, total nitrogen, total or reactive phosphorus and several metals including aluminium, arsenic, boron, chromium, cobalt, copper, iron, nickel and zinc WQOs.

4. PROJECT ACTIVITIES AND POTENTIAL GROUNDWATER IMPACTS

4.1. Construction Activities

An environmental aspect is an element of an organisation's activities, products, or services that has or may have an impact on the environment (ISO 14001 Environmental management systems). The relationship of aspects and impacts is one of cause and effect.

Key aspects of the Project activities that may result in impacts to groundwater are identified in Table 4-1. The extent of these impacts will depend on the nature, extent and magnitude of construction activities, hydrogeological system characteristics and their interaction with the natural environment.

Table 4-1: Project Aspects and Impacts

Environmental Aspects (Construction activities that may impact water)	Environmental Impacts	Environmental Factors (Conditions)
• Tunnelling (causing inflows) • Surface excavations intercepting the groundwater table • Water use and extraction • Dewatering (discharge of groundwater to surface water, minimising recharge availability) • Refuelling and chemical handling	• Reduction in groundwater availability (quantity) • Drawdown in groundwater levels • Reduced groundwater availability for GDEs • Groundwater contamination • Reduction in baseflow from groundwater to waterways	• Existing groundwater levels • Existing groundwater fluxes • Existing baseflow dependency • Geology type • Seasonal fluctuations • Existing groundwater quality

4.2. Potential Impacts

4.2.1. Overview

The assessment of possible Project related impacts are considered conservative due to the design scenario assumptions (i.e. modelling assuming unmitigated tunnel inflows) and the adoption of conservative hydraulic parameters (using relevant limits of field measurements). Therefore, it is considered that the actual tunnel ingress (and subsequent groundwater impacts) will be lower than predicted due to mitigation and management measures already proposed during construction (e.g. pre-grouting and post-grouting of key areas).

The RTS summarised the groundwater impacts as:

- Localised and regional drawdown of groundwater tables, resulting in potential impacts on:
 - Biodiversity including GDE's, subterranean fauna and aquatic fauna; and
 - Baseflow to surface water features;
- Changes to groundwater quality; and
- Cumulative impacts from any compounding local and regional impacts.

4.2.2. Numerical Groundwater Modelling

The regional numerical groundwater flow model, referred to as SH4.0, was developed for the Main Works EIS and was based on an unlined, unmitigated (i.e. no grouting) tunnelling scenario. This was done to provide a worst-case (conservative) prediction of potential impacts.

Subsequent to the Main Works EIS, refinement of the inputs into the regional groundwater model have been undertaken to better represent a more realistic outcome. These refinements have focussed on representing the predicted permeability characteristics of the concrete lining (i.e. how much groundwater inflow is expected through the segmented concrete lining of the tunnels) and better estimation of likely groundwater inflows into the immediate 15 m of tunnel construction (termed the 'face' of the tunnel boring machine (TBM)) prior to segmental lining installation. The representation of the inflow at the face of the TBM, a constrained inflow rate through the segmental lining (as opposed to the unconstrained inflows represented in the EIS), and the subsequent remodelling exercise, has resulted in a predicted reduction to the groundwater inflows, water table drawdown and related impacts at surface when compared to those modelled for the EIS. The revised Modelling Report submitted as Appendix I of the RTS provides further details on all updated inputs, scenarios modelled, and the scenario chosen for the reassessment of predicted impacts.

It should be noted that the hydraulic parameters of the rock to be excavated by the Project has been estimated using appropriate hydrogeological techniques and pump-out test methods at the groundwater bore locations. Groundwater flow in fractured rock is highly heterogeneous, however, and actual local scale and overall groundwater inflow to excavations were practically realised once the project commenced and ingress to the tunnels measured. The inherently fractured nature of the host rocks introduces uncertainty in the modelling exercise and this will influence the intensity and duration of any impacts. The regional scale of the numerical modelling does not permit local-scale influences on instantaneous flow to which ground calibration is required. Localised assessments and procedural frameworks are required to facilitate appropriate mitigation strategies when increased ingress zones are encountered.

To support the groundwater assessment for the development of the Marcia Adit (MOD3), a regional numerical groundwater flow model (referred to as SH5.0), was developed. This model was based on the SH4.0 and was informed by expanded datasets, both spatially and temporally. This enabled a greater conceptual understanding of the groundwater system and its interaction with surface environments. Key expanded datasets included groundwater level and inflow monitoring.

The general modelling objective was to quantify potential incremental and collective (generally equivalent to cumulative impact in this case) effects on the regional groundwater system, resulting from MOD3 works.

In 2025, the project-wide regional numerical model is being rebuilt to reflect the final infrastructure design and incorporate the expanded temporal and spatial groundwater datasets collected to date, as well as updated geological conceptualisation of the Project setting. This updated model will be used for predicting future regional groundwater impacts on the environment.

4.2.3. Groundwater Inflows Prior to 2026

The RTS Revised Water Modelling Report (EMM, 2020) included updated inflow volume predictions to peak during construction at 62 L/s before stabilising at 45 L/s during operation. This modelled reduction in groundwater inflow compared to the original EIS report significantly reduced the magnitude and extent of groundwater drawdown and associated impacts.

The RTS Model Report considered potential average, wet and dry climate scenarios and quantified groundwater inflows to all excavations at 1,874 ML (59L/s), 1,952 ML (62L/s) and 1,835 ML (58L/s dry) on an annual basis for the average, wet and dry climate scenarios modelled, as summarised in Table 4-2. These figures were adopted within the Project until the conclusion of the date provided whereby the revised volumes were considered appropriate.

Table 4-2: Predicted Annual Inflows Main Works to 2025

Year ending	Dry climate (ML)	Wet climate (ML)	Average climate (ML)
1 June 2019	0	0	0
1 June 2020	3	3	3
1 June 2021	392	395	393
1 June 2022	1212	1259	1212
1 June 2023	1456	1503	1475
1 June 2024	1835	1952	1874
1 June 2025	1398	1488	1800

The Modification 3 assessment works included a revised Modelling Report (EMM, 2024) which detailed inflow predictions specific to the modification 3 works. This report model focused on the excavations commencing outside the HRT alignment prior to joining the HRT and contributing to inflow volumes throughout the Kellys Plain Volcanics and the Gooandra Volcanics. It is noted the Mod 3 report details annual inflows consistent with previous construction timelines which have since been superseded. Table 4-3 displays predicted groundwater inflow rates for the MOD3 works as provided by EMM in 2024.

Table 4-3: Predicted Annual Inflow - Modification 3 (EMM, 2024)

Prediction	Inflow (ML/ yr)
Construction: Year 1 groundwater inflow (ML)	36.5
Construction: Year 2 groundwater inflow (ML)	40.1
Operation: Steady state groundwater inflow (ML)	0

4.2.3.1. Revised Inflow Predictions to 2028

Tunnel inflow volumes were subject to review during the December 2025 and January 2026 revision of this Management Plan to allow for estimation up to the anticipated conclusion of construction. The primary objective underpinning the review was to improve overall clarity regarding water source takes and establish the maximum inflow volumes expected until December 2028.

The revised maximum annual inflow volumes have been calculated utilising the medium scenario volumes provided in the RTS Revised Water Modelling Report (EMM, 2020) in conjunction with inflow records generated during the 2025 inflow volume reporting period. The medium inflow scenario (equating 5 L/s/km) detailed within Part 2 – 3.4 of the Model Report has been adopted as the maximum inflow volume applied per kilometre of unexcavated and unlined area until construction is complete. The predicted annual volumes were subsequently applied to the respective water sources on an annual basis.

As such, Table 4-4 quantifies maximum inflow predictions up to the end of 2028 separating the volumes via water sources.

Table 4-4: Predicted Annual Inflows

Year Ending	2026	2027	2028
Lachlan Fold Belt – Murray Darling Basin Groundwater Source (24.5 kms intersection)	1505 ML	2129 ML	2939 ML
Lachlan Fold Belt – South Coast Groundwater (2.5 kms intersection)	312 ML	339 ML	254 ML

4.2.4. Groundwater Level Behaviour

4.2.4.1. Groundwater Drawdown

Groundwater flow into the excavations will result in hydraulic head drawdown developing over time. Water level drawdown is predicted to occur primarily near the Tantangara Adit, and in the vicinity of the Gooandra Volcanics (near Gooandra Creek and the Snowy Mountains Highway). Groundwater modelling undertaken as part of the Response to Submissions (EMM, 2020) also predicts scattered pockets of water table drawdown within the Yarrangobilly River catchment. No change in groundwater level was predicted at the Yarrangobilly Caves.

Predicted water level drawdown after 5 years of construction (for the Base Case parameterisation; EMM, 2020) is shown in Figure 4-1.

Calculated as the difference between a “null scenario” that simulates only transient climate stresses and a model run simulating construction of Snowy 2.0 (RTS, EMM, 2020), the groundwater model predicted the following water level drawdown:

- After one year of construction none predicted;
- After two years of construction a drawdown footprint is predicted near the western edge of Tantangara Reservoir, associated with the construction and excavation of the HRT. The model simulates the Kellys Plain Volcanics intercepted by the project at this location to have a much higher permeability (consistent with values estimated from field assessments) when compared with the majority of the model domain. A small drawdown footprint (0.5m) is also predicted around the main access tunnel for the power station;
- After three and four years of construction the water level drawdown footprint associated with the Kellys Plain Volcanics is predicted to expand and increase in magnitude immediately above the HRT to over 50 m. Small pockets of minor drawdown occur elsewhere with a more significant region growing above the HRT in the Gooandra Volcanics (generally 2 - 5 m);
- After five years of construction the footprint of the Kellys Plain Volcanics drawdown is predicted to further expand, along with the region of drawdown above the HRT in the Gooandra Volcanics, which is predicted to reach magnitudes of greater than 10 m; and
- Groundwater levels at the Yarrangobilly Caves are not predicted to be impacted during any part of the construction.

Appendix C within Modification 3 Submission Report (EMM, 2024) predicts the maximum drawdown to occur in the final year of construction works within the Marcia works area.



Figure 4-1: Predicted drawdown after 5 years of construction

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4.2.4.2. Subsurface (Type 1) GDE: Loss of Aquifer Habitat

Aquifer habitat (i.e. where stygofauna may be present) is predicted to be affected. Specifically, the predicted impact to fractured-rock aquifers will likely result in water level drawdown, reducing the extent of habitat available to stygofauna. It is likely that predicted impacts will be restricted to an area on the Plateau bounded by Tantangara Creek in the east and the boundary of the Gooandra Volcanics in the west. Drawdown of less than 20 m is considered unlikely to have a significant effect on many stygofauna species given the ability of these species to relocate within the saturated zone. Thus, drawdown of up to 5 m would be unlikely to have any significant effect.

The stygofauna assessment by Macquarie University (2019) suggests the overall predicted impact to stygofauna will be low across the region. Species identified are not considered endemic to the local area and regionally species diversity will not be impacted.

The information contained within Appendix C (EMM, 2024) of Modification 3 Submission Report indicated the worst case predicted drawdown from these works would reduce the extent of habitat available to Stygofauna (approximately 383 ha).

Of note, no impact is predicted at or near the Yarrangobilly Caves or associated ecosystems.

4.2.4.3. Surface (Type 2) GDE: Reduced Surface Water Baseflow

As a result of water level drawdown, the groundwater model predicted that localised baseflow discharges to creeks and rivers would be seen in the catchments upstream of Tantangara Reservoir, Lake Eucumbene, and Talbingo Reservoir. While inflows to the excavations are predicted to peak in the final year of construction, impacts to stream baseflow are predicted to develop more slowly, with peak impacts occurring several decades after the completion of construction. Long-term peak baseflow reductions are predicted to approximately match the long-term inflow rate to the power waterway.

Baseflow reduction due to tunnelling and excavation works during the construction period was predicted in Gooandra Creek and the headwaters of the Eucumbene River. The timing of the baseflow reduction will depend on the project schedule, as drawdown impacts are predicted to peak after the tunnel excavation reaches the Gooandra Volcanics, which occur in the vicinity of Gooandra Creek and the Eucumbene River headwaters. If no delays to schedule occur, Gooandra Creek baseflow reduction could begin during Year 4 of construction, and Eucumbene River baseflow reductions could begin in Year 5 of construction. Impacts were predicted to be still developing at the end of the construction period. No impacts to baseflow due to tunnel excavation were predicted within other creek catchments north of the Snowy Highway (EMM, 2020). Baseflow reductions predicted by the groundwater model during project construction are predicted to balance the ingress of groundwater to the excavated tunnels (Table 4-2), but with an approximately 3-5 year lag (Figure 4-2).

The baseflow reduction in Gooandra Creek during the excavation of the power waterway is expected to cause no discernible changes to streamflow through winter months. During March–April in the final two years of excavation there is a potential that baseflow reduction may result in reduced flow within the Gooandra Creek catchment if those construction years coincide with dry climate conditions.

Within the Eucumbene River, baseflow reduction during the construction period is expected to cause no discernible changes to streamflow.

Inflows to the tunnel excavation are predicted to increase markedly during the groundwater model Year 2023 (construction Year 4), rising to approximately 60 L/s when the tunnel encounters the Gooandra Volcanics before stabilising during 2024. Through the final quarter of construction, the baseflow impacts within the Gooandra and Eucumbene catchments were estimated to be in the order of 10 L/s, significantly less than the tunnel inflows. Impacts to baseflow within the Gooandra Creek catchment and within the Eucumbene River catchment upstream of Gooandra Track were predicted to increase over the final years of the construction period, reflecting a lag between the

greatest tunnel inflow and the greatest baseflow impacts. The peak change in baseflow is expected to occur following completion of the project.

Specifically, during construction and in the areas directly overlying the tunnel alignment the model predicted that:

- Baseflow to Gooandra Creek may decline by up to 6%, beginning in Year 4 of construction; and
- Baseflow to the Eucumbene River may decline by up to 1%, beginning in Year 5 of construction, with impacts centred on the uppermost 1.5 km of the Eucumbene River headwaters.

The surface water catchment model was used to investigate the effect of these baseflow reductions on the streamflow regimes downstream of the impacted catchments, and showed that:

- Gooandra Creek will potentially change from a perennial streamflow regime to marginally ephemeral, as days with less than 0.1 ML/day streamflow at the downstream end of the creek increase from 0% to 2%; and
- North of the Snowy Highway the Eucumbene River could also become ephemeral, as days with less than 0.1 ML/day streamflow at this location increase from 0% to approximately 5-7%.

It is expected that the quick flow component of streamflow (surface runoff in response to rainfall) will not be affected by groundwater drawdown and baseflow reduction. In each catchment, the modelled impact reduced with distance downstream as flows from catchment areas unaffected by the project entered the creek system.

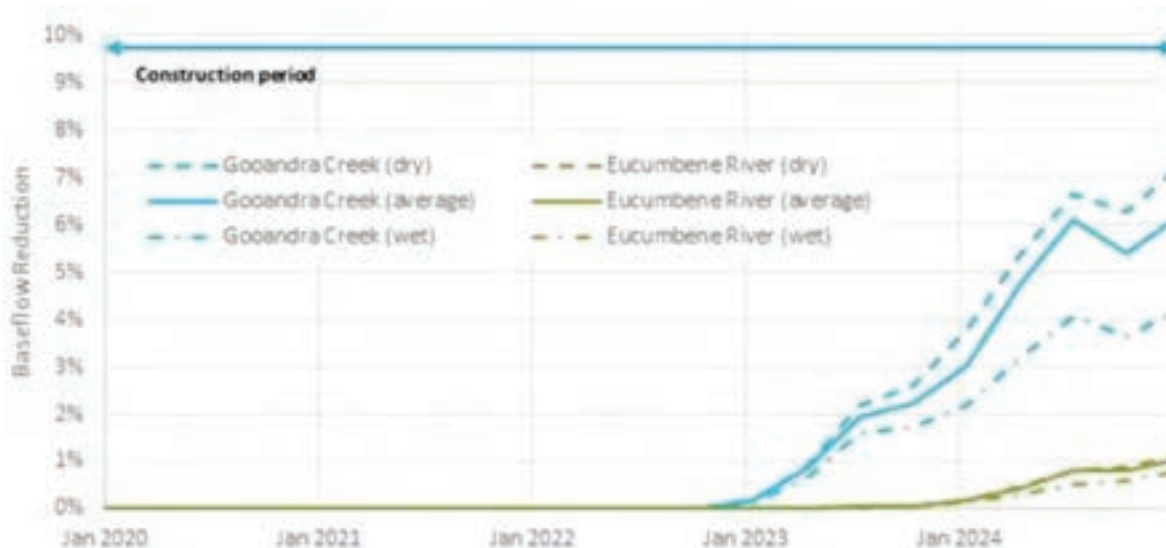


Figure 4-2: Baseflow Reduction Predicted

Groundwater-dependent riparian vegetation (Type 2 GDEs), consisting of species adapted to mesic/hydric soils, are located along sections of creeks and waterways where groundwater is expressing at the surface providing baseflow. It is unlikely that drawdown of less than 5 m will impact on these areas, as some groundwater will continue to be expressed at the surface. In addition, not all groundwater will be diverted from regional aquifers, with an unknown proportion continuing to supply baseflow to these GDEs, maintaining biological integrity. Groundwater-dependent riparian vegetation is predicted to be at moderate risk of predicted impact due to groundwater drawdown.

The small impacts to baseflow, as described above, will be indiscernible in the observed data considering the interannual variability in flow in the Gooandra and Eucumbene Creeks. Assessment of baseflow will be activated according to the Trigger Action Response Plan (TARP, Section 7).

4.2.4.4. Surface (Type 3) GDE: Lowering of Water Tables

The predicted impacts to surface GDEs were determined by calculating the area of each GDE that occurs within the groundwater drawdown areas predicted by the model. Future iterations of the numerical model, as further relevant data is collected, will refine our understanding and the potential impact extent. The current modelling identified the following potential impacts to surface (Type 3) GDEs:

- PCTs 302, 299 and 679 may experience predicted impacts to less than 3 ha of the community, and/or may experience groundwater drawdown of less than 5 m. These GDEs are considered to be at a low risk of impacts.
- PCT 303 may experience predicted impacts to 24.70 ha of the community, representing 6% of the 409 ha of the community mapped in the survey area, while PCT 300 may experience drawdown to 6.38 ha of the community, representing 2% of the 270 ha of the community mapped in the survey area. In addition, 14.02 ha of PCT303 and 3.71 ha of PCT 300 may experience drawdown of less than 2 m and will be unlikely to have any noticeable effect on the ability of these communities to access groundwater during periods of stress, and is therefore unlikely to result in any significant changes in the biological integrity of the GDEs. It is predicted these GDE are at low risk of impact.
- PCT 1225 may experience drawdown of >0.5 m to 10.27 ha of the community. Drawdown of more than 0.5 m may have some impact given the entirely/obligate dependence of this community on groundwater. While there is a high risk of predicted impact to some portion of the community, as defined in Serov et al. (2012), the predicted drawdown may impact on 3% of the 312 ha of this PCT mapped across the survey area, and larger patches of the community will be maintained on major watercourses such as Tantangara Creek and Nungar Creek. Overall impacts to community are expected to be low.
- PCT 637, aligned with the Alpine bogs and fens, may experience drawdown of >0.5 m to 6.93 ha of the community. This community is entirely/obligate dependent on groundwater and has a large number of hydric and mesic species that do not occur outside of this or other allied communities. The 6.93 ha that may be subject to drawdown represents 8% of the 86 ha mapped within the survey area, 0.08% of the mapped extent of the community in the Snowy Mountains (OEH 2012b) and 0.06% of the 11,100-ha mapped at a national scale (TSSC 2009). While there is a high risk of predicted impact to some portion of the community, as defined in Serov et al. (2012), the overall risk to the community and listed community is considered low.

The predicted impacts to these surface GDEs were determined through the RTS Numerical Modelling (Appendix G: Revised Biodiversity Development Assessment Report) and is presented in Table 4-5.

It is noted that Groundwater modelling contained within Appendix C of Modification 3 Assessment Submission (EMM, 2024) identifies localised drawdown in the vicinity of the works during construction. The water level drawdown is predicted to extend over approximately 25.5 hectares and does not transfer to any identified GDEs.

Table 4-5: Potentially Impacted Terrestrial GDEs

Mapped plant community type (PCT)	GW dependency	0.5m	plus 2-5m	plus 5-20m	Plus >20m	Total
PCT 1225 - Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	Entirely - obligate	9.96	0.3	0	0	10.27
PCT 637 - Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern	Entirely - obligate	6.03	0.85	.05	0	6.93

Mapped plant community type (PCT)	GW dependency	0.5m	plus 2-5m	plus 5-20m	Plus >20m	Total
Highlands Bioregion and Australian Alps Bioregion						
PCT 302 - Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion	Facultative proportional	0.71	0	0	0	0.71
PCT 299 - Riparian Ribbon Gum - Robertsons Peppermint - Apple Box riverine very tall open forest of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion	Facultative proportional	0.96	0.82	0.12	0	1.89
PCT 679 - Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion	Facultative opportunistic	0	0.02	0	0	0.02
PCT 303 - Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion and western South Eastern Highlands Bioregion	Facultative opportunistic	14.02	5.73	4.95	0	24.7
PCT 300 - Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment	Facultative opportunistic	3.71	2.17	0.49	0	6.38

Whilst potential predicted impacts are considered to be low for all plant communities, the obligate dependency of ecosystem PCT 1225 and 637 (Alpine Bogs and Associated Fens) requires specific recognition and focus during monitoring and impact assessment and inclusion in trigger action response plans (Section 7).

4.2.5. Groundwater Quality

4.2.5.1. Spills and Contamination

There is the potential for the project construction works to cause contamination to the groundwater resource. This predominately encompasses either spills of hazardous materials/chemicals and/or the generation of solid or liquid waste. Examples of this include spills of hydrocarbons while refuelling or lubricants used by machinery, and generation of solid construction waste or liquid waste during tunnelling. All scenarios have the potential to impact human and environmental health depending on the type of contaminant if not managed accordingly.

Protocols for the management of contaminated soil and water during construction will be included in a Construction Environmental Management Plan (CEMP) for all construction works.

Soil investigations will also be undertaken along all proposed medium and high-risk construction disturbance areas to identify the presence of any existing contamination and assess the risks posed to the groundwater environment. Management of soil and excavation waste will be undertaken through the SMP.

4.2.5.2. Acid Mine Drainage

As summarised in the Main Works EIS, it was concluded that the relative rates of acidity (i.e. PAF) versus alkalinity (i.e. ANC) generation in geological formations at the site are uncertain and require

further investigation, and that for many of the formations there remains insufficient information on the compositional variation.

There is potential for Acid Mine Drainage (AMD) impacts via the generation of acidic leachate from improper temporary or permanent storage of excavated PAF rock and this poses a risk to localised and wider (regional scale) groundwater environment.

To manage this risk, it is proposed that any excavated material is managed in accordance with the SMP. On-going monitoring in the vicinity of major excavations will recognise any changes to water quality and trigger an appropriate response. Further information is included in Section 5.5.

4.2.6. Nitrogen Management

Condition E5 of EPL21266 required the Project to develop a Nitrogen Management Plan (Plan (S2-FGJV-ENV-PLN-0367). This plan, which was prepared in consultation with the EPA, details the Project's reasonable and practical measures to manage the risks of nitrogen contamination stemming from construction activities.

A key objective of the Nitrogen Management Plan is the ongoing monitoring for Nitrogen in water across the project site and the framework provided in this Water Management Plan is critical in helping to support this.

4.3. Environmental Risk Assessment

The environmental aspects and impacts for water are further considered within Appendix A3 of the EMS. This includes a risk assessment process. The risk assessment is based on (1) the likelihood of an impact occurring as a result of the aspect; and (2) the consequences of the impact if the event occurred. These risks as well as any regulatory requirement form the basis for the groundwater mitigation measures committed to in this GMP in Section 5.

5. GROUNDWATER MANAGEMENT MEASURES

A range of environmental requirements and control measures are identified in the Main Works EIS, RTS and the Infrastructure Approval. Safeguards and management measures are implemented to avoid, minimise or manage impacts on groundwater.

Potential impacts to groundwater may be divided into those potential impacts relating directly to groundwater inflows to the tunnels and other excavation works and to those potential impacts indirectly caused by those groundwater inflows, that is, impacts to the environmental function of groundwater. The former may be distinguished as part of the process water cycle, the latter as part of the natural water cycle.

A conceptual overview of the water distribution network that relates to process water is provided in Figure 5-1. Minimising risks to the natural groundwater environment critically require minimisation of groundwater ingress to tunnels to acceptable levels. Specific safeguards and management measures to address potential groundwater impacts from the project are identified in Table 5-1. As control of groundwater inflow is the principal method to reduce potential groundwater impacts, the major components of groundwater management may thus be described in relation to the operation of the tunnel boring machine; the drill and blast excavations of the access tunnels; the excavation of the large transformer cavern and treatment of removed groundwater via water treatment plants.

5.1. Tunnel Boring Machine

The tunnels for Snowy 2.0 Main Works are excavated with a circular cross-section using four TBMs. Each TBM is fully equipped to perform excavation, ventilation, lining and removal of excavated material.

Groundwater enters the tunnel during construction. The volume and flux of ingress directly determines the potential for drawdown of water levels in the vicinity of the project corridor, including the potential to cause drawdown of groundwater near the surface. To mitigate impacts a number of controls have been identified that reduce the actual ingress of water to the tunnels. Specifically, developing a planned excavation sequence; forward surveys of rock condition; pre- and post-grouting of the rocks as determined through the surveys; use of segmental lining for the tunnel and continuous inflow monitoring facilitate reduced inflows to the tunnel and reduce the potential water level drawdown impacts.

5.1.1. Excavation Sequencing

Excavation sequencing is the process of managing the order that the excavation occurs to ensure critical sections remain open for the least amount of time possible.

Early identification of critical sections of highly permeable or vertically connected formations was undertaken during assessment of the EIS. This process identified that the Gooandra Volcanics had a higher hydraulic conductivity than other geological units in the project area.

The construction program has therefore been planned such that the Gooandra Volcanics region shall be excavated late in the construction program so that the excavation would remain open for the shortest period of time.

5.1.2. Forward Investigations

Surveys are conducted ahead of each TBM to identify potentially critical areas with poor rock conditions or high fracturing intensity. Each TBM is equipped with devices to perform the following surveys:

- geophysical seismic reflection surveys;
- geoelectrical surveys; and

- systematic probe core retrieval ahead of the advancing tunnel face.

5.1.3. Segmental Lining

Each TBM is equipped to install the segmental lining for the tunnel using the universal ring method. The ring is 2m wide, composed of nine pre-cast concrete segments which form each ring (eight segments, one 'large size' key-segment) and which have no bolts along the longitudinal joints. One drainage relief hole will be provided in each segment to guarantee a 'drainage effect' and water pressure re-equilibrium.

This segmental lining reduces permeability, assisting to:

- achieve acceptable head loss in the conduit;
- prevent hydraulic jacking; and
- prevent excessive leakage by seepage.

5.1.4. Pre-Grouting

Pre-grouting is conducted to reduce the hydraulic conductivity of the rock mass (minimise groundwater inflow) and improve the stability of the excavation face. This is undertaken ahead of the excavation face and is generally carried out by:

- drilling and testing a probe hole;
- drilling and installing a crown of groutable pipes;
- injecting grout through the pipes; and
- drilling a verification probe hole.

Probe holes are drilled up to 40 m in front of the working face. Water flow through the initial holes is measured and a decision is made on the need to grout.

The number and location of the holes will depend on rock mass condition and, in cases of work performed by a TBM, on the specific configuration of the excavation head.

The grouting of soil or rock masses with cement slurries or chemical mixtures to improve their mechanical and hydraulic properties is a well-established practice in engineering.

Verification of the grout effectiveness is made by comparing inflow rates in the original probe hole to those in verification holes.

5.1.5. Post-Grouting

Post-grouting is also used to further consolidate the surrounding rock and/or prevent water ingress if required. Tunnel water inflow will be measured using in-line monitoring of flow along the constructed tunnel and will inform the decision on the need to grout.

Post grouting entails drilling sets of holes perpendicular to the tunnel, in a fan of 9 holes around the tunnel. The holes are generally drilled at an even spacing from a jumbo with hydraulic top hammer. Mechanical packers are installed and connected to a pump via hoses. Grout is then injected to reduce the total permeability of the rock mass.

5.1.6. Inflow Monitoring

Groundwater inflow into the tunnels are monitored and compared to model predictions. Tunnel water inflow are measured in the tunnel via in-line flow meters. Tunnel inflow monitoring, water treatment plant (WTP) discharges and Project water inputs re-cycled back into the tunnel will all be monitored and used to determine a simple water balance to estimate local groundwater extracted during construction. Monitoring is undertaken at the indicated locations shown in Figure 5-1. Thus:

Groundwater inflow = WTP discharge (*flow meter C*) – Project water inputs (*flow meter E*).

Groundwater extraction will be reported on an annual basis in accordance with licence requirements (as described in Section 2.5.3).

5.2. Drill And Blast Operations

Access tunnels and the large cavern for the transformers are excavated using drill and blast techniques. These excavations are not planned to be lined and high initial inflows will reduce as groundwater tables are drawn down to the invert levels. Inflows are directed to sumps and pumped to the closest WTP for processing before entering the surface water stream, or re-cycled for use in the excavation process. The latter includes dust-suppression, cooling and cleaning.

Ingress monitoring will be undertaken as for the tunnels.

5.3. Water Treatment Plants

Water treatment facilities and systems are installed and operational across the Project in response to the evolving water management requirements facing the Project. The dynamic water management conditions have resulted in various water treatment applications being implemented. The primary purposes of the treatment facilities are to:

- Manage tunnel process water;
- Treat accommodation camp wastewater;
- Manage water quality prior to discharge and reuse; and
- Treat accommodation camps for potable water consumption.

In accordance with a previous Licence Condition E1.1, FGJV provided the NSW EPA with detailed designs of the various process water treatment plants and wastewater treatment plants used on the Project.

A detailed description of each of these WTPs streams is provided in the Surface Water Management Plan.

5.4. Spoil Emplacement

The SMP identifies spoil management process and measures for temporary and permanent spoil emplacement areas, including measures for natural occurring asbestos (NOA), leachate management and acid and metalliferous drainage (AMD).

NOA will be placed in designated encapsulation cells at the Tantangara emplacement area. In cell formations, the NOA will be placed over an inert foundation layer and contained with a geosynthetic textile wrapping.

AMD refers to potential for rock to be potentially acid forming (PAF) through exposure of sulphide minerals. In relation to groundwater quality, the key controls that are applied to each PAF treatment area include:

- Seepage from the treatment area is collected in a Leachate Basin downstream of the treatment emplacement area. Collected water is reused on the Project where water quality criteria is met or treated in the process water treatment plant. Discharge of seepage water to the environment is avoided, so far as reasonably practicable. The sizing of the basins is subject to final design and are dependent on disturbed ground extent and the utilisation of other erosion and sediment controls. The basin and all erosion and sediment controls will be designed and operated in compliance with mitigation measures in the SWMP;

- A barrier system will be installed under spoil emplacement areas as they are constructed (such as Geosynthetic clay liners) to prevent seepage from entering underlying soils and groundwater; and
- Neutralised PAF material can, once validated, be safely disposed of like any other spoil.

Further detail on spoil management and design is provided in the SMP.

5.5. Leachate Detection Programs

In accordance with the SMP various controls are implemented to ensure the potential for infiltration of water from permanent spoils emplacement areas (PSEs) to groundwater is minimised and monitored. Site specific controls including the compaction rates, water quality and erosion and sediment control are developed in consultation with the NSW EPA to ensure effective management. Relevant management controls may include:

- Lining system installation under PSEs to prevent seepage from entering underlying soils and groundwater;
- Runoff from upstream areas will be diverted around the emplacement areas to limit or reduce ingress and leaching; and
- Water seepage from the PSE treatment area e.g. during rainfall, will be minimised by compaction of materials.

Project Leachate Detection Procedures have been developed for each site and are described in detail within the SMP.

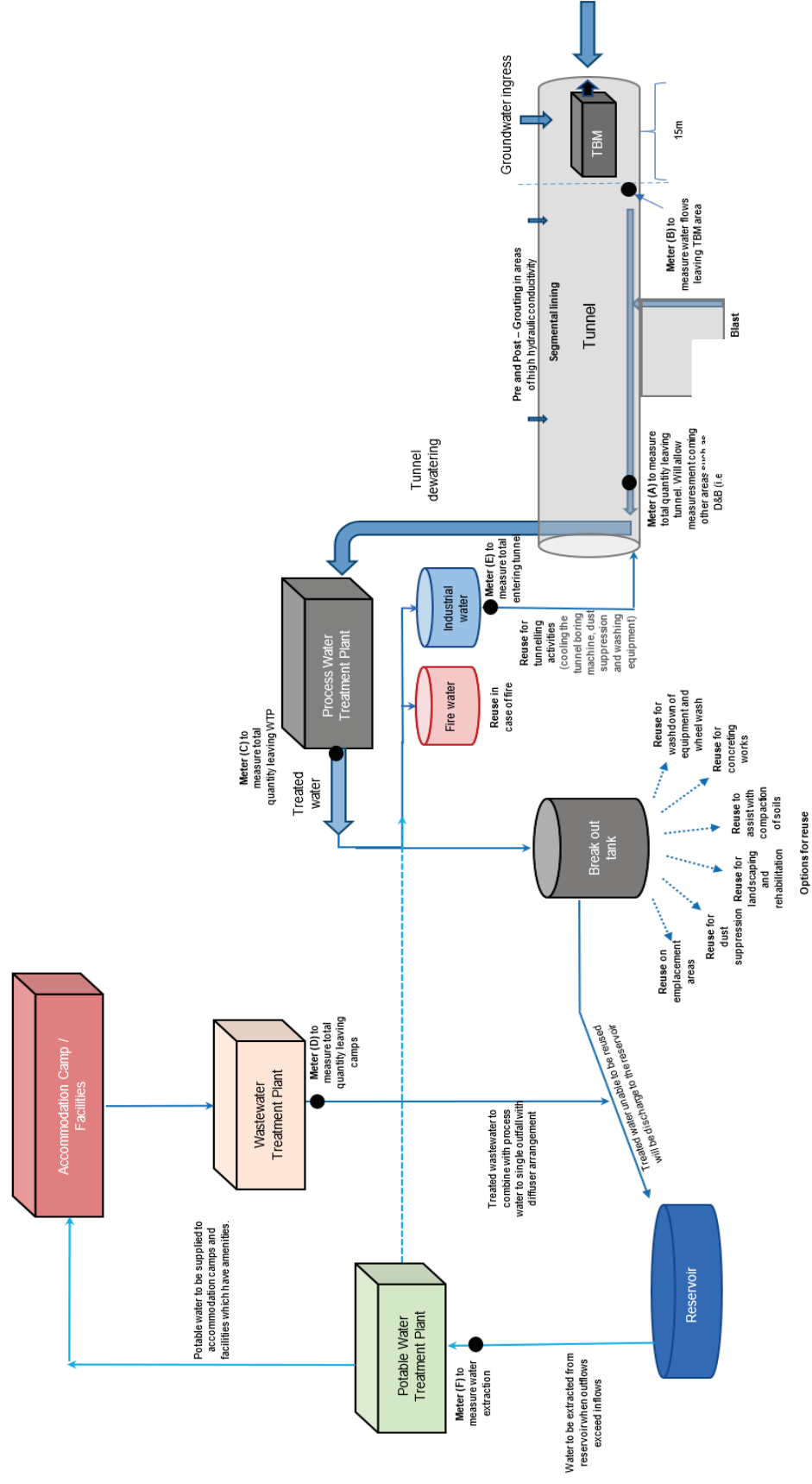


Figure 5-1: Conceptual Process Water Management System

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Table 5-1: Groundwater Management Measures

ID	Measure / Requirement	When implement to	Responsibility*	Source document**
General				
GW01	Training will be provided to all project personnel, including relevant subcontractors on groundwater management through inductions, toolboxes and targeted training.	Pre-construction and Construction	Contractor – EM, EC	Best Practice
Procedures and plans				
GW02	Spills and emergency response will be managed in accordance with the Emergency spill response procedure included in the Surface Water Management Plan (Appendix A of the Water Management Plan)	Construction	Contractor – All	MW REMM WM01
Groundwater management				
GW03	Groundwater discharged to reservoirs will be in accordance with the Surface Water Management Plan and unless an environmental protection licence authorises otherwise, in compliance with Section 120 of the POEO Act.	Construction	Contractor – All	CoA 29
GW04	The construction program shall be planned such that the Gooandra Volcanics region will be excavated late in the construction program.	Construction	Contractor – CM	CoA 30(e)
GW05	Where discrete high flow features are intercepted such as the Gooandra Volcanics and Kelly Plain Volcanics, pre-grouting and / or post-grouting will be undertaken to enable tunnel construction and minimise further ingress.	Construction	Contractor – CM, DM, S	CoA 30(e) MW REMM WM07 EW REMM WAT03
Groundwater contamination				
GW06	Emergency spill kits will be readily available at key construction sites across the project and workers trained in their use.	Construction	Contractor – EM, EC, CM, S	MW REMM WM01
GW07	Storage and handling of chemicals, fuels and oils will be as per manufacturer's instructions in bunded, storage areas.	Construction	Contractor – All	MW REMM WM01
GW08	During borehole drilling, slurries used will be of appropriate grade and composition such that it poses no threat to groundwater quality should it infiltrate intersected aquifers	Construction	Contractor – CM	EW REMM M1.6
GW09	Temporary and permanent emplacement areas will be managed in accordance with the Spoil Management Plan	Construction	Contractor – DM, CM, S, SS	MW CoA 30(o)
Monitoring and model validation				

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ID	Measure / Requirement	When implement to	Responsibility*	Source document**
GW10	Groundwater monitoring will be undertaken in accordance with the Groundwater monitoring program (Annexure A of this Groundwater Management Plan)	Construction	Contractor – EM, EC	CoA 31(d) MW REMM WM01 MW REMM WM02 EW REMM WAT02
GW11	Groundwater level monitoring will be undertaken in accordance with the Groundwater monitoring program (Annexure A of this Groundwater Management Plan) to provide early warning for impacts beyond those assessed for: - baseflow connected waterways; - the local groundwater flow system; - local depressurisation of groundwater resources; and - groundwater dependant ecosystems. The trigger actions response plans (TARPs) will be initiated in the event that a trigger value banding is exceeded (refer to Section 7.2 of this Groundwater Management Plan)	Construction	Contractor – EM, EC	CoA 31(d) MW REMM WM01 MW REMM WM02
GW12	The groundwater model developed for Snowy 2.0 Main Works will be validated and, if necessary, recalibrated to new groundwater monitoring data as the monitoring record increases throughout construction. Review will be undertaken annually during construction and include review of the monitoring data collection frequency, in consultation with NRAR and DPIE-Water Group.	Construction	SHL	CoA 31(d) MW REMM WM06 NPWS / DPIE consultation comment on reviewing monitoring frequency.
GW13	Groundwater extraction will be monitored and tracked against water access licence limits.	Construction	Contractor – EM, EC	Water Access License.
GW14	Adaptive management will be implemented for groundwater monitoring, including review, analysis and modification of mitigation measures if they are shown to be ineffective.	Construction	Contractor SHL	MW REMM WM01 (TARP).

* Responsibility Regardless of the allocation of responsibilities within this plan, the responsible party is to be assigned in accordance with the Contract

**Source Documents 1. MW RMMM – Main Works Revised Water Management Measure (Main Works RTS Appendix J Appendix C)

2. CoA – Condition of Approval (SSI 9687)

3. EW REMM – Exploratory Works Revised Environmental Management Measures (Exploratory Works RTS Chapter 8)

Responsibility abbreviations

CM – Construction Manager, DM – Design Manager, EM – Environmental Manager, EC – Environmental Coordinator, S – Supervisor, All – All personnel including subcontractors

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6. COMPLIANCE MANAGEMENT

6.1. Roles and Responsibilities

FGJV's organisational structure and overall roles and responsibilities are outlined in Section 4 of the EMS. Specific responsibilities for the implementation of mitigation measures are detailed in Section 5 of the GMP. Regardless of the allocation of responsibilities within this plan, the responsible party is to be assigned in accordance with the Contract.

6.2. Licenses and permits

Licenses and permits relevant to groundwater extraction were summarised in Section 2.5.3.

6.3. Monitoring and Inspections

6.3.1. Groundwater Monitoring Program

A Groundwater Monitoring Program has been developed to monitor potential impacts to groundwater during construction of the Project to ensure compliance with this management plan.

Details of the groundwater monitoring program, including detailed inspection criteria, are provided in Annexure A, Groundwater Monitoring Program (S2-FGJV-ENV-PLN-0108).

The Main Works monitoring program differs in fundamental ways to that developed for the Exploratory Works. Thus, whilst the Exploratory Works groundwater monitoring program was designed to provide baseline data and understanding of ambient groundwater conditions across the Project area, the Main Works monitoring program is designed to provide warning of potential risks to groundwater receptors and any mitigation measures for any impacted assets. The Program i

The objectives of the Groundwater Monitoring Program are to:

- Quantify groundwater inflow volumes to tunnels;
- Assess any changes to groundwater levels;
- Assess any changes to water quality across the various aquifers;
- Assess groundwater conditions against nominated trigger values;
- Identify and monitor the response of any actions required in the event of trigger value exceedances;
- Assess the effectiveness of groundwater mitigation measures;
- Assist with compliance to relevant consent and licencing conditions and other monitoring requirements; and
- Provide additional data for groundwater numerical modelling verification, validation and re-calibration, as required.

The Program provides detailed criteria including:

- Groundwater monitoring locations;
- Parameters/analytes to be monitored;
- Monitoring methodologies; and
- Monitoring frequency of monitoring, and

Groundwater monitoring is reviewed to determine whether any actions are required due to inconsistencies between monitored and predicted data. The groundwater monitoring process measures are outlined in Table 6-1, which provides reference to the relevant trigger, action, response plan for water levels, quality and usage.

Table 6-1: Groundwater Monitoring Overview

Performance measure	Monitoring sites	Frequency	Trigger	Objectives	Management Measures
Groundwater quality	EPL21266 designated monitoring locations	Monthly for all EPL designated locations (with exception to EPL1, EPL2, EPL4 and EPL25 which are sampled quarterly). Weekly when directed by the individual LDP's.	¹ If a parameter exceeds the nominated water quality triggers for two consecutive monitoring events.	To identify (where possible) if the exceedance is naturally occurring or due to construction	Implement Groundwater Quality TARP
Groundwater level monitoring: Piezometers	Groundwater bores designated as water level sites in the Groundwater Monitoring Plan / LDP's	Daily – 6 hourly (web platform bores only)	If the 7-day moving average exceeds the month's established trigger level by 1 standard deviation at the impacted bore		Implement Groundwater Level TARP
Groundwater level monitoring: Bogs and Fens Standpipes	GDE standpipes within PCT 637	Daily – 6 hourly (web platform locations only) Data collected quarterly*	If the 7-day moving average exceeds the 80 th percentile level at the impacted standpipe during the months of May to October, inclusive		Implement Level 3 investigation as described under the Groundwater Level TARP
Groundwater inflow	As indicated in Figure 5-1	Daily – continuous collection reported as daily flux	Monthly inflow volumes exceed modelled values for three consecutive months and cumulative inflows exceed cumulative modelled inflows	To ensure the water take is within licence limits To limit the volume of groundwater take and consequent drawdown	Implement Groundwater Usage TARP

¹ Conduct validation sampling within 7 days of review of initial NATA comprehensive results. Validation sampling must be comprehensive and include physiochemical conditions.

** Telemetry enabled groundwater monitoring is currently being installed across the project. No drawdown is predicted for the first few years of the project (see Section 0) hence existing data loggers will be downloaded manually quarterly until telemetry is in place. Monitoring frequency will be continuously reviewed and data compared to model predictions, and frequency of data collection will be adapted to ensure potential significant trigger events are detected early (i.e. particularly when Tunnelling commences in high-risk areas). Data collection will also be reviewed annually during groundwater model review as identified in Table 5-1: GW12.*

6.4. Trigger Levels and Methodology

All groundwater data collected prior to the commencement of construction is used as reference baseline data against which to compare monitoring data collected during construction at all locations detailed in the monitoring program (Annexure A). Groundwater triggers have been developed in line with recommendations under the NSW Aquifer Interference Policy (NOW, 2012) and based on baseline data collection for a minimum of two years to capture a full seasonal cycle twice at an appropriate frequency and scale commensurate with the Project. This is also reflected in the provisions of the Environmental Protection Licence (Section 2.5.1) whereby groundwater quality triggers refer to the exceedance of any analyte compared to the adopted WQO's.

Where baseline data was not been collected for a minimum of two years, collection continues at that site until a baseline can be established or until such time that construction activities occur in close proximity to monitoring locations.

6.4.1. Groundwater Triggers

Four levels of groundwater trigger can be described, dependent on the level of impact observed. Thus:

Level 1 Triggers (TARP 1 only) are those that might be expected to occur due to the activities and which do not result in undue, or significant, stress to the system.

Level 2 Triggers indicate that groundwater levels or inflows are trending towards an exceedance of a trigger value (but remain within predicted levels) and may represent an early sign of unpredicted or greater future effects.

Level 3 Triggers indicate that groundwater levels, quality, and/or inflows have exceeded a relevant trigger value, warranting a formal investigation into the potential cause and significance of the exceedance. These triggers mark the point at which an unpredicted or potentially unacceptable impact may be confidently assigned.

Level 4 Triggers denote an observed impact on a groundwater-dependent receptor (e.g. GDE). An investigation should be initiated to determine the cause of the impact and assess the extent of environmental harm. Mitigation measures must be implemented, along with any additional actions recommended by the investigation.

Different triggers are set for different parameters and require specific monitoring requirements as described below (Table 6-2). Baseline conditions have been used to determine site specific trigger values (SSTVs) for water level and quality at each target measuring point. That is, for each bore and at each depth if multiple depth samplers are in place.

Table 6-2: Groundwater Trigger Levels

Trigger Level	Description	Groundwater Level Impact ¹	Groundwater Quality Impact ¹
1	Indicator triggers – levels of impact up to the expected maximum response for the Project	No impacts beyond that predicted in the RTS	Not relevant to GW Quality TARP
2	Early Warning triggers – increased monitoring and assessment	Drawdown trending towards exceedance (80% of groundwater level trigger) of the maximum level of predicted impact in the RTS	No impacts beyond that predicted in the RTS or in exceedance of SSTVs (refer Annexure A – Groundwater Monitoring Program Attachment A and B)

Trigger Level	Description	Groundwater Level Impact ¹	Groundwater Quality Impact ¹
3	Threshold triggers – additional investigations and identification of potential impacts on receptors	Drawdown exceeds maximum level of predicted impact in the RTS continuously for more than 30 days	Water quality may exceed baseline trigger values
4	Limit triggers – mitigation actions to be implemented	Investigation indicates groundwater level drawdown has negatively impacted a receptor (GDE)	Water quality at risk of change to beneficial use

¹(refer Annexure A – Groundwater Monitoring Program Attachment A and B)

6.4.1.1. Groundwater Extraction Triggers

Groundwater usage in NSW is regulated according to the financial year, also referred to as the water year. Metering equipment will be installed within the tunnel to monitor tunnel inflows. Readings are undertaken manually (the Project are investigating opportunities for electronic monitoring) on an ongoing basis throughout construction (i.e. weekly) and recorded in a Project water register.

Comparison between groundwater ingress volumes and predicted groundwater inflow, as modelled in the numerical groundwater model, are undertaken throughout the year to ensure groundwater extraction are within permitted volumes of take from respective water sources. Actual water take will be reported to NRAR on an annual basis in accordance with water access licence conditions.

If cumulative water extraction exceeds cumulative water production published in the EIS (and subsequent Response to Submissions), review of the groundwater modelling predictions will be undertaken and assessment made of the implications on groundwater levels and pressures.

6.4.1.2. Groundwater Level Triggers

Groundwater level Site Specific Trigger Values (SSTVs) are set for two primary purposes:

- Monitoring for project impacts, which supports model validation and refinement of the numerical groundwater model; and
- Monitoring for asset protection, which enables early detection of potential or actual impacts to GDEs.

Groundwater level SSTVs are assigned to each SHL controlled groundwater monitoring site (piezometer) and represent the cumulative predicted groundwater level drawdown (as per the regional numerical groundwater model) at each monitoring site due to Main Works activities, applied to the site's baseline groundwater level.

Groundwater level SSTVs are reviewed and updated monthly using the most recent observed water levels to account for climatic variability and construction progression. Groundwater monitoring data continues to be collected using the established network of loggers and telemetry-enabled bores.

Observed groundwater levels are compared to the SSTVs assigned to each monitoring site. Where groundwater levels exceed the SSTV for a continuous period 30 days, the Groundwater Level Trigger Action Response Plan (Section 7.2 and Annexure B) and Trigger Investigation Process (Section 7.2.2) are initiated. Groundwater level trigger process at GDE sites (shallow standpipes) is carried out via a different method (refer to Section 7.3.2) with relevant triggers only being assessed against groundwater level data collected from Autumn through to Spring (May through to October) as baseline assessment has demonstrated that drying of these sites is a normal occurrence through the summer months and constitutes normal ecosystem function.

6.4.1.3. Groundwater Quality Triggers

Baseline collection of groundwater quality (Annexure A Attachment A) has identified two critical aspects that influence the efficacy of water quality sampling:

1. Water quality objectives are only exceeded by a constrained sub-set of analytes across all groundwaters, with most groundwaters exhibiting nutrient and metal concentrations close to, or below, limits of detection.
2. Analytes that present above WQOs exhibit similar levels (concentrations) across most groundwater units. That is, there is a broadly homogeneous (and good) water quality across the region, particularly across the Plateau, though increasing salinity is observed towards the western Ravine Beds in the Ravine area.

Combined, these characteristics infer:

- (i) Water quality does not provide a good marker for inter-aquifer connectivity, nor exchange; and
- (ii) There is minimal risk from inter-aquifer exchange induced by changing groundwater flow regimes.

Further, baseline monitoring has identified significant intra-sample variability, in large part due to the inherently low levels of most analytes, but also reflecting the high inter-connectedness between shallow and deep units and response to recharge events across the region. Monthly sampling at the EPL sites indicates a water quality dependency on water levels, likely reflecting the variable recharge in response to the variable rainfall across the area. This is more evident for shallow sites, but all sites show significant temporal variability in salinity and major ions that reflect climatic inputs.

These characteristics have implications on the optimal frequency of sampling and relevance of analysed parameters. Thus, water quality changes can be ascribed to correspond to significant water level changes and water levels can reasonably act as proxy for stable water quality if levels do not change beyond those observed during the baseline collection period.

Significant changes to water levels, as indicated by exceedance of groundwater level SSTVs (as described above) would trigger water quality sampling at a restricted suite of nominated nearby groundwater monitoring sites to check for water quality impacts. As water quality variables either do not vary significantly with time, or may show a seasonal pattern, quarterly sampling is undertaken for this initial phase of analysis. Quarterly sampling achieves comparable confidence in water quality characteristics as monthly sampling with most analytes currently analysed being very unlikely to change with time or under any perceived potential impacts.

If water quality trigger values are triggered at this restricted suite of nearby monitoring bores, this would prompt additional sites to be monitored, and Level 3 groundwater quality triggers assigned to all analytes at these bores. Repeated exceedance would instigate investigation and assessment of the causes for the triggers.

For most parameters, ANZECC trigger values are used as the foundation for determining appropriate water quality targets (and hence triggers) to be adopted for groundwater monitoring during construction. These same default trigger values were also applied in the Main Works EIS during assessment of baseline groundwater quality, where relevant.

The following default WQO values have been adopted for the purposes of this GMP:

- Physical and chemical stressors – default trigger values for upland rivers in Southeastern Australia that are reported in ANZECC/ARMCANZ (2018); and
- Toxicant trigger values for the protection of 99% of freshwater aquatic species that are provided in ANZECC/ARMCANZ (2018).

In setting the groundwater quality trigger values for this plan, results from the EIS baseline monitoring were also reviewed to identify those sites where consistent exceedances were recorded against the ANZECC values. At these locations, SSTVs may be adopted in place of the default ANZECC trigger value.

SSTVs rely on a temporal trend that is sufficiently long to determine consistent variability through time. Thus, a distribution of values equally distributed around a mean value allows the determination of the standard deviation of data around that mean value. If a consistent baseline can be established, deviation from normally expected variation can be assessed by considering the number of sequential data points that exceed the normal variability in the data. Using this “control chart” approach, a trigger event may be defined when:

- A single data point exceeds the mean plus 3 standard deviations; or
- Two consecutive data points are greater than the mean plus 2 standard deviations; or
- Five successive data points are greater than the mean plus 1 standard deviation.

An example of this type of analysis is shown in Figure 6-1.

For parameters that display a skewed distribution, such as those at the limits of detection or which are impacted by systematic external events (e.g. periodic recharge from a freshwater source), it is appropriate to use equivalent percentiles to assess a trigger event. In this case, a trigger event is defined when:

- One data point exceeds the 99.87th percentile;
- Two consecutive data points exceed the 97.73rd percentile; or
- Five successive data points exceed the 84.14th percentile.

This methodology is illustrated in Figure 6-2.

Where continued monitoring demonstrates a shift in variability under baseline conditions (i.e. can be demonstrated to not be due to the Project), these values will be modified to reflect the changing conditions.

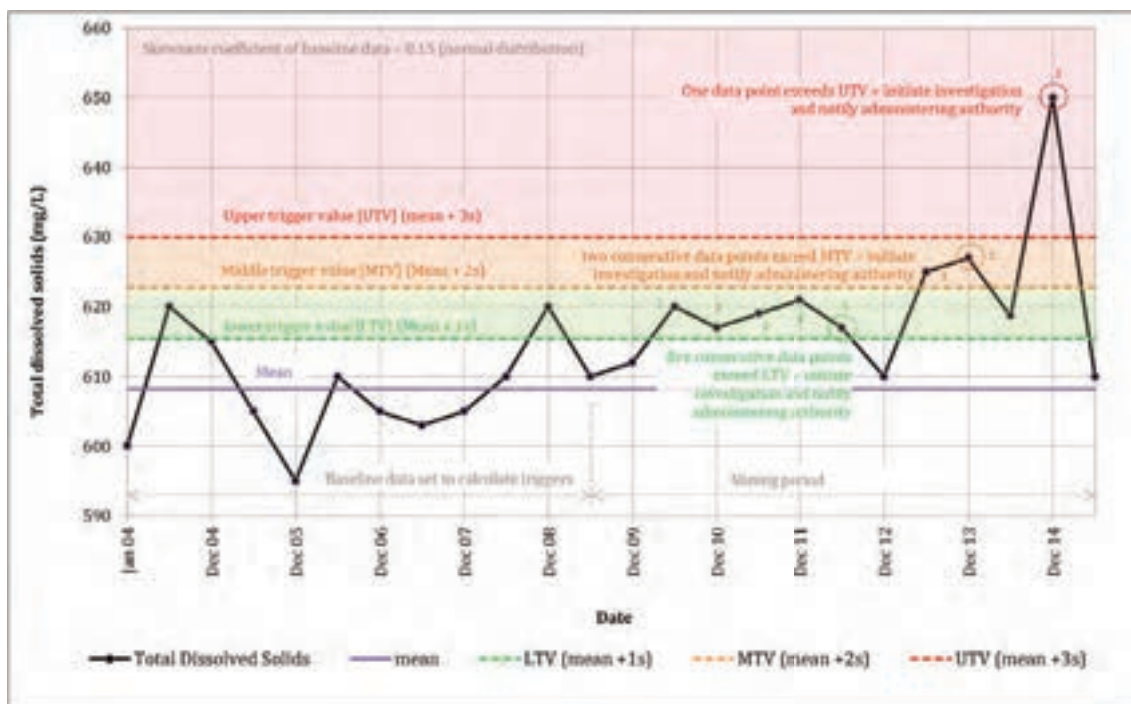


Figure 6-1: Example Control Chart for Total Dissolved Solids

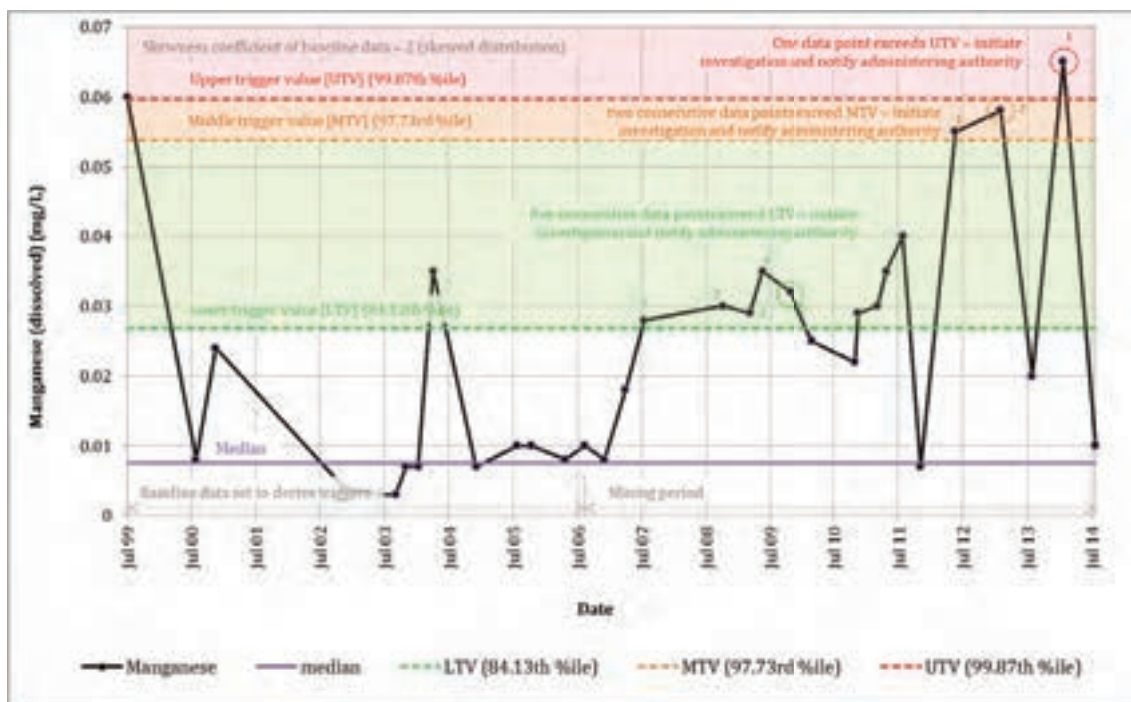


Figure 6-2: Example Control Chart for Manganese

The proposed default ANZECC target values are adopted where appropriate across the network and are summarised in Table 6-3. The sites for which SSTVs will be identified are indicated with SSTV in Table 6-3 and values for SSTVs are provided by bore in the Groundwater Monitoring Program (Annexure A).

Throughout Project, should consistent exceedances be observed above these values and shown to not be the result of Project activities, a revision of this GMP will be undertaken and trigger values will be revised. If the exceedances are believed to be related to the Project, investigation into the exceedances are required (see Section 7.2, below).

6.4.1.4. Water Quality

Table 5-3 below contains the comprehensive analytical suite which constitute the trigger parameters for TARP B – Groundwater Quality.

The pH of waters is an indicator of the concentration of hydrogen ions. The scale is logarithmic, with values less than 7 indicating acidic waters and greater than 7 being basic. Baseline values of pH measured in groundwater samples from the monitoring network are reported in Attachment D of the Water Assessment for the EIS (EMM, 2019). The report contains statistics summarising the pH range in each geological formation. Based on the field values, pH of the groundwater typically falls within the 6.5 to 8.0 range specified as the WQO value.

The control chart methodology used for salinity is not appropriate for pH as the log scale results in control lines that are too closely spaced relative to natural variability. The baseline groundwater monitoring shows pH values are commonly between pH 6 and pH 9. These values are therefore adopted as upper and lower trigger thresholds.

It should also be noted that the upper annulus² of groundwater monitoring bores is commonly sealed using a grout slurry of cement and bentonite to prevent ingress of surface water. Occasionally this slurry can impact upon groundwater pH immediately around the borehole. This unintended outcome can often result groundwater samples with greater than pH 9 (and up to pH 12) for a significant period of time. If investigations determine the grout seal around any boreholes has raised pH around the boreholes it will not trigger DPHI review as there is no regional impact from the small volumes of cement³ used in the sealing process.

² The volume between the outside of the borehole and the outside of the PVC bore casing

³ Dependent on bore depth but commonly less than 1 m³

Table 6-3: ANZECC groundwater quality trigger values

Field Parameters		Unit	Gooandra Volcanics	Temperance Formation	Boggy Plain Suite	Tantangara Formation	Kellys Volcanics	Plain	Tertiary basalt	Plateau bogs/fens	Ravine East	Ravine West	Beds	Boraig Group	Yarrangobilly Caves
Dissolved oxygen Electrical conductivity pH Oxidation Reduction Potential Turbidity	% saturation		No Water Quality Objective Value												
	µS/cm		30-350	SSTV	30-350	30-350	30-350		30-350	30-350	30-350	SSTV	SSTV	30-350	30-350
	-		6.5-8.0	6.5-8.0	6.5-8.0	6.5-8.0	6.5-8.0		6.5-8.0	SSTV	6.5-8.0	6.5-8.0	6.5-8.0	6.5-8.0	6.5-8.0
	Mv		No Water Quality Objective Value												
Analytical results – nutrients		NTU	No Water Quality Objective Value												
Analytical results – metals (dissolved)	Total nitrogen	µg/L	0.25	0.25	SSTV	0.25	0.25		0.25	SSTV	0.25	0.25	0.25	0.25	0.25
	Reactive phosphorus	µg/L	0.015	0.015	0.015	0.015	0.015		0.015	0.015	0.015	0.015	0.015	0.015	0.015
	Aluminium (Al)	µg/L	0.027	0.027	SSTV	0.027	0.027		0.027	SSTV	0.027	0.027	0.027	0.027	SSTV
	Copper (Cu)	µg/L	SSTV	SSTV	SSTV	0.001	0.001		SSTV	0.001	0.001	0.001	SSTV	SSTV	SSTV
	Iron (Fe)	µg/L	0.34	0.34	0.34	0.34	0.34		0.34	SSTV	0.34	0.34	0.34	0.34	0.34
	Lead (Pb)	µg/L	0.001	0.001	0.001	0.001	0.001		0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Manganese (Mn)	µg/L	1.2	1.2	1.2	1.2	1.2		1.2	1.2	1.2	1.2	1.2	1.2	1.2
	Nickel (Ni)	µg/L	0.008	0.008	0.008	0.008	0.008		0.008	0.008	0.008	0.008	0.008	0.008	0.008
	Silver (Ag)	µg/L	0.00026	0.00026	0.00026	0.00026	0.00026		0.00026	0.00026	0.00026	0.00026	0.00026	0.00026	0.00026
	Zinc (Zn)	µg/L	SSTV	SSTV	SSTV	0.00246	0.00246		SSTV	SSTV	0.00246	0.00246	SSTV	SSTV	0.002

SSTV Site specific trigger values to be calculated based on long-term statistical analysis – see Annexure A: Groundwater Monitoring Program

6.5. Training

All site personnel undergo site induction training relating to groundwater management risks which have the potential to impact on groundwater resources.

Targeted training in the form of toolbox talks or specific training is also provided to personnel with a key role in water management. Examples of training topics include:

- Discharge quality parameters;
- Groundwater monitoring methodology and protocols;
- Groundwater dependent ecosystems;
- Incident response; and
- Spill management and reporting,

Further details regarding the staff induction and training are outlined in Section 5 of the EMS.

6.6. Incident Management

Incidents are managed in accordance with the Section 7 of the EMS and the Pollution Incident Response Management Plan (PIRMP). The investigation will include a review of events leading up to the incident and implement improved practices as required.

The Secretary and other relevant agencies will be notified of incidents in accordance with Section 7 of the EMS. Depending on the type and severity of the incident this may include notification to the Department and NPWS in writing for incidents defined under the conditions of approval, notification to the NPWS where required under the Deed of Agreement of Lease and notification to the EPA for pollution related incidents. SHL would notify DPHI in writing immediately after they become aware of the incident on site.

6.7. Auditing

Audits will be undertaken to assess the effectiveness of water management measures and overall compliance with this GMP. Audit requirements are detailed in Section 8.3 of the EMS.

This Management Plan has been reviewed and updated in accordance with the Environmental Independent Audit and Schedule 4, condition 4b, of the CoA.

6.8. Reporting

FGJV will report to SHL and other agencies as detailed in Table 6-4 on groundwater management aspects related to the Project. During construction, groundwater monitoring data will be collected, tabulated and assessed against thresholds.

Table 6-4: Reporting Requirements

Report	Requirement	Recipient
Reporting		
Weekly inspection	<u>EMS Requirement</u> Weekly inspection report undertaken by environmental advisor which includes aspects relevant to the management of water	FGJV Internal Record
Incident Report (related to water)	<u>Infrastructure Approval Schedule 4, CoA 6</u> The Proponent must notify the Department and NPWS via the Major Projects Portal immediately after it becomes aware of an incident on site. This notice must set out the location and nature of the incident.	Depending on the type and severity of the incident this may include notification to the Department and NPWS in writing for incidents defined under the conditions of approval, notification to the NPWS where required under the Deed of Agreement of Lease and notification to the EPA for pollution related incidents. SHL will notify DPHI in writing immediately after they become aware of the incident on site.
	<u>EPL 21266</u> Incident reports to be provided to EPA in accordance with EPL notification of environmental harm and written report requirements.	
EPL Monitoring Reports and Annual Review/Returns	<u>EPL 21266</u> EPL monitoring reports will be prepared in accordance with the requirements of the EPL. An EPL Annual Review/Return will be prepared in respect of each EPL reporting period (typically 12 months)	EPA
Water Access Licence Report (annual)	<u>Water Access Licence</u> Actual water take will be reported to NRAR on an annual basis in accordance with water access licence conditions.	NRAR
Environmental Water Report (every 6 months)	<u>Infrastructure Approval Schedule 3, CoA 31(c)(d)</u> Commentary on the performance of the groundwater monitoring program (including rainfall data and tunnelling progress) will be documented in the 6-monthly environmental water report. Any incidents and key environmental issues will be documented.	Publicly available on project website
Other Aspects		
Site Water Balance	<u>Infrastructure Approval Schedule 3, CoA 31(b)</u> Yearly calendar revision of the Site Water Balance will be undertaken and where updates are identified, the revised Balance will be updated and included in a future revision of this WMP.	Proposed future updates to this WMP will be provided to EPA, NPWS, Water Group, NRAR and NSW DPI.
Groundwater model validation	<u>Infrastructure Approval Schedule 3, CoA 31(d)</u> Yearly calendar groundwater model review, validation and recalibration/update (as required/dictated by monitoring results) (undertaken by SHL).	The review will be submitted to NRAR, and the revised model will be submitted to the relevant agencies on completion.

Report	Requirement	Recipient
Updates to this WMP	<u>Section 1.7 of this WMP</u> This WMP will be updated prior to the commencement of the following activities: • Dredging, channel extraction or underwater blasting; • in-reservoir emplacement works; • construction works in the third year for the purposes of determining need / location of streamflow monitoring sites; and • Snowy 2.0 operations (a separate SHL document or framework may be prepared).	Proposed future updates to this WMP will be provided to EPA, NPWS, Water Group, NRAR and NSW DPI.

7. TRIGGER ACTION RESPONSE PLANS

This section details the Trigger Action Response Plans (TARPs) that have been developed for appropriate groundwater variation response. TARPs allow for prompt identification of unpredicted impacts and guide the implementation of additional management measures and corrective actions should adverse conditions arise that are attributable to construction.

Groundwater monitoring is undertaken using a combination of methods and requires varying levels of processing and review before collected data can be used to inform assessment and decision making.

7.1. Adaptive Management

Monitoring results obtained during construction are subject to monitoring, analysis of results, review of mitigation measures (where exceedances are identified) and updates to measures and trigger values where required.

Additional or varied monitoring locations may be warranted following detailed design and during construction. Where a well becomes inoperable, damaged or within the disturbance footprint, the Environmental Manager will identify a suitable replacement in consultation with a suitably qualified hydrogeologist. Changes to monitoring locations and parameters would be approved by SHL in consultation with relevant agencies, and via EPL variation where required. Any relocation or addition of monitoring locations would trigger updating of the monitoring plan.

On-going monitoring results inform future re-assessment of the numerical groundwater model. If a modelling up-date indicates increased drawdown over time at any location this may trigger additional monitoring in the vicinity of the predicted drawdown area. The monitoring program (Annexure A) is designed to continue logging data at the majority of sites, with a restricted suite of sites used for instantaneous assessment. If any changes in excess of the predicted drawdown are registered, this would trigger expansion of the assessment suite of sites and will inform potential locations for additional monitoring sites.

7.2. Trigger Action Response Plans

In addition to the general principles described above (Section 6.4.1) for assessment of groundwater TARPs's have been developed to further investigate potential impacts to groundwater during construction of the Project.

The purpose of the groundwater TARPs is to detail a standardised response procedure in the event that a trigger value banding is exceeded during a monitoring event for groundwater quantity, quality, pressures and/or levels. As groundwater take (in the form of discharged tunnel inflows) is a condition of approval, a groundwater ingress TARP is also developed.

The objectives of the TARPs are as follows:

- Undertake supplementary monitoring to confirm and establish the extent of water quality or level variation;
- Identify the potential cause(s) of the water quality or level variation, if possible;
- Identify and implement appropriate mitigation measures to minimise on-going trigger of the water quality or level variation, if possible;
- Perform due diligence when any variation is triggered; and meet CoA and REMMs requirements for trigger response.

The groundwater TARP's include:

- TARP 1 Groundwater level (Annexure B). It is noted this TARP relates to SHL managed networks only.
- TARP 2 Groundwater quality (Annexure C).
- TARP 3 Groundwater ingress (Annexure D).

7.3. Trigger Exceedance Assessment Process – Groundwater Level Network

Figure 7-2 illustrates the assessment process to be followed when groundwater level monitoring results exceed site-specific trigger values, as itemised in the Groundwater Monitoring Program (Annexure A).

The process involves a stepwise review of potential causes, including:

- Natural variation (e.g., climatic conditions);
- Changes to the geological conceptualisation;
- Physical constraints or operational conditions (e.g., TBM progress); and
- Potential construction-related impacts.

Each stage of the assessment is outlined as follows:

Stage 1 – Trigger Detection

Monitoring results are compared against SSTVs for groundwater levels. .

Stage 2 – Verification Measurement

If an exceedance is detected, a manual measurement of the standing water level is undertaken at the relevant site to confirm the result.

Stage 3 – Preliminary Assessment

Once verified, the site environmental officer reviews the data to identify external or natural contributing factors.

Stage 4 – Natural/Operational Factors

The officer assesses external influences such as climatic variability (e.g., drought or rainfall) and operational conditions (e.g., tunnelling rate or dewatering).

Stage 5 – No External Cause Identified

If no external cause can be confirmed, the potential for construction-related impact is evaluated.

Stage 6 – Third-Party Review

If a construction impact is suspected or the cause remains unclear, an independent third-party reviewer is engaged to assess the exceedance and provide recommendations.

Stage 7 – Regulatory Notification

If the third-party reviewer identifies a likely link to construction activities—or cannot rule one out—NSW DPHI and NPWS will be notified within 24 hours of becoming aware of the exceedance. seven

Stage 8 – Trigger Level Classification

The third-party reviewer will also determine the applicable trigger level classification in accordance with relevant TARP, and Section 6.4.

Stage 9 – Regulator Reporting and Mitigation

The specific Groundwater TARPs provided in Annexure B

The results of the trigger investigations are reported in each Annual Review as described in Section 6.8. Consequent identified changes to baseline data or trigger levels that are not deemed a result of Main Works will trigger an update of the GMP and groundwater monitoring plan.

7.4. GDE Monitoring and Trigger Framework

GDEs are critical environmental assets that require protection during construction. The key risk to these ecosystems arises from reduced access to groundwater due to seasonal water level declines, particularly during the winter months when groundwater inputs are essential to ecosystem function.

Monitoring of GDEs is undertaken at twelve Type 3 GDE locations across the Plateau, including Bullocks Hill Bog, Gooandra Hill Bogs, Nungar Creek Bog, and Tantangara Creek Bog. At each site, shallow bores have been installed to record groundwater level fluctuations and assess ecosystem health. These monitoring records show seasonal variability, with groundwater levels typically in the top metre of the soil profile. Drying occurs over summer, while saturation is observed from May to October. Water level variability exceeding one metre has been observed between seasons, though this is generally constrained by surficial discharge limits.

Baseline assessments (Annexure A Attachment A) have shown that Alpine Bogs and Associated Fens can tolerate summer water level drawdown, with ecosystem function maintained provided winter rainfall and/or spring snowmelt restores groundwater levels to near-surface conditions. Therefore, the critical period for assessing groundwater dependence and potential ecological impacts is from May to October, during which shallow water tables are essential to support ecosystem function.

Groundwater level Site-Specific Trigger Values (SSTVs) are used to track potential deviations from expected groundwater behaviour. A drawdown below the 80th percentile of observed groundwater recharge levels during the May–October period is considered a material change (i.e. greater than negligible, as per Condition of Approval 15A), triggering a Level 3 investigation in accordance with the Groundwater Level Trigger Action Response Plan (TARP, Annexure B).

GDE monitoring sites are categorised according to their predicted risk of impact:

- (i) Within the modelled drawdown zone (expected to be impacted);
- (ii) Along the tunnel alignment but outside the predicted impact zone (unlikely to be impacted); and
- (iii) Distant from the alignment and outside the predicted drawdown zone (baseline reference sites).

This tiered site selection allows differentiation between natural variability, construction-related impacts, and background trends.

If a trigger exceedance is deemed irreversible and ecosystem function is compromised, further biodiversity management measures are required. This includes consideration of offsets, in accordance with the Biodiversity Management Plan. The process for escalating such outcomes is outlined in Figure 7-3.

In the unlikely event that observed impacts exceed model predictions (Section 4.2.4), additional GDE monitoring sites will be established in consultation with DPHI and NPWS, as described in Section 7.2.2 (Step 8).

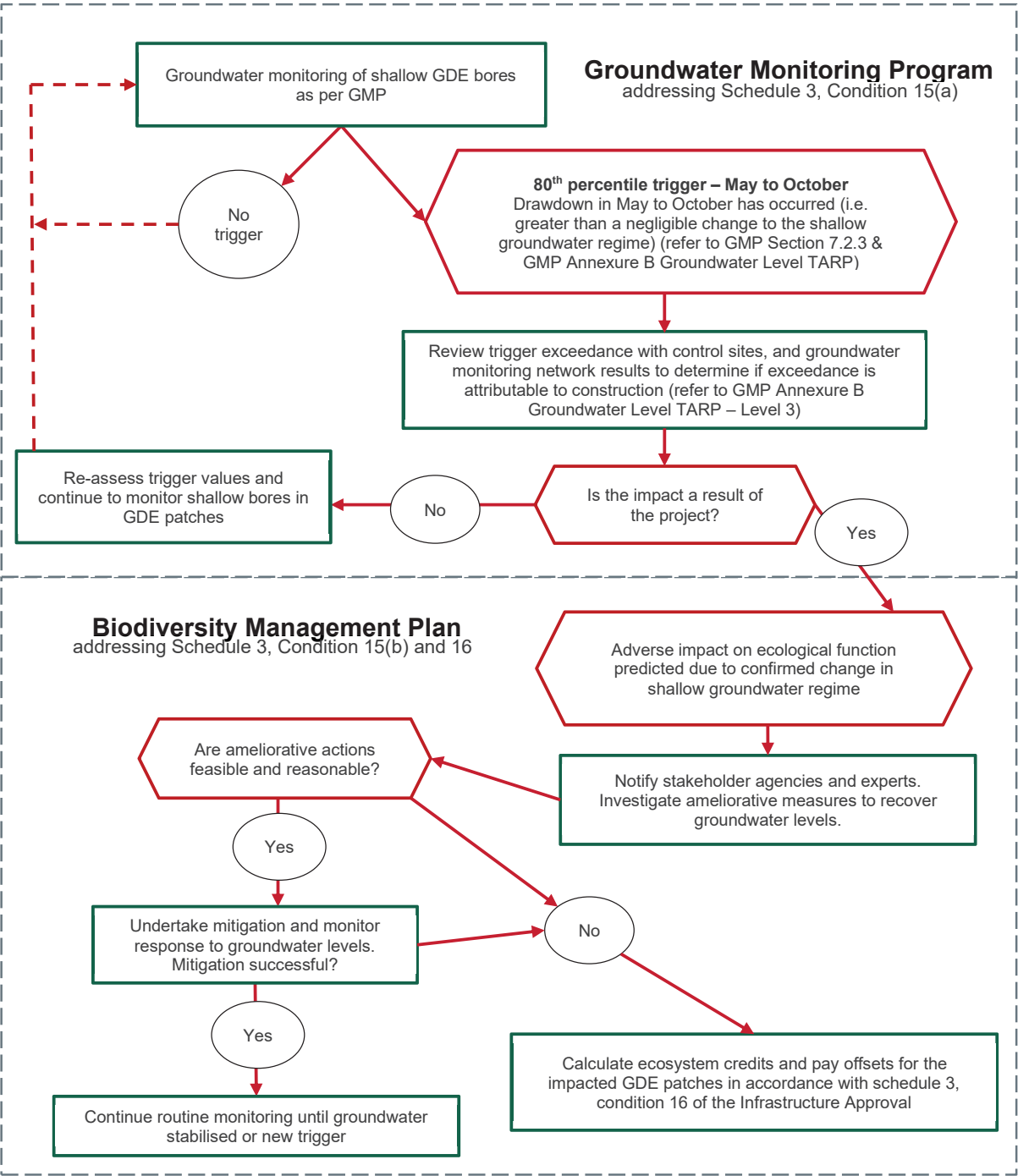


Figure 7-1: Groundwater Level TARP and Biodiversity Management Plan Relationship

8. REVIEW AND IMPROVEMENT

8.1. Continuous Improvement

This plan is subject to continuous improvement through regular evaluation of environmental management performance against the policies, objectives and targets outlined in this plan and the project EMS in order to identify opportunities for improvement.

This review and improvement process is designed to:

- Assess performance of the environmental management system through comparisons with objectives and targets;
- Identify opportunities for improving practices and processes;
- Determine the cause or causes of non-conformances or exceedance events;
- Develop and implement a plan of corrective and preventative action to address any non-compliances;
- Verify the effectiveness of the corrective and preventative actions; and
- Document any changes in procedures resulting from process improvement.

8.2. Groundwater Model Validation

The groundwater model is kept as a live groundwater management tool throughout construction. It is validated and, if necessary, recalibrated to new groundwater monitoring data as the monitoring record increases.

Of particular benefit to ongoing validation of the model is the inclusion of measured groundwater responses at the commencement of excavations and as works progress. Dewatering of excavations provides a much greater stress on the groundwater system than climate-driven stresses, and this information will enable greater accuracy in the prediction of impacts to the system.

Monitoring data is reviewed throughout the construction period to provide validation of the groundwater model and potential requirements to increase, or decrease, the number of sampling locations and/or the analytical suites.

The review to recalibrate and update the groundwater model, and associated monitoring data collection frequency is undertaken during each Annual Reporting cycle, in consultation with NRAR and DPIE Water Group.

The revised model will be submitted to the relevant agencies on completion, or as required by the REMMs and Conditions of Approval.

8.3. Groundwater Management Plan Revision

Throughout construction, there may be a need to update or revise this Plan. This may be in response to updates of the groundwater model, other elements of the project EMS or due to an update to the EPL. Plan updates will occur on an as needed basis, with conditions approved through the EPL taking precedence until any changes to the GMP are approved.

Amendments to this plan will be in accordance with the delegations outlined in the EMS. A copy of the updated plan and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure.

9. REFERENCES

ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra, ACT, Australia. Viewed [viewed 08/04/2020], [<https://www.waterquality.gov.au/anz-guidelines>].

Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000).

Australian Drinking Water Guidelines (Natural Resource Management Ministerial Council (NRMMC), 2011).

EMM, 2019. Appendix J.1: Water Assessment for the Snowy 2.0 Main Works EIS (report #J17188 RP#86).

EMM, 2020. Modelling Report. Annexure I to Main Works Preferred Infrastructure Report and Response to Submissions.

Groundwater Dependent Ecosystems Risk Assessment Guidelines (NOW 2012d).

NSW State Groundwater Quantity Management Policy (2001 (unpublished).

NSW State Groundwater Quality Protection Policy (DLWC 1998).

NSW State Groundwater Dependent Ecosystem Policy (DLWC 2002).

Australian Groundwater Modelling Guidelines (National Water Commission 2012).

National Water Quality Management Strategy Guidelines for Groundwater Quality Protection in Australia (NWQMS 2013).

Department of Primary Industries Guidelines for Controlled Activities (2012).

Environment Protection Authority (EPA): Approved methods for Sampling and Analysis of Water Pollutants in NSW (EPA 2004).

Department of Planning and Environment (DPR): Guideline for riparian corridors on waterfront land (DPE 2012).

Department of Water and Energy (DWE): NSW Water Extraction Monitoring Policy (DWE 2007).

NSW Office of Water (NoW) NSW Aquifer Interference Policy (NoW 2012).

ANNEXURE A – GROUNDWATER MONITORING PROGRAM



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MANAGEMENT PLAN

SNOWY 2.0 MAIN WORKS – GROUNDWATER MONITORING PROGRAM

S2-FGJV-ENV-PLN-0108

REV. I

DECEMBER, 2025

ABSTRACT

This Groundwater Monitoring Program Management Plan establishes a comprehensive strategy for the monitoring and management of groundwater. The plan's central objective is to identify, prevent, and mitigate potential groundwater ingress through a systematic monitoring program. It details the methodologies for data collection, analysis, and reporting, as well as the specific trigger values that will prompt a response.

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Rev.	Date	Reason for Issue	Responsible	Accountable	Endorsed
I	13.12.2025	Updated to include stakeholder comments.	S. Lang	E. Porter	D. Drummond



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Revision Tracking

Rev.	Date	Description of Revision
A	13.03.2020	Initial draft
B	22.05.2020	Update to reflect conditions of approval and revised environmental management measures
C	15.06.2020	Revised to address SHL comments. For consultation
D	25.06.2020	Update to address Commonwealth conditions of approval
E	06.08.2020	Revised to address stakeholder comments
F	19.09.2020	Revised to address DCCEEW and DPIE comments
G	28.09.2022	Revised to address annual audit findings and currency.
H	31.07.2025	Revised to address annual findings and currency
I	13.12.2025	Updated to include EPA comments and in accordance with Schedule 4 condition 4b of the CoA.

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1. INTRODUCTION

1.1. Background

The Project is responsible for employing a groundwater monitoring system that is capable of providing continual groundwater data across the expansive footprint. This Groundwater Monitoring Program (Program) provides key contribution to the Snowy 2.0 Environmental Management Strategy through forming part of the Groundwater Management Plan S2-FGJV-ENV-PLN-0012 (GMP) and subsequent Water Management Plan (WMP) S2-FGJV-ENV-PLN-0010.

The Program intends to address the requirements set out in Infrastructure Approval SSI 9687, the revised environmental management measures (REMMs) and Environmental Protection Licence 21266 (EPL21266).

1.2. Purpose and Objectives

The purpose of the Program is to detail the management measures Snowy Hydro Limited (SHL) and Future Generation Joint venture (FGJV) employ to effectively monitor the extent and nature of any potential impacts to groundwater and groundwater dependent ecosystems during the Main Works Construction Phase of the Snowy 2.0 Project.

This Program provides the groundwater locations and monitoring requirements of the permanent spoil emplacement areas (PSE) and Marica temporary spoil emplacement area (TSE). Further information on leachate management is included within the individual Leachate Detection Procedures (LDPs). The objectives of the program are to:

- Quantify groundwater inflow volumes to tunnels;
- Assess any changes to groundwater levels;
- Assess any changes to water quality across the various aquifers;
- Assess groundwater conditions against nominated trigger values;
- Identify and monitor the response of any actions required in the event of trigger value exceedances;
- Assess the effectiveness of groundwater mitigation measures;
- Assist with compliance to relevant consent and licencing conditions and other monitoring requirements; and
- Provide additional data for groundwater numerical modelling verification, validation and re-calibration, as required.

Operational monitoring and operation measures do not fall within the scope of the construction phase and therefore are not considered within this Program. Surface water monitoring is also out of scope for the Program and is covered in detail in the Surface Water Management Plan (S2-FGJV-ENV-0011).

1.3. Relationship to Other Documents

The overall environmental management system for the Project is described in the Environmental Management Strategy (EMS).

This Groundwater Monitoring Program forms part of the Project's environmental management framework as described in the EMS. An overview of the Groundwater Monitoring Program relative

to the elements of water management is provided in the Groundwater Management Plan (S2-FGJV-ENV-PLN-0012).

This Program provides groundwater level and quality monitoring relevant to protection of groundwater-dependent ecosystems (GDEs). Additional monitoring and mitigation measures for ecosystems are outlined in the Biodiversity Management Plan (S2-FGJV-ENV-PLN-0008).

1.4. Consultation

In accordance with schedule 3, condition 31 of the Infrastructure Approval and Main Works REMM WM01, the WMP (which includes the GMP) is to be prepared in consultation with:

- NSW Environment Protection Agency (EPA);
- National Parks and Wildlife Services (NPWS);
- Department of Planning, Industry and Environment – Water group (DPIE – Water Group);
- Natural Resources Access Regulator (NRAR); and
- NSW Department of Primary Industries (NSW DPI).

In accordance with condition 18 of the Commonwealth approval, the WMP (including the GMP) is also to be prepared in consultation with the DAWE.

A summary of consultation undertaken during the development of the GMP and GWMP is included in Section 1.7 of the GMP.

1.5. Physical Environment

The existing physical environment is described in Section 3 of the WMP and Section 3 of the GMP and summarised below.

The Snowy 2.0 Project spans the NSW Western Slopes, South Eastern Highlands and Australian Alps Interim Biogeographic Regionalisation for Australia (IBRA) regions characterised as diverse landforms of limestone, granite and basalt valleys and mountain ranges. These landscapes vary from 545 m AHD in the Lobs Hole zone leading up the valleys (Marica/ Plateau zones) to the plateau topped Tantangara zone at 1524 m AHD. The Ravine area is characterised by deep gorges and steep sloping ridges. The plateau area is typical of elevated alpine environments, dominated by low energy streams, gentle rolling hills and mostly flat floodplains.

The Project area is located within the south-eastern portion of the Lachlan Fold Belt (LFB) of NSW. The LFB comprises a suite of Ordovician to Devonian sedimentary, igneous and metamorphic rocks that have been laid down, compacted and deformed across multiple orogenic periods.

The geology between Talbingo and Tantangara reservoirs is structurally deformed with numerous folds and several major faults associated with the north-south trending Long Plain Fault (LPF) zone.

The project intercepts two major geological structural blocks. These two structural blocks form distinct geological terrains: the dominantly Silurian Tumut Block in the west (the incised ravine area), and the dominantly Ordovician Tantangara Block in the east (the plateau). The terrains are separated by an escarpment caused by movement on the LPF ().

The EIS identified two high risk geological formations, the Gooandra Volcanics and Kelly's Plain Volcanics, both of which are located in the Plateau structural block (). These formations demonstrated (through pumping tests) vertical hydraulic connections between shallow and deeper horizons within these geological units. A summary of hydraulic properties for the plateau and ravines regions are summarised in Section 3 of the GMP.

This monitoring plan aims to provide groundwater information on each of the identified geological units and specifically to provide information that informs the groundwater interpretations and supports further development of the groundwater model and protection of groundwater dependent users and ecosystems.

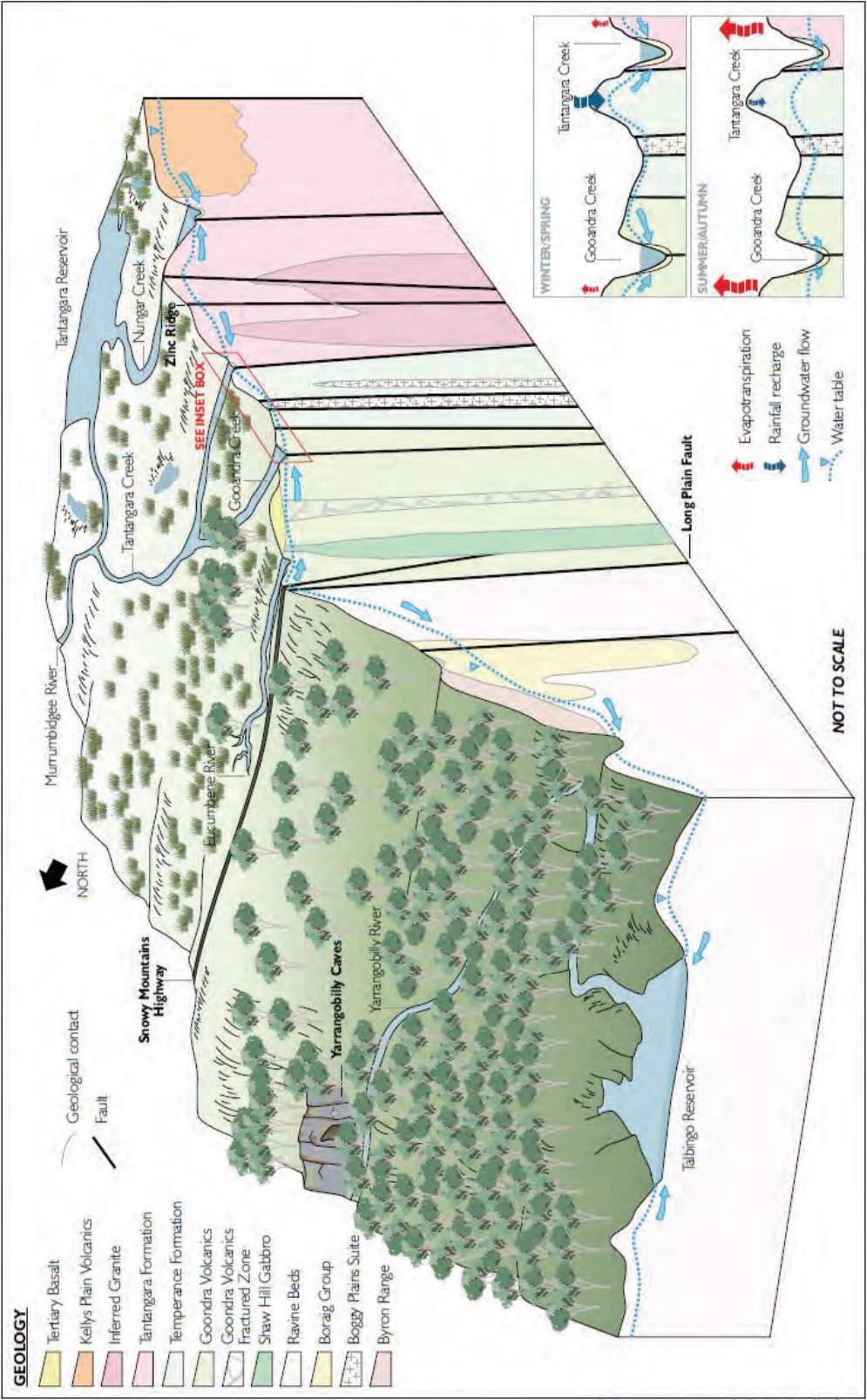


Figure 1-1: Schematic geological block diagram of the Project area showing key groundwater interactions

1.6. Baseflow

Numerical modelling (Response to Submissions, Appendix I) has simulated annual baseflow to rivers and creeks across the Project area and identified reaches of Stable Creek, Eucumbene Creek and Gooandra Creek that may undergo baseflow loss during the latter stages (post year 7) of the Main Works and during operation. Combined losses to creeks feeding Yarrangobilly River may result in a 2.5% loss in baseflow at the stream gauge (station 410574) in the long term (steady state), but less than 1% loss over the first 10 years. No impact is predicted at the Murrumbidgee gauging station (410535). Loss therefore will not be discernible at the existing stream gauges for many years at the time of issue. Alternate sites (at creek crossings adjacent to existing or planned shallow groundwater bore installations) on the Eucumbene and Gooandra Creeks will be instrumented with pressure transducers and manual flow readings will be undertaken during routine sampling rounds to provide a proxy for continuous creek flow volumes. These records will be assessed for baseflow using a combination of:

- Analysis of stream flow at the surface water gauging stations compared to simulated flow at the creek crossings;
- Use of suitable hydrograph filters (e.g. Lyne & Hollick, 1979) at established stream gauge sites subsequent to each month's data collection;
- Calculation of baseflow indices (BFI) using rainfall, stream and groundwater salinities at the designated streamflow sampling sites and adjacent shallow groundwater bores; and
- Consideration of groundwater hydrographs and rainfall conditions.

An example of baseflow separation is provided at Figure 3-7 (reproduced from the Main Works EIS; Appendix J – Annexure A) which demonstrates a manual estimation of baseflow through comparison of streamflow with groundwater levels at a relevant shallow bore.

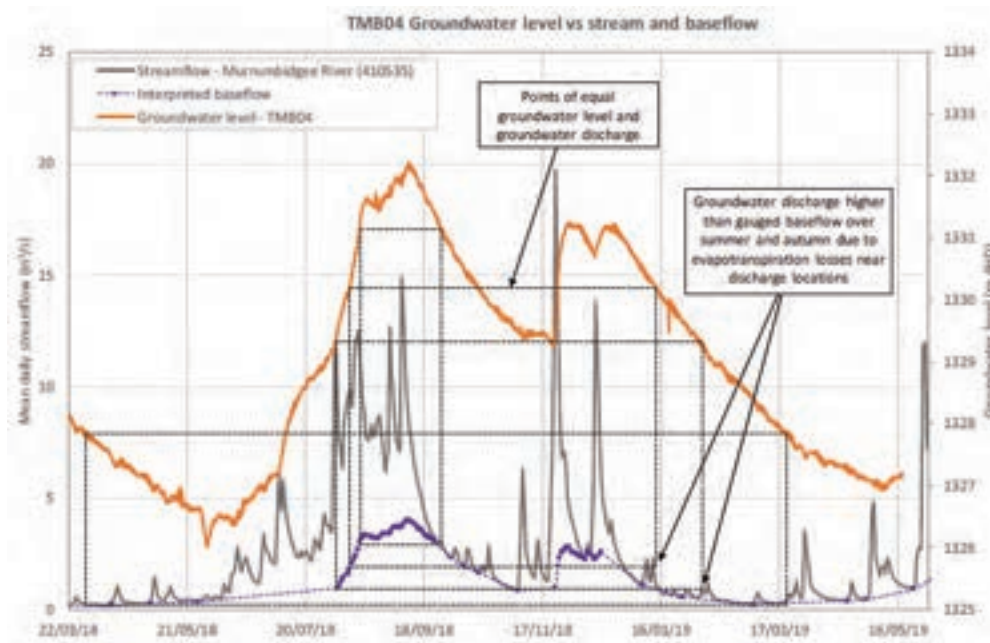


Figure 1-2: Groundwater Level vs Stream and Baseflow

Any calculated baseflow reduction greater than that predicted from the numerical groundwater modelling for the RTS (Appendix I – Part 3, Table J.1) will constitute a trigger to the Groundwater Level TARP as described in Section 3.2.

During construction, groundwater is intersected and managed by capturing the water that enters the tunnels or by restricting inflow through pre grouting and / or post grouting.

Groundwater inflow into the tunnels is monitored during construction and compared to model groundwater ingress predictions and water access licencing. The groundwater model is updated as required based on the results of monitoring, and proposed management measures to minimise potential groundwater impacts adjusted accordingly.

2. GROUNDWATER MONITORING PRINCIPLES AND DESIGN

2.1. Key Principles

To meet the objectives identified in Section 1.2, the groundwater monitoring program has been developed specifically to:

- Verify the groundwater model (i.e. validate the predicted drawdown);
- Monitor water quality conditions across the Project footprint;
- Monitor in areas predicted to be at high risk of groundwater drawdown, including the Kelly's Plain Volcanics and Gooandra Volcanics geological formations; and
- Monitor impacts to groundwater dependent ecosystems.

The following key principles were adopted:

- Identification of key receptors to monitor (to identify suitable impact mitigation measures);
- Identification of locations requiring inclusion on EPL21266;

- Use of the existing baseline network to understand natural variations and fluctuations;
- Use of compliance groundwater bores north and south of the tunnel alignment in high-risk areas to validate the predicted model impacts extents (the distance from the alignment was chosen to confirm the absence of impact in areas that were modelled to have no impact);
- Addition of lagging indicator groundwater bores within areas of predicted impacts to verify modelled predicted impacts and provide warning for further investigation, and
- Addition of shallow bores to assess potential groundwater-related impacts to GDEs.

2.2. Groundwater Network Design

This Program is based on the baseline monitoring program established during the assessment of the Project EIS (EMM, 2019) and continued through baseline monitoring reports (EMM, 2020).

For the EIS, the Project designed and implemented a dedicated project baseline groundwater monitoring network to assess groundwater conditions in the project area. The network was developed in consultation with DPIE-Water (formerly DPI Water). The network and baseline data were reported in the EIS (Appendices J.2 and J.3). Groundwater data continues to be collected.

The Project's baseline groundwater monitoring network within the project area consists of conventional groundwater monitoring bores, test production bores, vibrating wire piezometers (VWPs) and shallow bog and fen standpipes (GDE monitoring sites). Monitoring bores, VWPs and shallow bog and fen standpipes were positioned to provide spatial coverage, investigate the major geologies and groundwater environments, and monitor potentially sensitive features (GDEs). The monitoring network also consists of both background (regional) monitoring locations and targeted (local) monitoring locations along the alignment of the key proposed project features. Numerous nested sites were developed to provide information on surficial to deep connectivity along the alignment to inform the conceptualisation of the numerical groundwater model.

The Project's baseline groundwater monitoring network forms the foundation for the construction phase monitoring program. This network has been rationalised to focus on high-risk areas and sensitive assets, with monitoring frequency reduced where appropriate to minimise landscape disturbance from intensive sampling. Importantly, numerical groundwater modelling has also identified locations where additional monitoring would provide critical data to improve future model iterations. These additional sites have been selected based on the principles outlined in Section 2.2.

The Main Works groundwater monitoring network is identified in Section 2.3.

2.3. Groundwater Monitoring Network

The groundwater monitoring infrastructure for Main Works includes 112 groundwater bore constructions listed in Table 1. These are listed for each bore type and associated geological formation from west to east. Locations are shown in Figure 2 to Figure 6.

The groundwater monitoring network is equipped with a combination of remote telemetry and direct-read data loggers, all of which are programmed to log hydrostatic pressure every six hours.

Remote telemetry provides a daily raw data transmission feed to SHL's groundwater database.

The currently active groundwater monitoring infrastructure includes:

- 46 conventional groundwater monitoring. At some locations multiple monitoring bores are installed next to one another to varying depths (nested bores). These bores are suitable for both water level and water quality sampling.

- 4 test production bores used historically to assess indicative groundwater yields and quality at the proposed tunnel depth. These test production bores are currently used as conventional monitoring bores.
- 30 shallow bog and fen standpipes.
- 32 VWP locations with 75 depth sensors.

Where bores have been decommissioned, they have been crossed out in the below Table 1.

Table 1 - Baseline groundwater monitoring network

Target formation	Bore ID	Ground level (m AHD)	Total depth (m BGL)	Screen interval (m BGL)	Target lithology
Conventional monitoring bores					
Ravine Beds West	BH6104	860.8	98.5	81.0 - 96.0	Siltstone
	BH6105	667.2	99	81.5 - 96.5	Siltstone
	~~BH7106~~	~~613~~	~~154.4~~	~~141.1–153.4~~	~~Siltstone~~
	~~BH8101~~	~~610~~	~~68.4~~	~~53.4–65.4~~	~~Siltstone~~
	~~BH8102~~	~~608~~	~~68.6~~	~~53.6–65.6~~	~~Siltstone~~
	~~BH8105~~	~~624~~	~~58.9~~	~~43.9–55.9~~	~~Siltstone~~
	~~BH8108~~	~~629~~	~~60~~	~~45.0–57.0~~	~~Siltstone~~
	RSMB1	564	30	27.0–30.0	Siltstone/sandstone
	RSMB2	570	30	27.0–30.0	Siltstone/sandstone
	RSMB3	593	30	27.0–30.0	Siltstone/sandstone
	RSMB6	581	15	11.0-14.0	Siltstone
	RSMB7	581	45	38.0-44.0	Siltstone
	RSMB8	583	15	11.0-14.0	Siltstone
	RSMB9	583	45	38.0-44.0	Siltstone
	TMB01B [#]	582	72	63.0–69.0	Siltstone
	TMB05A [#]	603	21	12.0–18.0	Weathered Siltstone
	~~TMB05B~~	~~603~~	~~77~~	~~68.0–74.0~~	~~Siltstone~~
Boraig Group	BH5105A	1,199	108.2	97.0–109.0	Ignimbrite
	BH7104	584	92.2	80.2–89.2	Ignimbrite
	MB06A	1,145	14	9.0–12.0	Weathered volcanic
	MB06B	1,145	72	64.0–70.0	Volcanic
	~~TMB04A~~	~~584~~	~~44~~	~~41.0–44.0~~	~~Ignimbrite~~
Ravine Beds East	MB12B	1,331	180	149.0–179.0	Siltstone
	~~MB12A~~	~~1,330~~	~~36~~	~~26.0–35.0~~	~~Weathered siltstone~~
Tertiary basalt	MB01B	1,464	7.5	5.3–6.8	Basalt
	RtS_BH3A	1,467	50	40-49	Basalt
	RtS_BH4A	1,427	78	68-77	Basalt

Target formation	Bore ID	Ground level (m AHD)	Total depth (m BGL)	Screen interval (m BGL)	Target lithology
Gooandra Volcanics	BH3110	1,346	178.9	165.9–177.9	Diorite
	MB01C	1,464	52	45.0–51.0	Basalt
	MB02	1,387	150	141.0–147.0	Chloritic schist
	MB03	1,373	101	92.0–98.0	Chloritic schist
	MB11A	1,485	7.5	17.0–23.0	Weathered basalt
	RtS_BH1A	1390.56	50	42.0 - 48.0	Slate
	RtS_BH1B	1390.35	316	308.0 - 314.0	Basalt
	RtS_BH2A	1396.8	50	42.0 - 48.0	Schist
	RtS_BH2B	1396.7	314	306.0 - 312.0	Schist
	RtS_BH3B	1466.95	316.4	309.0 - 315.0	Slate
	RtS_BH4B	1427.36	150	143.0 - 149.0	Phyllite
	SMB04	1,342	180	170.0–179.0	Chloritic schist
	SMB05	1,342	50	40.0–49.0	Basalt
	TMB02A	1,470	15	11.0–14.0	Weathered basalt
	TMB02B	1,472	200	191.0–197.0	Chloritic schist
	TMB03A	1,478	34	29.5–32.5	Weathered basalt
	TMB03B	1,478	150	141.0–147.0	Chloritic schist
	TMB04	1,346	200	191.0–197.0	Basalt
Temperance Formation	BH3102	1,383	91	82.0–88.0	Sandstone
	MB04A	1,330	30	23.0–29.0	Basalt
	MB04B	1,330	102.5	93.5–99.5	Chloritic schist
	MB07A	1,265	15	10.0–13.0	Weathered siltstone
	MB07B	1,265	60	51.0–57.0	Sandstone
	MB13A	1,382	60	50.0–59.0	Weathered siltstone
	MB13B	1,382	190	169.0–189.0	Siltstone
Temperance Formation /Boggy Plain Suite	SMB03	1,335	50	40.0–49.0	Sandstone
	SMB02	1,335	195	182.0–194.0	Sandstone
Tantangara Formation	BH2103	1,264	103.3	94.3–100.3	Sandstone
	BH3101	1,418	85.6	76.6–82.6	Sandstone
	MB08A	1,435	30	20.0–29.0	Weathered siltstone
	MB08B	1,436	298	277.0–297.0	Sandstone
	BH1115	1,234	55	42.0–51.0	Dacite

Target formation	Bore ID	Ground level (m AHD)	Total depth (m BGL)	Screen interval (m BGL)	Target lithology
Kelly's Plain Volcanics	BH1116	1,234	93.1	80.5–89.5	Dacite
	BH1117	1,241	65	51.9–60.9	Dacite
	BH2101	1,314	169.9	154.6–166.6	Siltstone
Test production bores					
Ravine Beds West	PB05	614	400	50.0–100.0	Siltstone
Ravine Beds East	PB09	1,330	300	200.0–300.0	Siltstone
Gooandra Volcanics	PB04	1,341	200	185.0–200.0	Chloritic schist
	TMB03C	1,478	250	237.0–249.0	Chloritic schist
Temperance Formation	PB10	1,382	230	210.0–230.0	Chloritic schist
Boggy Plain Suite	PB03	1,336	215	200.0–215.0	Granite
Tantangara Formation	PB06	1,436	318	298.0–318.0	Sandstone
Kelly's Plain Volcanics	PB01	1,231	60	30.0–60.0	Dacite
Vibrating wire piezometers				Vertical sensor depth (m BGL)	
Ravine Beds West	BH5107	1162.5	774.4	737.5, 554.5, 381.4	Interbedded Siltstone and Sandstone
	BH5108	1140.8	764	666, 431, 380	Siltstone
	BH5208	1145.83	743.85	275, 525	Siltstone/Sandstone
	BH5209	1149.34	768.96	350, 650	Siltstone/Sandstone
	BH5206	1158.4	781.85	600, 680	Siltstone/Sandstone
	BH5207	1163.8	783.41	680	Siltstone/Sandstone
	BH6103	602	220	218.7, 131.2	Siltstone/sandstone
	BH8106	1096.3	672.97	669, 431	Sandstone/Interbedded Siltstone and Sandstone
Boraig Group	BH5103	1272	882	765.0, 562.0, 352.0	Mixed sediments
	BH5104A	1187	840	673.3, 475.3, 376.3	Siltstone/sandstone
	BH5110	1196	799	687.5, 435.4, 267.3	Mixed sediments
	BH5113B	1182.7	798.45	279.5, 702	Conglomerate, Interbedded Sandstone and Conglomerate
	BH5113C	1182.8	629.6	458.2, 321.65	Sandstone, Conglomerate, Interbedded Siltstone and Sandstone
	BH5203A	1181.19	512.28	280, 350, 450	Interbedded Tuff and Siltstone, Conglomerate, Ingimbrite

Target formation	Bore ID	Ground level (m AHD)	Total depth (m BGL)	Screen interval (m BGL)	Target lithology
	BH5204	1196.91	755.48	590, 690	Interbedded Sandstone/Stilstone and Conglomerate
Ravine Beds East	BH4104	1484	917	628.4, 506.6	Siltstone
	BH5101A	1390	1011	248.0	Siltstone
	BH5102	1329	949	818.8, 619.1, 419.4	Siltstone/sandstone
	BH5111	1351	271.86	232.4, 180.7, 116.5	Interbedded Siltstone and Sandstone, Siltstone
	~~BH5114~~	~~1287~~	~~532~~	~~491.9, 359.0, 208.5~~	~~Siltstone~~
	BH5115	1330	789	292.0, 192.0	Siltstone
	BH5202	1261.2	280	230	Siltstone
Gooandra Volcanics	BH3203	1461.6	400.16	110, 200, 350	Phyllite, Metasandstone, Metabasalt
	BH3108	1369	998	620.0, 342.0, 250.0	Schist
	BH4101	1479	1100	883.9, 729.6, 542.5	Meta-rhyolite
	BH4102	1460	534	455.6, 374.3, 246.3	Gneiss, Phyllite
	BH4103	1471	388	335.6, 232.2, 139.5	Metatuff, Tuff, Gneiss
	BH4202	1464.02	501.9	281, 460	Breccia, Rhyolite
	BH4201	1464.22	485.83	382, 448	Rhyolite, Metabasalt
Temperance Formation /Gooandra Volcanics	BH3107A	1325	237	200.2, 133.5	Siltstone/sandstone
Temperance Formation/Boggy Plain Suite	BH3106	1335	247	194.3, 150.1	Pyroxenite, Diorite
Tantangara Formation	BH2102	1246	145	107.2, 41.8	Meta-siltstone/sandstone
	BH3104	1436	339	287.0, 174.0, 72.9	Siltstone/sandstone
	BH3111	1502	406	354.6, 252.5, 120.5	Meta-siltstone/sandstone
	BH3113	1334	234	184.8, 94.9	Meta-siltstone/sandstone
Drive point piezometers and narrow diameter piezometers					
Alluvium/colluvium	BH01	1,351	0.4	0.2–0.4	Alluvium/colluvium
	BH02	1,352	0.9	0.6–0.9	Alluvium/colluvium
	BH03	1,350	0.7	0.5–0.7	Alluvium/colluvium
	~~BP1~~	~~1,366~~	~~1.8~~	~~1.5–1.8~~	~~Alluvium/colluvium~~
	~~BP2~~	~~1,364~~	~~1.8~~	~~1.5–1.8~~	~~Alluvium/colluvium~~

Target formation	Bore ID	Ground level (m AHD)	Total depth (m BGL)	Screen interval (m BGL)	Target lithology
	BP3	1,364	1.8	1.5–1.8	Alluvium/colluvium
	BP4	1,363	1.8	1.5–1.8	Alluvium/colluvium
	GH01	1,456	1	0.5–1.0	Alluvium/colluvium
	GH02	1,456	0.9	0.5–0.9	Alluvium/colluvium
	GH03	1,455	0.6	0.3–0.6	Alluvium/colluvium
	NC01	1,237	0.8	0.5–0.8	Alluvium/colluvium
	NC02	1,237	1.1	0.8–1.1	Alluvium/colluvium
	NC03	1,237	1.0	0.7–1.0	Alluvium/colluvium
	RtS_BH5A	1384.76	0.89	0.6	Sandy clay and gravel
	RtS_BH6A	1448.58	1.4	1.1	Silty clay and gravelly clay
	RtS_BH7A	1230.17	1.3	1	Gravelly clay
	~~RtS_BH8A~~	~~1219.24~~	~~2.6~~	~~2.4~~	~~Clay and schist~~
	RtS_BH9A (GH05)	1458.36	1.3	0.1	Alluvium/colluvium
	RtS_BH9B (GH06)	1458.05	1.3	0.1	Alluvium/colluvium
	RtS_BH9C (GH07)	1457.35	1.3	0.1	Alluvium/colluvium
	RtS_BH10A (GH10)	1420.57	0.92	0.1	Alluvium/colluvium
	RtS_BH10B (GH11)	1419.9	0.98	0.1	Alluvium/colluvium
	RtS_BH10C (GH12)	1419.57	0.8	0.1	Alluvium/colluvium
	RtS_BH11A (GH15)	1353.86	0.9	0.1	Alluvium/colluvium
	RtS_BH11B (GH16)	1353.64	1.2	0.1	Alluvium/colluvium
	RtS_BH11C (GH17)	1352.89	0.85	0.1	Alluvium/colluvium
	RtS_BH12A (GC03)	1316.63	1	0.1	Alluvium/colluvium
	RtS_BH12B (GC04)	1316.48	0.87	0.1	Alluvium/colluvium
	RtS_BH12C (GC05)	1316.16	1.04	0.1	Alluvium/colluvium
	RtS_BH13A (NC04)	1263.85	0.63	0.1	Alluvium/colluvium
	RtS_BH13B (NC05)	1263.87	0.95	0.1	Alluvium/colluvium
	RtS_BH13C (NC06)	1262.69	0.8	0.1	Alluvium/colluvium
	TC01	1,324	1	0.6–1.0	Alluvium/colluvium
	TC02	1,322	1.1	0.7–1.1	Alluvium/colluvium
	TC03	1,321	0.8	0.5–0.8	Alluvium/colluvium

Notes: # boreholes inaccessible

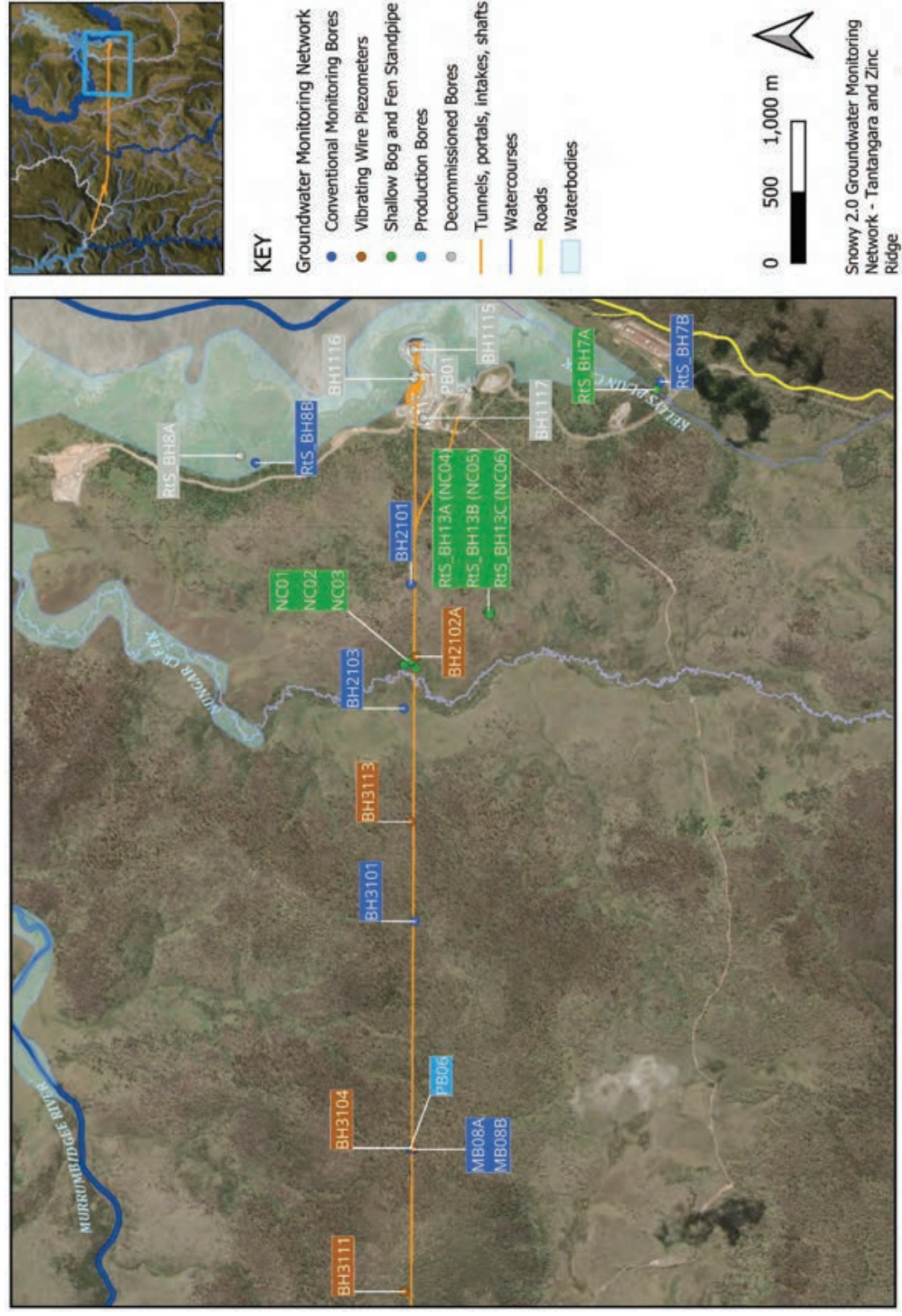


Figure 2-1: Groundwater monitoring network – Plateau (Tantangara and Zinc Ridge Areas)

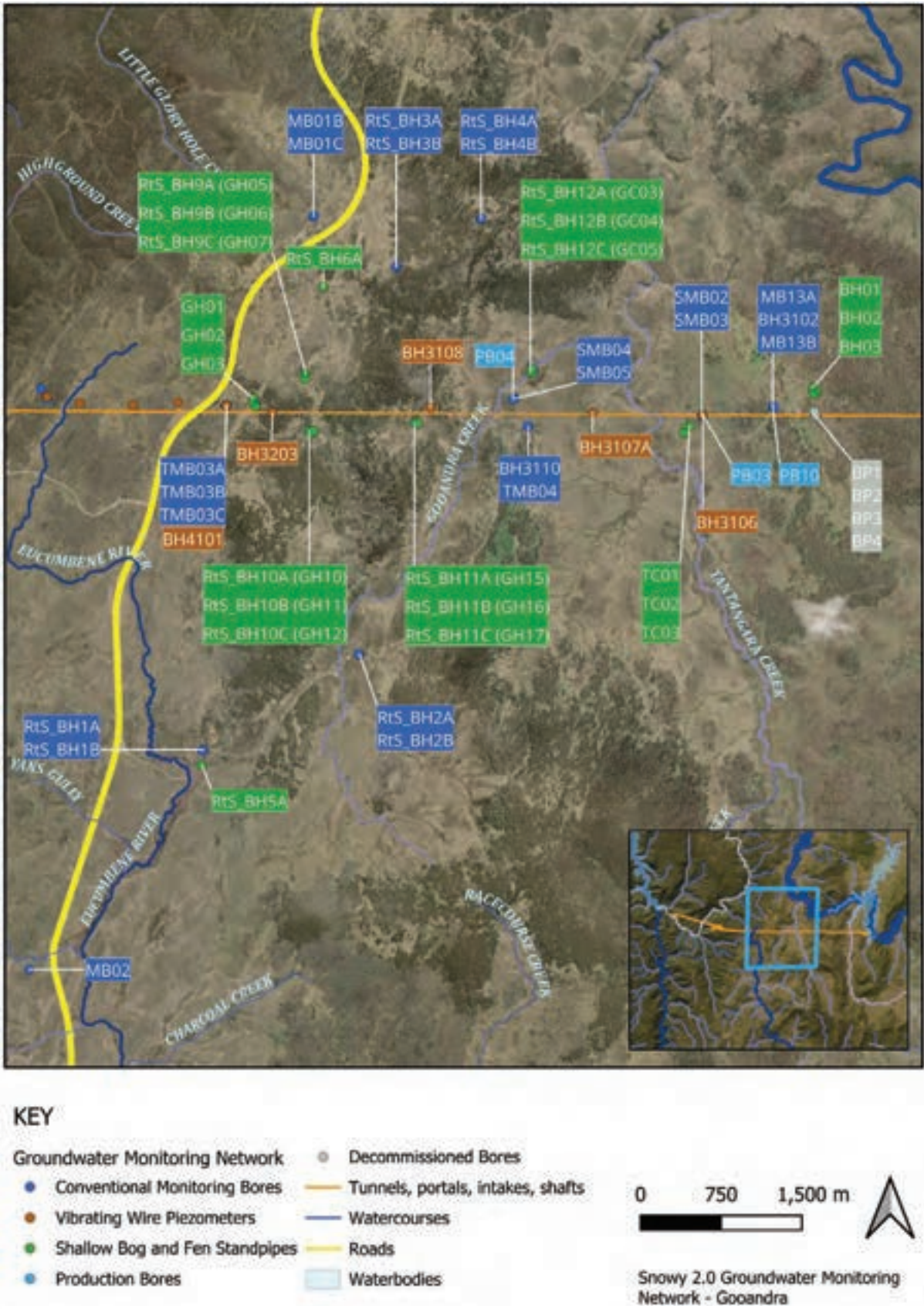


Figure 2-2: Groundwater monitoring network – Plateau (Gooandra Area)

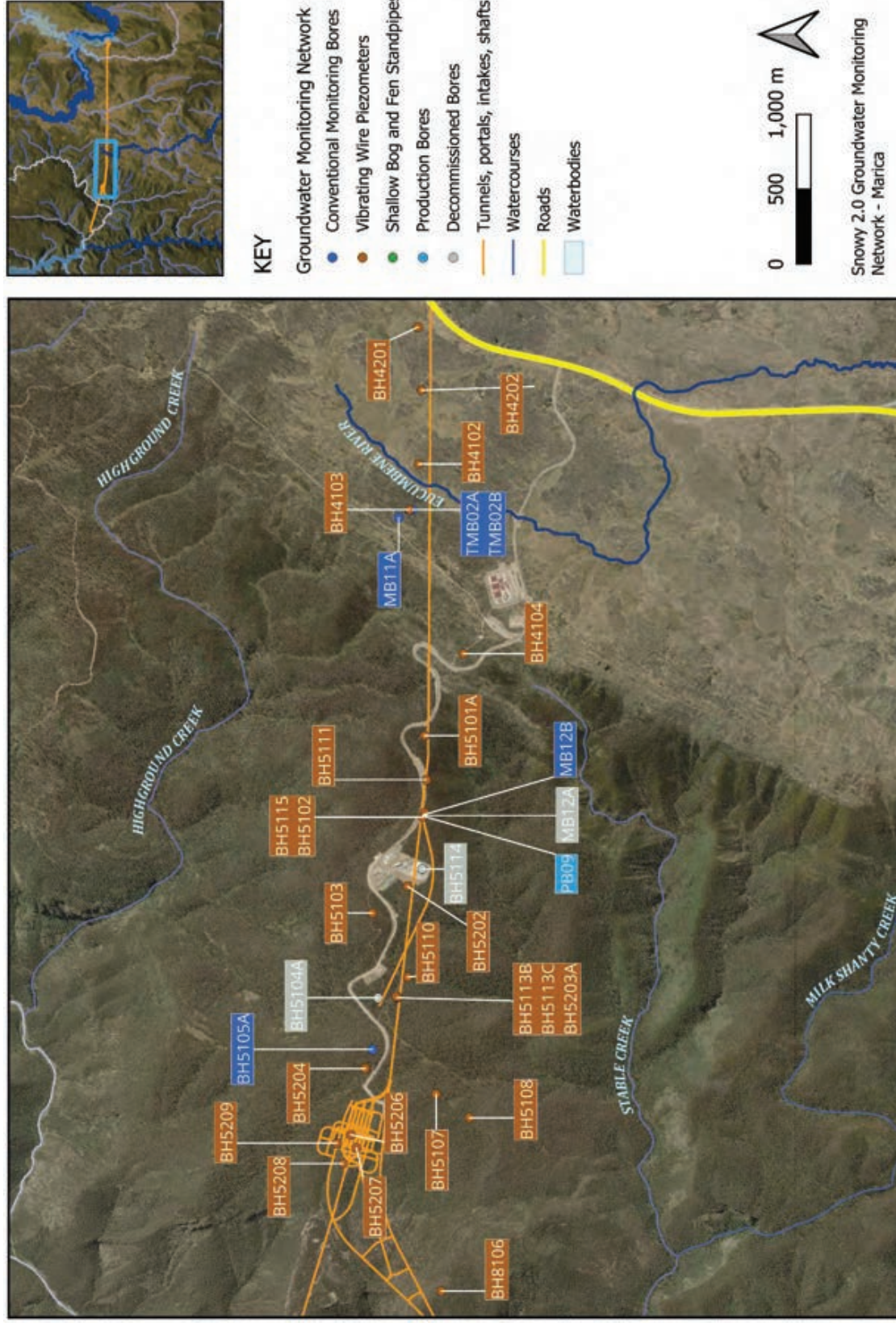


Figure 2-3: Groundwater monitoring area – Ravine (Marica Area)

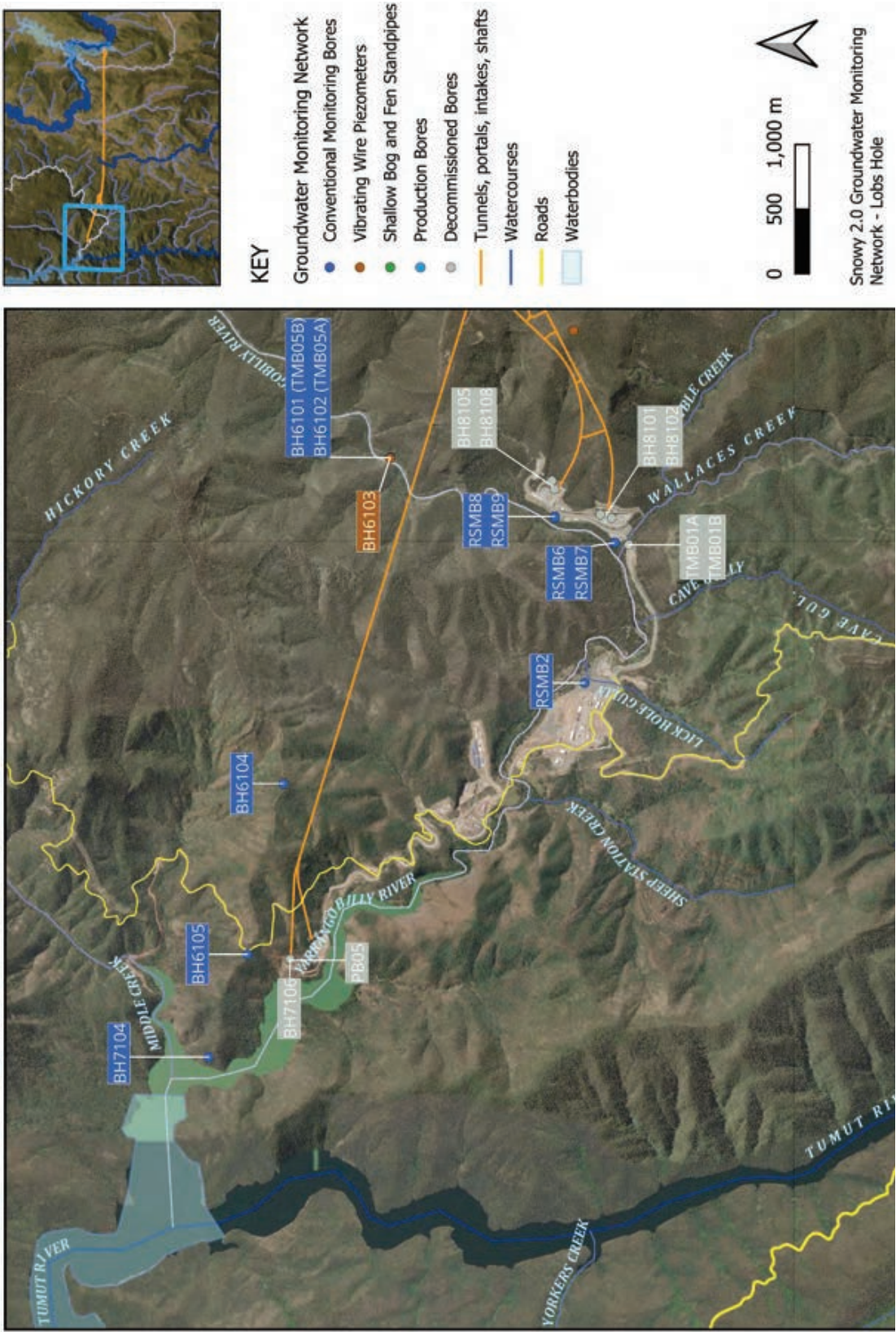


Figure 2-4: Groundwater monitoring network – Ravine (Lobs Hole Area)

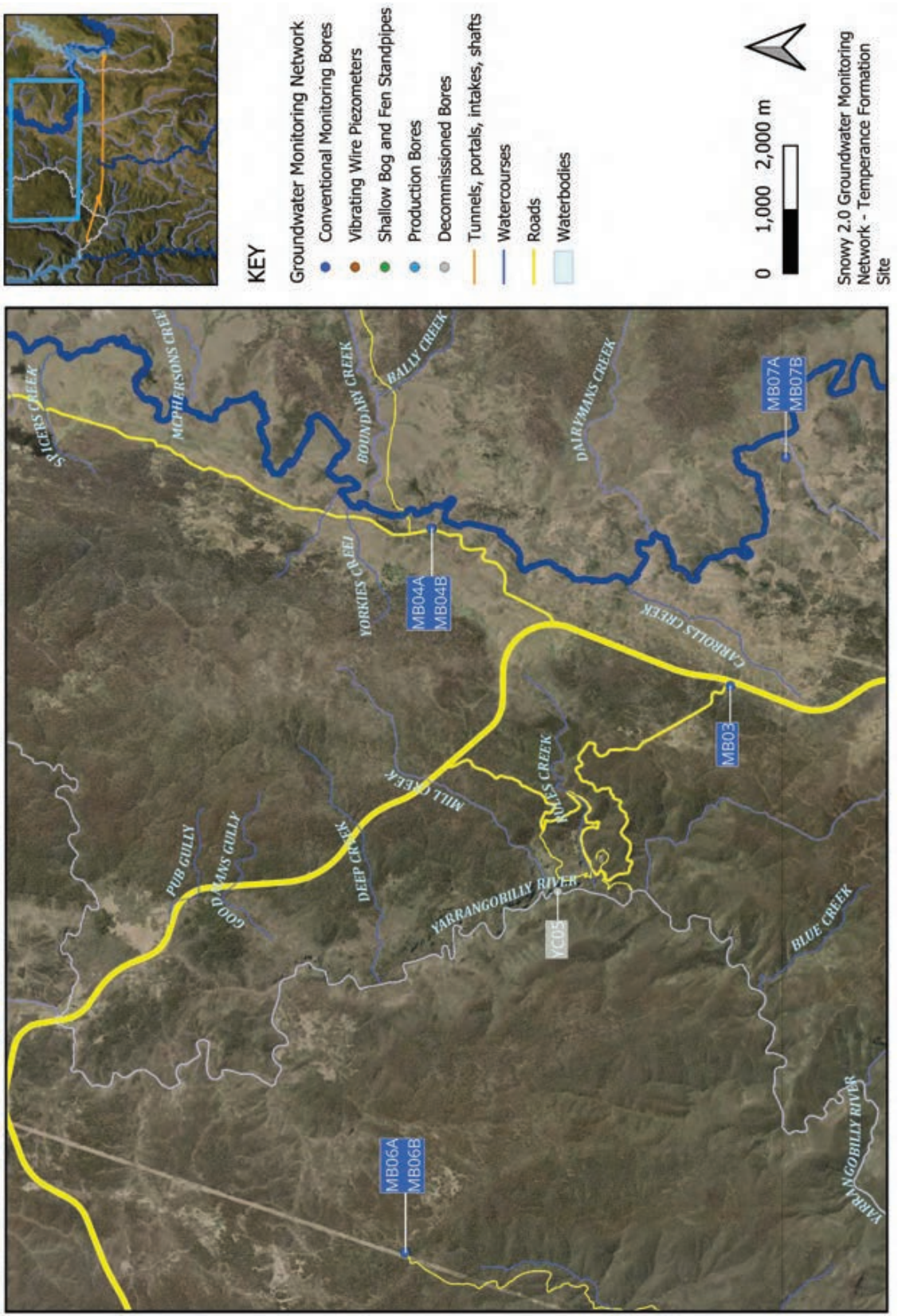


Figure 2-5: Groundwater monitoring network – Plateau (Northern Plateau Area)

2.4. Risk Prioritisation

The adaptive management framework outlined in the WMP enables the targeted expansion of the groundwater monitoring network in response to improved understanding of risk and site-specific conditions. Expansion is primarily driven by outputs from the regional numerical groundwater model and EPL21266.

As construction progresses, monitoring data are used to validate model predictions. Where discrepancies are observed or where existing monitoring resolution is insufficient, additional monitoring locations are established to improve data coverage and attribution confidence. This includes installation of new bores in areas or GDEs that were previously considered lower risk, unmonitored, or where uncertainties in the groundwater model remain.

In cases where data gaps are identified near critical receptors (e.g., groundwater dependent ecosystems or infrastructure assets), additional sites are prioritised to inform both impact attribution and future iterations of the numerical model.

Where new monitoring infrastructure is proposed outside the approved construction envelope—such as within the Kosciuszko National Park—site selection is guided by environmental constraints analysis and undertaken in consultation with relevant stakeholders (e.g., NPWS).

Through this iterative and risk-informed approach, the adaptive management framework ensures that the groundwater monitoring network remains responsive, technically defensible, and aligned with both model performance and regulatory expectations.

Additional monitoring locations will be progressively installed upon approval of this GMP. The exact location of each bore will be confirmed on-site and final survey locations included in a revision to the GMP, where required.

2.5. Expansion of the Regional Groundwater Monitoring Network

An expansion of the groundwater monitoring network is proposed across the Plateau, focusing on:

- High-risk zones in the Gooandra Volcanics, where modelled drawdown from tunnel inflows assumes strong water table connection—potentially conservative given limited test data and potentially variable hydraulic conditions across the formation.
- Data-poor Tertiary Basalts, where limited monitoring restricts understanding of hydrogeology and connectivity, reducing confidence in model predictions and ecological risk assessments.

The proposed drilling and installation of additional monitoring points are listed in Table 2 and shown on Figure 7 to Figure 10, and includes:

- 14 shallow bog and fen standpipes in unmonitored GDE areas to improve seasonal water level tracking.
- Seven conventional bores (15–50 m deep), including:
 - six in Tertiary Basalt units to assess hydraulic connectivity between shallow and deeper aquifers.
 - one in the Kelly's Plain Volcanics to replace a decommissioned bore.
- One shallow production bore (~75 m) in the Gooandra Volcanics Shear Zone for targeted aquifer testing.
- Aquifer testing (step and long-duration) to define hydraulic properties and validate model assumptions.

This integrated expansion of the groundwater monitoring network aims to reduce model uncertainty, refine the hydrogeological conceptual model, and inform adaptive management to protect groundwater-dependent ecosystems during construction.

Table 2: Proposed Additional Monitoring Points

Geological formation	Bore ID	Target Depth (m BGL)	Rationale
Conventional monitoring bores			
Tertiary Basalts	MB14	15	Aquifer testing, assessment of localised hydraulic connectivity, and long-term groundwater monitoring
	MB15	25	
	MB16	50	
	MB17	30	
	MB18	15	
	MB19	50	
Kelly's Plain Volcanics	MB20	40	Bore replacement
Gooandra Volcanics	PB11	75	Aquifer testing and assessment of localised hydraulic connectivity
Shallow bog and fen standpipes			
Alluvium/colluvium	NC07	<1	GDE monitoring
	NC08	<1	
	TC05	<1	
	TC06	<1	
	TC07	<1	
	GH04	<1	
	GH08	<1	
	GH09	<1	
	GH13	<1	
	GH14	<1	
	GC01	<1	
	GC02	<1	
	EC01	<1	
	EC02	<1	

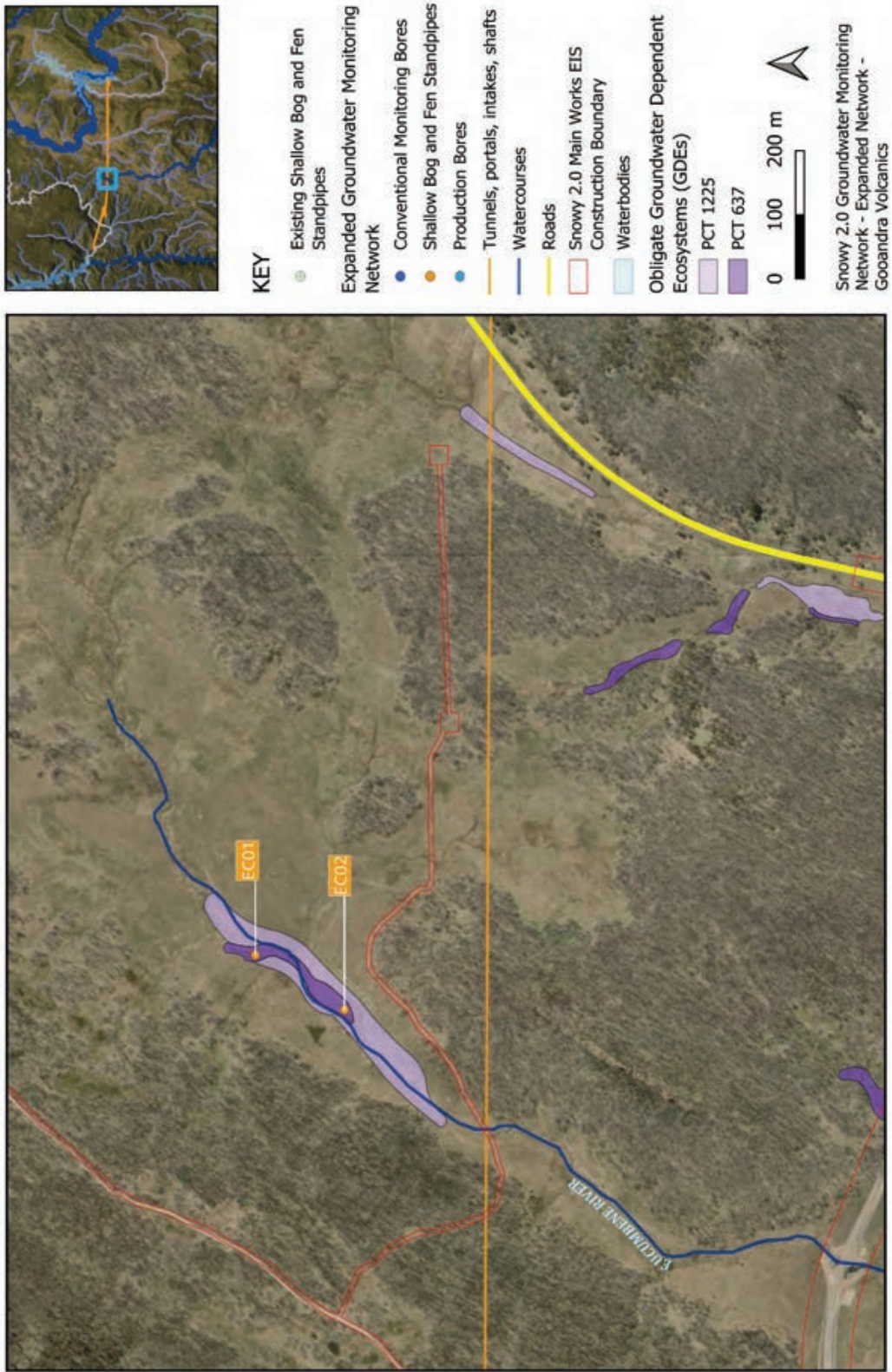


Figure 2-6: Proposed expanded groundwater monitoring network – Eucumbene River headwaters

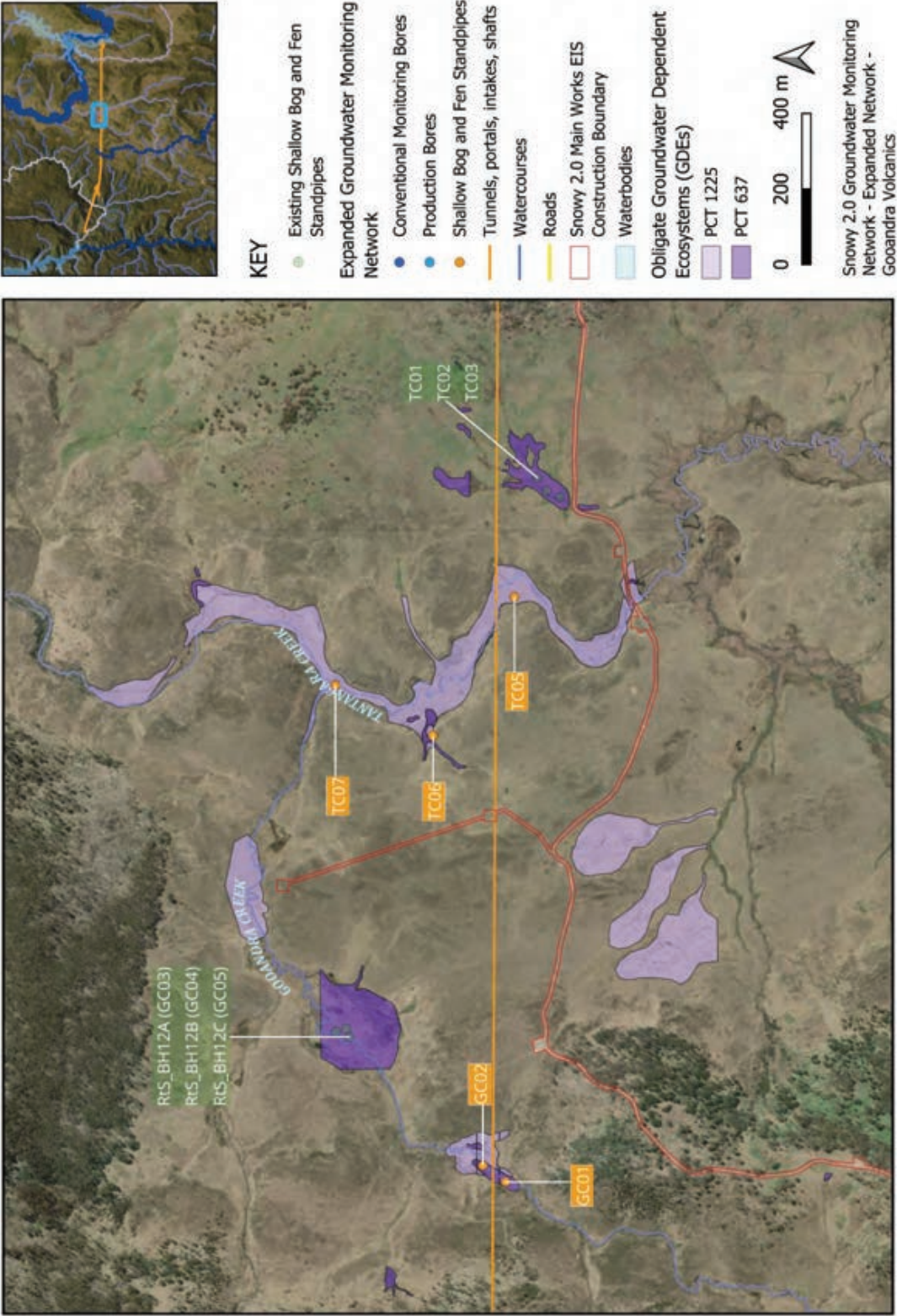


Figure 2-8: Proposed expanded groundwater monitoring network – Gooandra Volcanics

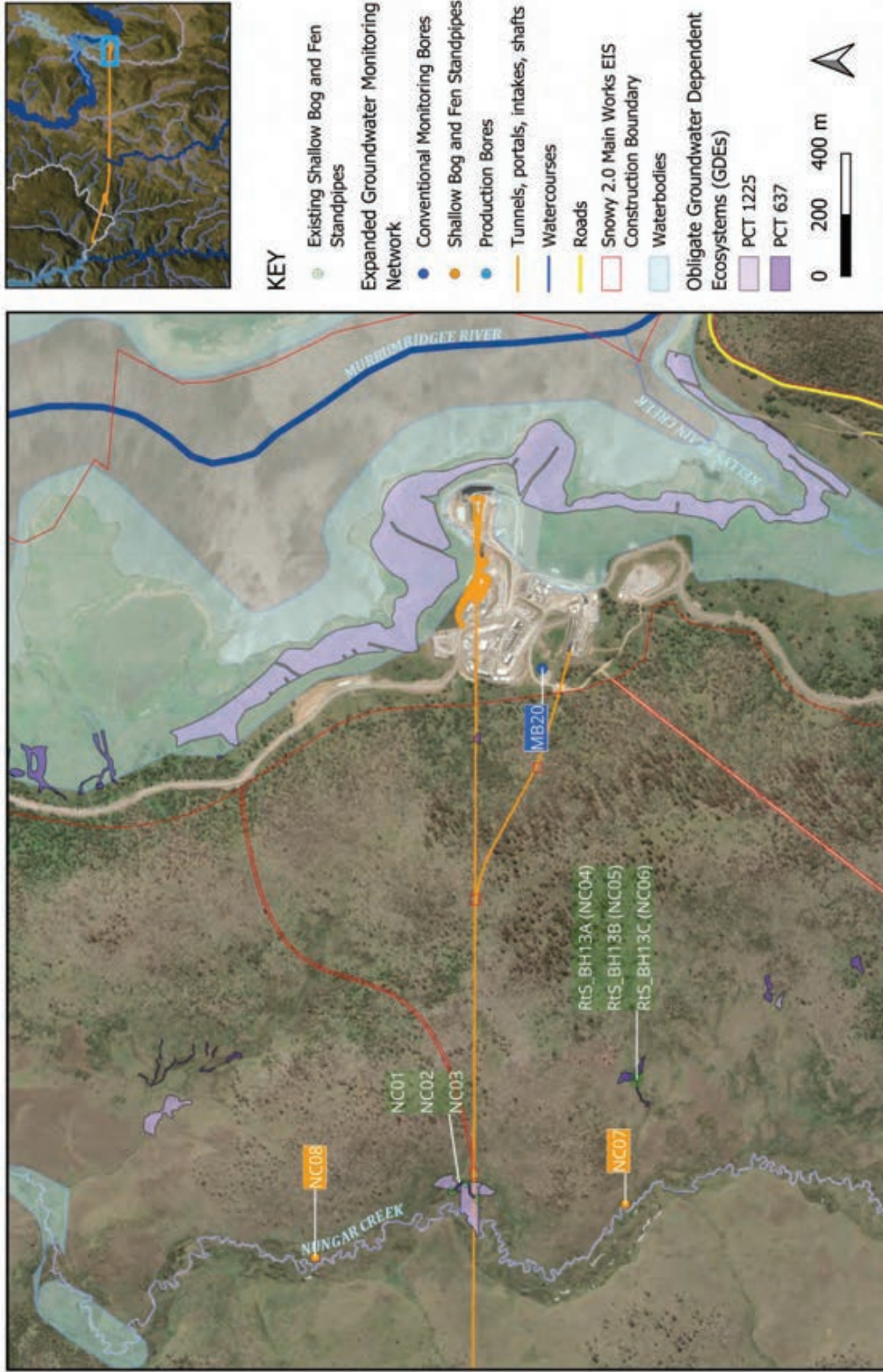


Figure 2-9: Proposed expanded groundwater monitoring network – Nungar Creek and Tantangara

3. GROUNDWATER MONITORING

The groundwater monitoring systems are managed through two distinct monitoring networks, each comprising numerous groundwater monitoring locations. The two monitoring networks are defined by their primary objectives and licensed requirements.

3.1. Monitoring Overview

The groundwater monitoring systems proposed are broadly defined by two individual groundwater monitoring networks namely the Groundwater Level Monitoring network and the Groundwater Quality Monitoring Network. Although levels and quality are monitored within each network, the Groundwater Level network is utilised to inform groundwater modelling and potential impacts to the groundwater level from tunnelling. The Quality Network monitors water quality conditions to inform or identify any potential impacts from any Main Works activities. Groundwater monitoring to be undertaken is summarised in Table 3.

Table 3 - Groundwater Monitoring

Characteristic	Monitoring Methodology	Frequency
Groundwater level monitoring	Groundwater Level – Telemetered and direct-read data loggers	Level readings recorded six-hourly.
Groundwater quality	Comprehensive NATA external laboratory and physiochemical water quality analysis (Basic and Comprehensive).	Monthly for all EPL designated locations (with exception to EPL1, EPL2, EPL4 and EPL25 which are sampled quarterly). Weekly when a location is managed under TARP conditions. Weekly as directed by the individual LDP's (during rainfall events or when accumulating baseline data).
Volumetric	Volume - Measured extraction volume, including groundwater inflow to the tunnels	As required by the extraction license.

Where a well becomes inoperable, damaged or poses unnecessary risk to the environment, the Project will request decommissioning be undertaken and will identify a suitable replacement in consultation with a suitably qualified hydrogeologist.

3.2. Monitoring Framework

Details of the monitoring framework are provided in Table 12 below. .

Table 4 - Water Monitoring Sampling Framework

Waterbody Type	
Groundwater	Subsurface aquifers
Frequency	
Weekly Monitoring	Monitoring undertaken on a weekly basis if required (Visual and Basic).
Monthly Monitoring	Comprehensive and Basic.
TARP Monitoring	Comprehensive and Basic sampling undertaken weekly. If exceedance is attributable to Project activities, sampling to continue for a maximum of 2 months unless remedial actions are applied earlier or otherwise directed by SHL/ NSW EPA. If no determination of source, sampling to cease after 2 months of weekly Basic and Comprehensive.
Water monitoring	
Visual	Gross water quality indicators – e.g. visible oil and grease, turbidity plumes Management measures – e.g. erosion and sediment controls, downstream drainage and clean water diversion
Basic	Site observations and basic water quality parameters via in situ measurement including pH, electrical conductivity, turbidity, dissolved oxygen, temperature and redox potential.
Comprehensive	Site observations, basic water quality parameters via in situ measurement and collection of water samples for laboratory analysis by an external NATA accredited laboratory. Analyses include nutrients (nitrogen, ammonia, oxidised nitrogen, total kjeldahl nitrogen, total phosphorus, and reactive phosphorus), dissolved and total metals (aluminium, arsenic, silver, total chromium, copper, iron, manganese, nickel, lead, and zinc), and cyanide.

1. All sampling will be subject to work health and safety assessments to ensure worker safety at all times.
2. All analytes will be reported to sensitivities and with units in accordance with EPL 21266.

3.3. Groundwater Level Monitoring Network

3.3.1. Groundwater Level Monitoring Locations

The following suite of bores, referred to as Level 1 groundwater monitoring trigger sites will be used for local targeted groundwater monitoring. These locations will have regular six hourly monitoring for level information and monthly comprehensive monitoring.

Monitoring frequency will be continuously reviewed and data compared to model predictions, and frequency of data collection will be adapted to ensure potential significant trigger events are detected early (i.e. particularly when Tunnelling commences in close proximity to sensitive groundwater areas). Monitoring data collection frequency will also be reviewed during the annual review of the groundwater model, in consultation with NRAR and DPI Water.

The local targeted groundwater monitoring locations (Level 1 (Indicator) Trigger sites) have been selected based on where the numerical model predicted significant (>2m) cumulative groundwater drawdown impacts, to provide a balanced assessment of water level response from the Project and are listed in Table 5, and shown on Figure 2 to Figure 6.

Groundwater data will continue to be collected from the remainder of regional groundwater monitoring network (i.e. bores where significant drawdown (>2m) is not predicted) and will be used as sentinel 'control' monitoring sites.

Table 5 - Local Targeted Groundwater Level Monitoring Network - Level 1 (Indicator) Trigger sites

Target Formation	Bore ID	Groundwater Level SSTV - (maximum predicted drawdown) (m)
Conventional Monitoring Bores		
Ravine Beds West	BH6104	6.35
	BH6105	7.28
Boraig Group	BH5105A	29.76
Ravine Beds East	MB12B	66.36
Tertiary Basalt	RtS_BH3A	5.11
	RtS_BH4A	13.45
Gooandra Volcanics	BH3110	17.70
	MB03	3.39
	MB11A	23.26
	RtS_BH3B	4.27
	RtS_BH4B	4.82
	SMB05	9.88
	TMB02A	16.51
	TMB03A	13.12
Temperance Formation	MB04A	5.42
	MB04B	2.50
	MB13A	9.83
	MB13B	72.79
Boggy Plain Suite	SMB03	32.60

Tantangara Formation	BH2103	23.32
	BH3101	14.25
Kelly's Plain Volcanics	BH2101	61.68
Vibrating Wire Piezometers		
Ravine Beds West	BH5108	183.76
	BH5208	94.07
	BH8106	184.48
Boraig Group	BH5103	100.57
	BH5110	159.85
	BH5113B	65.45
Ravine Beds East	BH4104	48.15
	BH5111	71.95
	BH5202	130.32
Gooandra Volcanics	BH3107	43.78
	BH3108	15.27
	BH3203	11.09
	BH4101	14.85
	BH4102	29.04
	BH4201	25.52
Tantangara Formation	BH2102	74.96
	BH3104	113.96
	BH3111	105.23
	BH3113	105.66

3.3.2. Groundwater Level Site Specific Trigger Values

Groundwater level site specific trigger values (SSTVs) for the local targeted groundwater monitoring network (Level 1 (Indicator) Trigger sites) are provided in Table 4.

3.3.3. Comparison of Observed and Predicted Groundwater Level Changes

Raw groundwater data is stored in the Project's groundwater database and will be processed weekly into the Snowy 2.0 Groundwater Dashboard, including graphing of the compensated water pressure data as a groundwater level relative to monthly and CDFM rainfall, and the groundwater level SSTV.

Observed groundwater levels will be compared monthly to the groundwater level SSTVs presented in Table 4.

Where the 7-day moving average groundwater level exceeds the SSTV for a continuous period of 30 days, management actions will be initiated in accordance with the Groundwater Level TARP (Section 4.5), and Groundwater Management Plan, including notification to external agencies (if required).

Collection of additional groundwater level and quality data from an expanded network of nearby existing bores (from the regional groundwater monitoring network) will be initiated to assess the scale and/or propagation of potential localised impacts.

3.3.4. Groundwater Dependent Ecosystems

Shallow groundwater levels in standpipes located at known GDEs will be compared to the 80th percentile between the months of May and October. If drawdown is identified beyond trigger levels in areas of these GDEs during this period, actions outlined in the Groundwater level TARP will be initiated.

The GDE monitoring and trigger assessment process, including transfer of impact assessments to the Biodiversity Management Plan is further outlined in Section 7.4 of the GMP.

3.4. Groundwater Quality Network

EPL21266 designated monitoring locations are routinely monitored in accordance with the frequencies listed in Condition M2. For clarity, sampling of EPL designated locations is undertaken monthly with exception to nominated locations whereby quarterly frequencies are required.

If a Level 2 water level trigger occurs, additional sampling is conducted at the triggered bore within following 7 days of receipt of initial results. Validation monitoring is to indicate whether water quality at the specific location is representative or if initial result was anomalous.

Field analysis of physico-chemical parameters (EC, pH, DO, NTU) are collected during all monitoring events to provide additional water quality information.

To manage potential leachate seepage, Leachate Detection Procedures are implemented and followed for relevant PSEs (Ravine, GF01 and Tantangara) and the Marica TSE. Monitoring via surface water and ground water sampling enables continually assessment if leachate is occurring from the spoil emplacement.

The LDPs have been developed to fulfil the requirement of a leachate detection system for the placement of spoil in accordance with the Project Environmental Protection License (EPL) 21266.

3.4.1. Water Quality Objectives

For most parameters, ANZECC trigger values are used as the foundation for determining appropriate water quality targets (and hence triggers) to be adopted for groundwater monitoring during construction. These same default trigger values were also applied in the Main Works EIS during assessment of baseline groundwater quality, where relevant.

The following default WQO values have been adopted for the purposes of this GMP:

- Physical and chemical stressors – default trigger values for upland rivers in Southeastern Australia that are reported in ANZECC/ARMCANZ (2018); and
- Toxicant trigger values for the protection of 99% of freshwater aquatic species that are provided in ANZECC/ARMCANZ (2018).

Table 6 - Water quality objects for groundwater (source: Appendix J of EMM 2020)

Category	Analyte	Unit	Water Quality Objective Value*
Field	pH	-	6.5-8
	Electrical Conductivity	µS/cm	30-350
	Oxidation Reduction Potential	mV	No Water Quality Objective Value
	Temperature	°C	No Water Quality Objective Value
	Dissolved Oxygen	% saturation	90-110
	Turbidity	NTU	2-25
Laboratory analytes	TSS	mg/L	No Water Quality Objective Value
	Hardness as CaCO ₃	mg/L	No Water Quality Objective Value
Nutrients	Ammonia as N	µg/L	13
	Nitrite + Nitrate as N (NO _x)	µg/L	15
	Kjeldahl Nitrogen Total	µg/L	No Water Quality Objective Value
	Nitrogen (Total)	µg/L	250
	Reactive Phosphorus	µg/L	15
	Phosphorus (Total)	µg/L	20
Inorganics	Cyanide Total	µg/L	4
Hydrocarbons	Oil and Grease	mg/L	No Water Quality Objective Value
Metals	Aluminium (dissolved)	µg/L	27
	Arsenic (dissolved)	µg/L	0.8
	Chromium (III+VI) (dissolved)	µg/L	0.01
	Copper (dissolved)	µg/L	1
	Iron (dissolved)	µg/L	300
	Lead (dissolved)	µg/L	1
	Manganese (dissolved)	µg/L	1,200
	Nickel (dissolved)	µg/L	8
	Silver (dissolved)	µg/L	0.02
	Zinc (dissolved)	µg/L	2.4

3.4.2. Groundwater Quality Monitoring Locations - LDP

A list of groundwater monitoring locations is provided in the below sections, a comprehensive Premise Map displaying EPL designated locations and their coordinates is included as an attachment to this Program.

3.4.2.1. Lobs Hole – GF01

The groundwater monitoring locations for the GF01 LDP are listed in .

Table 7 - Groundwater Monitoring Locations - GF01

Sample Location	EPL IDs	GPS Coordinates ¹
GW Upstream East	EPL56	35.7747567°S, 148.3915042°E
GW Upstream West	EPL57	35.7754320°S, 148.3891429°E
GW Downstream	EPL58	35.7785823°S, 148.3879381°E
GW Downstream	EPL90	35.7784065°S, 148.3862534°E
GW Downstream	EPL91	35.7794614°S, 148.3868388°E
GW Downstream	EPL92	35.7776898°S, 148.3873789°E
GW Downstream	EPL93	35.7777801°S, 148.3877464°E
GW Downstream	EPL94	35.7777788°S, 148.3877499°E
GW Downstream	EPL95	35.7785660°S, 148.3879305°E
GW Downstream	EPL96	35.7778136°S, 148.3891488°E
GW Downstream	EPL97	35.7785258°S, 148.3899984°E

1. GPS Coordinates are a guide only, ground truthing is required and sampling locations will be determined based on conditions in field.

3.4.2.1. Lobs Hole - Ravine Bay

The water monitoring locations for the Ravine Bay PSE are listed in Table 7 and Maps at Figure 3-3.

Table 8 - Ravine Bay Water Monitoring Information

Sample Location	Proposed EPL ID	GPS Coordinates ¹
GW Upstream East	EPL113	35.7532496S 148.3640226E
GW Upstream West	EPL114	35.7556957S 148.3581398E
GW Downstream East	EPL115	35.7570108S 148.3617797E
GW Downstream West	EPL116	35.7572316S 148.3568102E
GW Downstream	EPL117	35.7579279S 148.3588701E
GW – Splitter Box	EPL129	35.757903S 148.357283E

1. GPS Coordinates are a guide only, ground truthing is required and sampling locations will be determined based on conditions in field.

3.4.2.2. Lobs Hole - Main Yard**Table 9 - Main Yard Water Monitoring Information**

Sample Location	Proposed EPL ID	GPS Coordinates ¹
GW Upstream	EPL82	35.79182S 148.396579E
GW Upstream	EPL80	35.792176S 148.399849E
GW Downstream	EPL83	35.787649S 148.399201E
GW Downstream	EPL81	35.790078S 148.401436E
GW Downstream	EPL87	35.7847589S 148.3934260E
GW Downstream	EPL88	35.7862556S 148.3964659E
GW Downstream	EPL89	35.7910518S 148.4039778E

1. GPS Coordinates are a guide only, ground truthing is required and sampling locations will be determined based on conditions in field.

3.4.2.3. Tantangara**Table 10 - Tantangara Water Monitoring Information**

Sample Location	EPL ID (proposed)	GPS Coordinates*
GW Downstream East1	EPL68	35.760452S 148.644412E
GW Downstream West1	EPL69	35.762842S 148.649502E
GW Upstream East	EPL70	35.769867S 148.645177E
GW Upstream West	EPL103	35.7684242S 148.6436704E
GW Downstream East2	EPL104	35.7668572S 148.647485E
GW Downstream West2	EPL105	35.7662304S 148.6424414E

1. GPS Coordinates are a guide only, ground truthing is required and sampling locations will be determined based on conditions in field.

3.4.2.4. Marica**Table 11 - Marica Water Monitoring Information**

Sample Location	Sample ID	EPL ID	GPS Coordinates ¹
GW Above Gradient	EPL72	EPL72 (BH 5404)	-35.786909 148.464091
GW Triangulation Relocation	BH5411	EPL designation required	-35.784402 148.456856
GW Down Gradient Relocation	BH5412	EPL designation required	-35.786373 148.449348
Additional GW Down Gradient Location	BH5413	EPL designation required	-35.783195 148.445797

^{2.} GPS Coordinates are a guide only, ground truthing is required and sampling locations will be determined based on conditions in field.

3.4.2.1. Rock Forest**Table 12 - Rock Forest Water Monitoring Information**

Sample Location	Sample ID	EPL ID	GPS Coordinates ¹
GW Upstream W	RF - GW – USW	(Proposed EPL123)	35.570349S 148.3936363E
GW Upstream (NE)	RF - GW – USNE	(Proposed EPL124)	35.5656392S 148.3946128E
GW Downstream (S)	RF - GW – DSS	(Proposed EPL125)	35.576338S 148.3956548E
GW Downstream (SE)	RF - GW – DSSE	(Proposed EPL126)	35.570196S 148.408227E
GW Downstream	RF - GW – DS	(Proposed EPL127)	35.5650859S 148.4028244E

^{1.} GPS Coordinates are a guide only, ground truthing is required and sampling locations will be determined based on conditions in field.

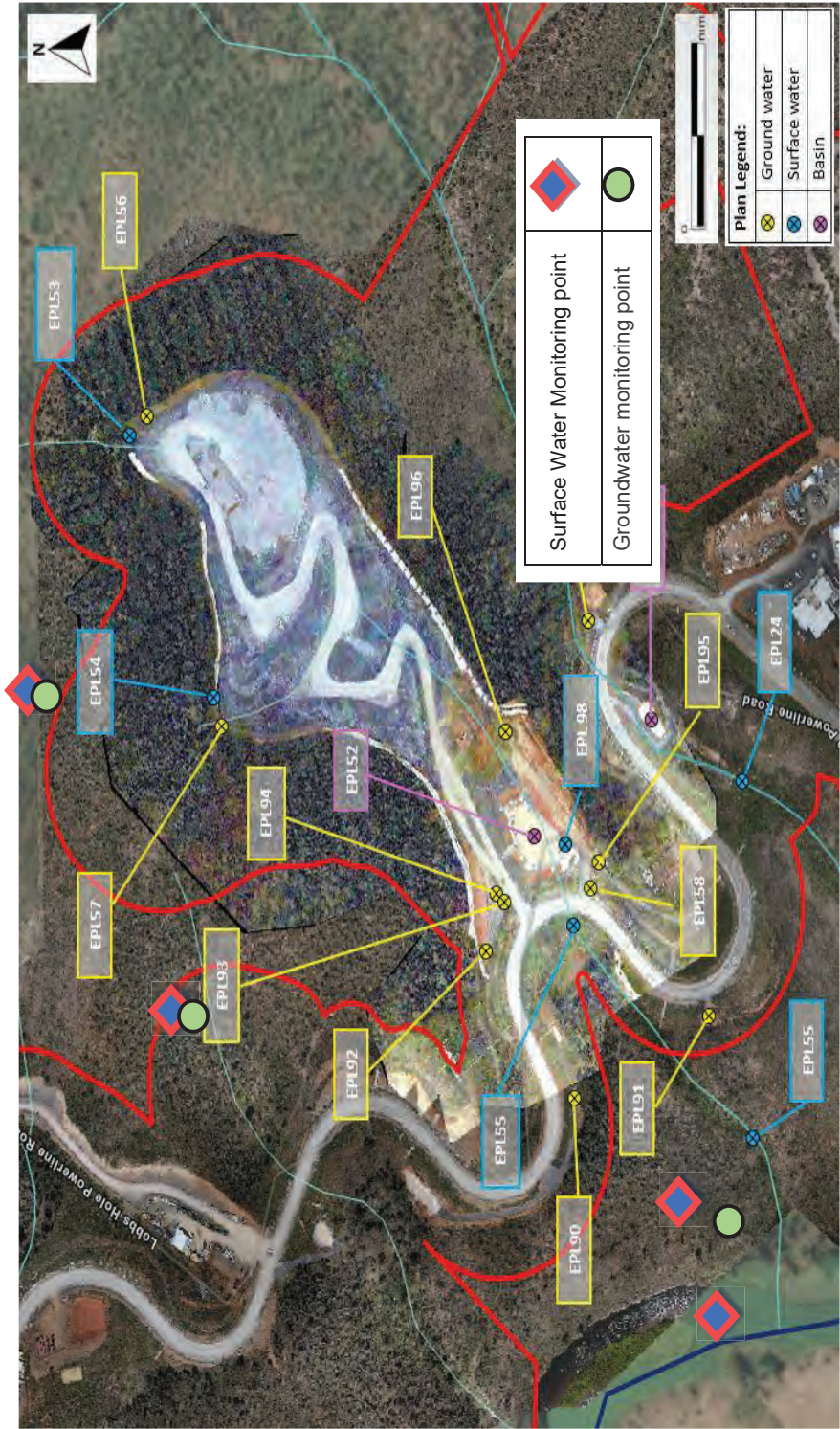


Figure 3-1:GF01 LDP Monitoring Location



Figure 3-2:Tantangara PSE LDP Locations

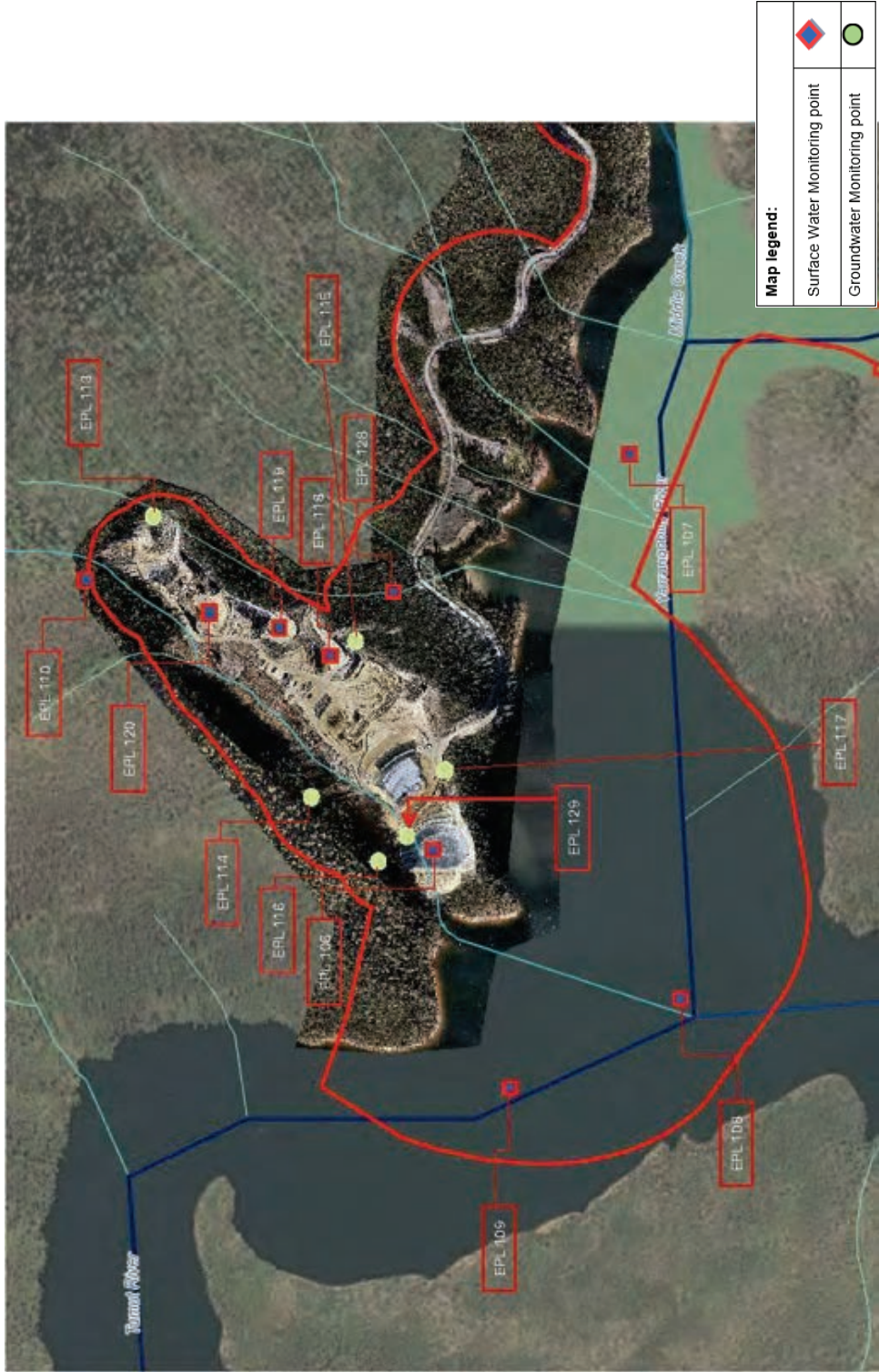


Figure 3-3: Ravine Bay PSE LDP Locations



Figure 3-4: Marica TSE LDP Monitoring Locations

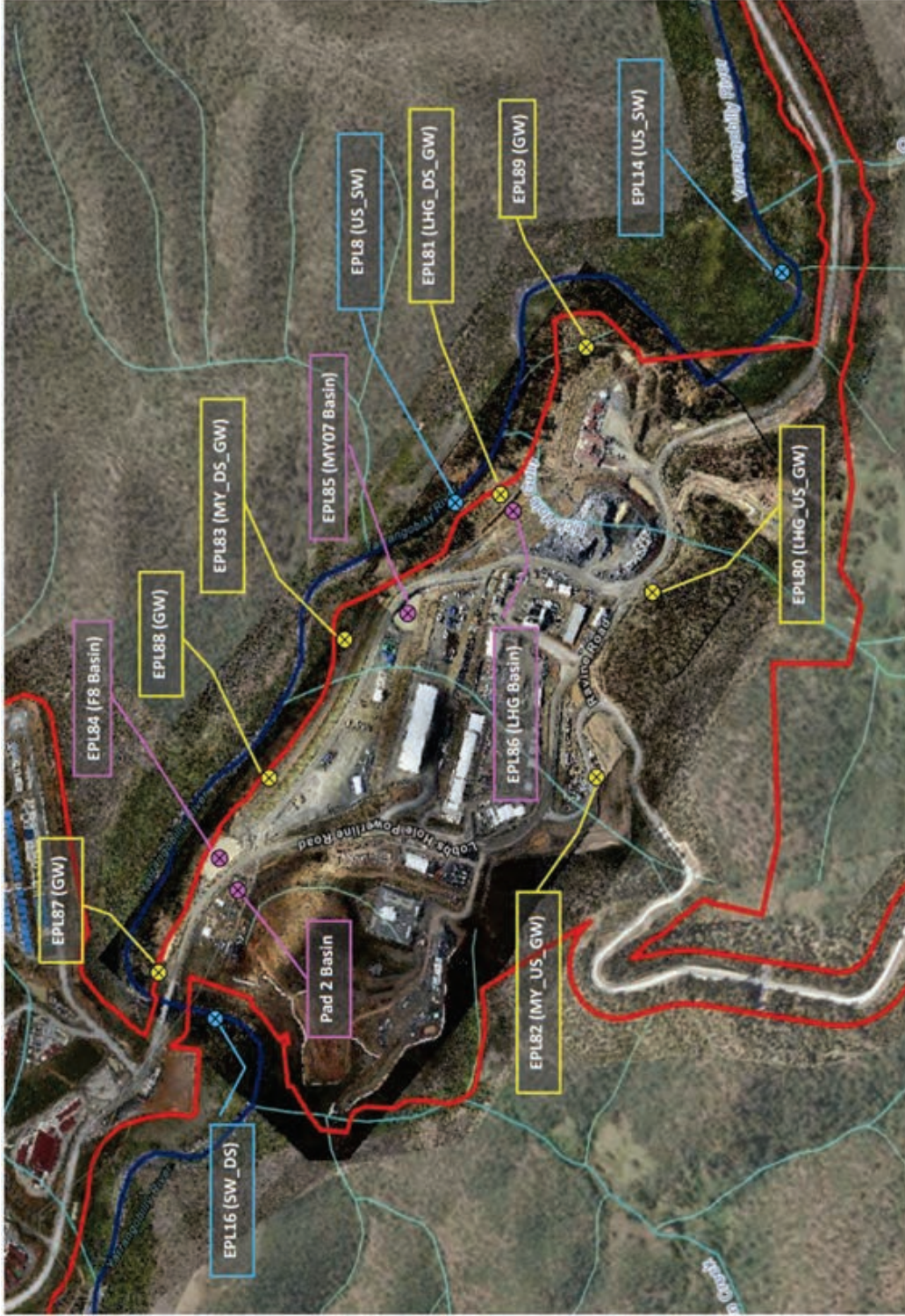


Figure 3-5: Main Yard PSE LDP Monitoring Locations

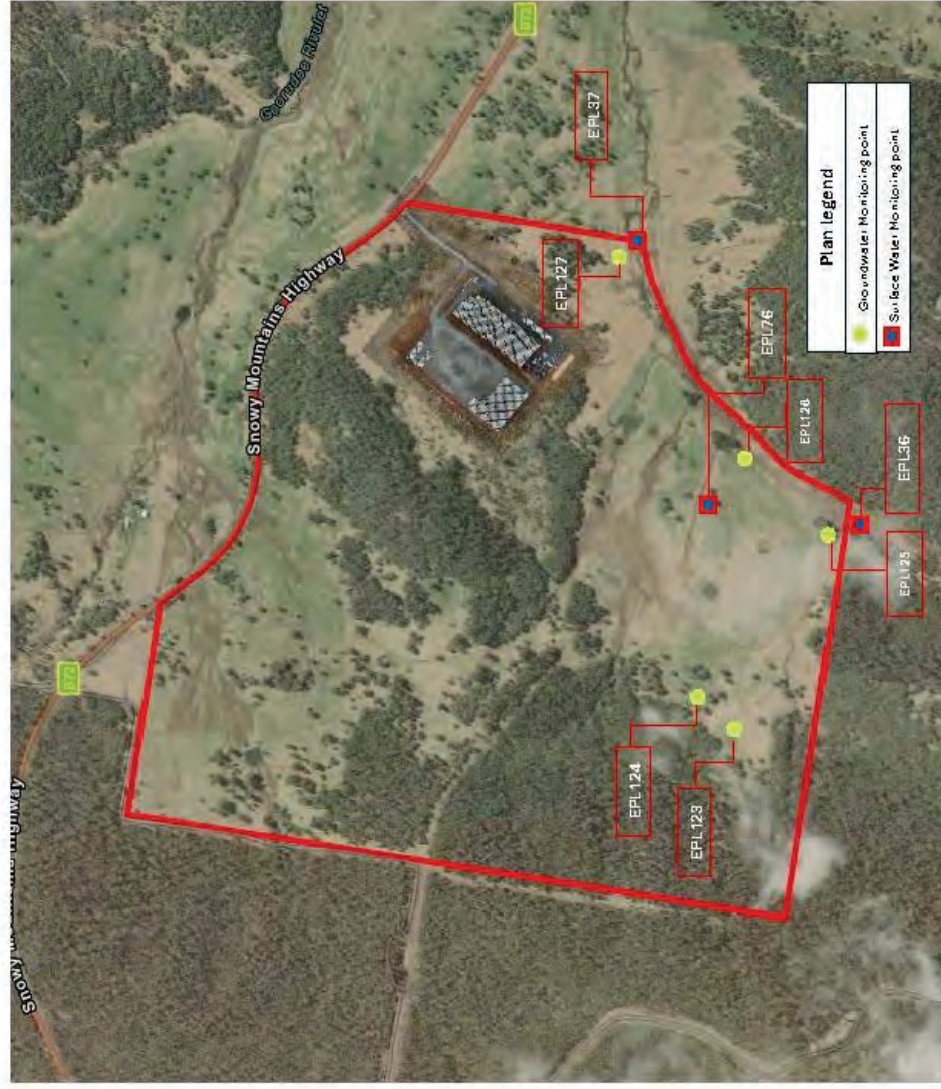


Figure 3-6: Rock Forest PSE LDP Monitoring Locations

3.5.

3.5. Groundwater Extraction

The groundwater sources that have been and will be intercepted include the Lachlan Fold Belt Murray Darling Basin (MDB) groundwater source and the Lachlan Fold Belt South Coast groundwater source. Groundwater extraction such as potable supply bores, tunnel inflow monitoring, WTP discharges and Project water inputs are monitored and used in a simple water balance approach to estimate groundwater extracted during construction. A conceptual diagram is presented in in Section 5 of the Water Management Plan.

Groundwater inflow = WTP discharge (flow meter C) – Project water inputs (flow meter E)

Groundwater extraction is monitored throughout the year to ensure groundwater extraction is within permitted volumes of take from respective water sources and reported on an annual basis in accordance with licence requirements (described in Section 2.4.3 of the Groundwater Management Plan).

3.6. Water Treatment Plant Monitoring

All groundwater encountered during tunnelling is drawn to the surface where it is treated via a water treatment plant (WTP).

The water from the treatment plants is tested and either reused or discharged in accordance with the Surface Water Management Plan and EPL21266. Discharge volumes are continuously monitored at the WTPs via calibrated flow meters, which enables the daily measurement of the amount of water discharged from the WTPs.

Details of the water treatment management system is provided in Section 5 of the Surface Water Management Plan.

4. REVIEW AND RESPONSE

4.1. Responsibility

Sampling and testing of the Groundwater Level Monitoring Network is coordinated by SHL. Sampling and testing of the Groundwater Quality Program is coordinated by FGJV and reported to SHL.

At all times during construction, SHL will be responsible for initiation of Trigger Action Response Plan 1 and FGJV will be responsible for initiation of the Trigger Action Response Plans 2 and 3 (Section 6. of the GMP).

Sample data collected by SHL will be provided to FGJV

4.2. Data Analysis

Results from the construction monitoring program are compared against default criteria, water quality objectives and groundwater modelling predictions.

Monitoring results of groundwater level involves recorded data being compensated for barometric pressure and converted to a groundwater level measurement. Groundwater level data is compared to local rainfall records to assess trends for reporting in Annual Reports.

Monitoring results for both groundwater levels and groundwater quality are compared against WQOs and reported in the monitoring reports. If results trigger a response, management actions are implemented (Section 4.5), as required, should an initial review determine a potential impact outside of approved predictions.

The monitoring results for groundwater level and groundwater quality are used to inform the groundwater model updates increasing the confidence level in model predictions with respect to

groundwater inflow, drawdown, and aquifer chemistry. Where required the groundwater model is calibrated to monitoring results and predictions updated.

4.3. Quality Assurance

During each sampling and reporting round, calibration and quality assurance is carried out relevant to the data being collected as outlined in Table 13, below.

Table 13 - Calibration and Quality Assurance

Measure	Calibration process	Quality Assurance
Groundwater quality	All field analysis equipment needs to be calibrated prior to usage at a frequency recommended by the supplier. NATA Accredited Laboratories used for analyses.	Chain of custody documentation to be created for each sampling campaign. Data storage and recovery procedures to follow best practice.
Groundwater level	Monthly check for data drift and aberrations (spikes, missing data) and comparison to adjacent bores for continuity and consistency.	Calibration statistics provided with reports. Long-term trends plotted and provided with each report.
Groundwater inflow	Cross-checking of metered and manual estimates of flow in tunnels. Data redundancy in metering through input/output checks and multiple water balance associations.	Daily recording of tunneling water production documented with tunnelling processes and activities (e.g. grouting schedules). Monthly reporting and cross-checking of groundwater take and surface water processing.

4.4. Adaptive Management

Monitoring results obtained during construction are subject to monitoring, analysis of results, review of mitigation measures (where exceedances are identified) and updates to measures and trigger values where required.

An adaptive management approach is taken that applies observed data to influence mitigation response and system understanding. Thus, the groundwater monitoring network records actual groundwater levels and groundwater take (via bore sensors and tunnel discharge meters, respectively) which are used to validate and verify or re-calibrate the numerical groundwater model. Revised predicted drawdowns can then be predicted with increasing confidence and the extents of potential impacts revised accordingly.

4.5. Trigger Action Response Plan

The purpose of a TARP is to detail a standardised response procedure in the event that a trigger value is exceeded during a monitoring event for groundwater quality, level and/or inflow monitoring. TARPS are included as Annexure B, C and D in the GMP (S2-FGJV-ENV-PLN-0012).

This allows for the prompt identification of unpredicted impacts and guide the implementation additional management measures and corrective actions should adverse conditions arise attributable to construction.

TARP applies to all current and future groundwater monitoring locations.

4.6. Trigger values

Preference under the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018) is given to site specific guidelines determined through a comprehensive assessment of baseline data for a minimum period of two years (24 months). To date, a sub-set of bores has provided data for groundwater levels extending back to October 2017. The majority of bores have provided data since autumn 2018, with some bores only recording data since the last drilling campaign in April 2019 (EMM, 2019a).

Those bores designated as Level 1 bores will continue to be assess for water level change on a quarterly basis. Water levels are compared to numerical modelling results. Where measured water levels are lower than those predicted from subtraction of the predicted drawdown for the Base Case from the previous month's level, this constitutes a trigger event. Measured drawdown less than predicted constitute a Level 1 (indicator) trigger value that does not illicit a response, except where the bore is located at a GDE, whereby drawdown greater than the 80th percentile during the winter months (May to October) constitutes a trigger event.

4.7. Reporting

FGJV report to SHL and other agencies on ground water monitoring aspects related to the Project. During construction, ground water monitoring data is collected, tabulated and assessed against thresholds. Reporting occurs in accordance with Section 6.9 of the GMP.

5. REFERENCES

ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra, ACT, Australia. Viewed [viewed 08/04/2020], [<https://www.waterquality.gov.au/anz-guidelines>].

EMM, 2019. Appendix J.1: Water Assessment for the Snowy 2.0 Main Works EIS (report #J17188 RP#86)

EMM, 2020. Modelling Report. Annexure I to Main Works Preferred Infrastructure Report and Response to Submissions

Lyne, V. & Hollick, M. 1979, "Stochastic time variable rainfall-runoff modelling", *Proceedings of the Hydrology and Water Resources Symposium*, Perth, 10-12 September, Institution of Engineers National Conference Publication, No. 79/10, pp. 89–92.

6. APPENDIX A – EPL 21266 PREMISE MAP



snowyhydro

Snowy Hydro 2.0

EPL Premises Map

Environmental Protection Licence: 21266

Version: A

Date: October 2024



Certificate of Approval

Title: Snowy Hydro 2.0 EPL 21266 Premises Map – EPL Point Locations

Version: A

Date of issue: October 2024

Approval Record

	Name	Title	Signature
Prepared By:	Rhia Martin	Senior Env Advisor	
Reviewed By:	Dave Langston	Senior Env Scientist	
Approved By:	Lisa McKeown	HSE General Manager	

Document Revision Table

Rev.	Date	Description of modifications



Acronyms and Definitions

EMS	Environment Management Strategy
FG	Future Generation Joint Venture
NEM	National Energy Market
SHL	Snowy Hydro Limited



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1. Introduction

Snowy Hydro Limited (SHL) is the proponent of the Snowy Mountains Hydro-electric Scheme which operates within a catchment of approximately 5,100 square kilometres (km²), most of which is located within Kosciuszko National Park (KNP). The purpose of the Snowy Scheme was to collect water from the alpine areas of the Great Dividing Range 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.

Snowy 2.0 is a pumped hydro-electric project that will link the existing Tantangara and Talbingo reservoirs through a series of new underground tunnels and a hydro-electric power station. Snowy 2.0 will increase the generation capacity of the Snowy Scheme by an additional 2,200 megawatts (MW), and at full capacity, provide approximately 350,000 megawatt hours (MWh) of large-scale energy storage to the National Electricity Market (NEM).

An Environmental Management Strategy (EMS) exists for the project and all procedures required to support, interface, or directly relate to the development and execution of the strategy, where relevant. A Water Management Plan¹ (WMP) was prepared for the Snowy 2.0 Main Works project and superseded the Stage 1 and Stage 2 Exploratory Works Management Plan, which included the Main Works–Surface Water Management Plan² (SWMP) and Main Works–Groundwater Management Plan³ (GWMP).

2. Environmental Protection Licence

Environmental Protection License (EPL) 21266 was initially granted 21 February 2020, for the purpose of controlling and monitoring construction operations. Its conditions relate to pollution prevention and effective materials management through recycling, re-use, and the implementation of best practice.

To assess and monitor environmental conditions during construction an initial network of ninety seven (97) locations were setup to allow for routine monitoring and sampling in accordance with the EPL. Over the years this has increased; the present EPL (revised in 2024) contains one hundred and six (106) locations at the time of Rev A submission.

3. Objective

The objective of the *SHL 2.0 Premise Map* is to document EPL sampling locations in one document and will be used as the basis of EPL 21266.

This document intends to be a working document which will track changes and regular updates to EPL sampling network based on project needs.

4. Site Identification

Snowy 2.0 is identified by five key areas with a total of 106 EPL points:

1. **Talbingo Reservoir and Ravine Bay.**
2. **Lobs Hole.**
3. **Marica and Plateau.**
4. **Tantangara Reservoir.**
5. **Rock Forest (outside KNP boundary, private land ownership).**

An overview of the EPL locations by area is presented in Table 3.1 and Figure 3.1 below.

¹ Water Management Plan – S2-FGJV-ENV-PLN-0010

² Main Works–Surface Water Management Plan – S2-FGJV-ENV-PLN-0011

³ Main Works–Groundwater Management Plan – S2-FGJV-ENV-PLN-0012


Table 4.1: Project Area EPL Overview

Project Area	EPL Sampling Locations	Access	Key Features
Lobs Hole, Talbingo Reservoir, & Ravine Bay	1 x WTP discharge point 1 x diffusion point 4 x inflow / outflow points 7 x leachate basin 12 x surface water 5 x reservoir water 16 x groundwater Total: 46 locations	Lobs Hole – Main access gate	Western extent of the work area and downslope reservoir of Talbingo. Ravine Bay spoil emplacement area. Main Yard / Lick Hole Gully spoil emplacement area. ECVT and MAT portals and Main Camp
GF01	1 x leachate basin 5 x surface water 11 x groundwater Total: 17 locations	Lobs Hole – Main access gate	GF01 spoil emplacement area.
Tantangara & Tantangara Emplacement Area	3 x WTP, 1 x STP 5 x reservoir water 9 x leachate basin 5 x surface water 6 x groundwater Total: 29 locations	Tantangara - Main Access Gate	Eastern extent of the work area and upslope intake for pumped Hydropower. Tantangara spoil emplacement area. Auxiliary camp.
Marica & Plateau (Nungar Creek)	0 x WTP, 0 x STP 3 x leachate basin 5 x surface water 3 x groundwater Total: 11 locations	Marica Access Gate – Snowy Mountains Highway	Area of works including surge and ventilation shafts construction and auxiliary camp. Potential Spoil emplacement area.
Rock Forest	0 x WTP, 0 x STP 1 x leachate basin 2 x surface water 0 x groundwater Total: 3 locations	Snowy Mountains Highway	Lay-down yard on private property. Potential Spoil emplacement area.

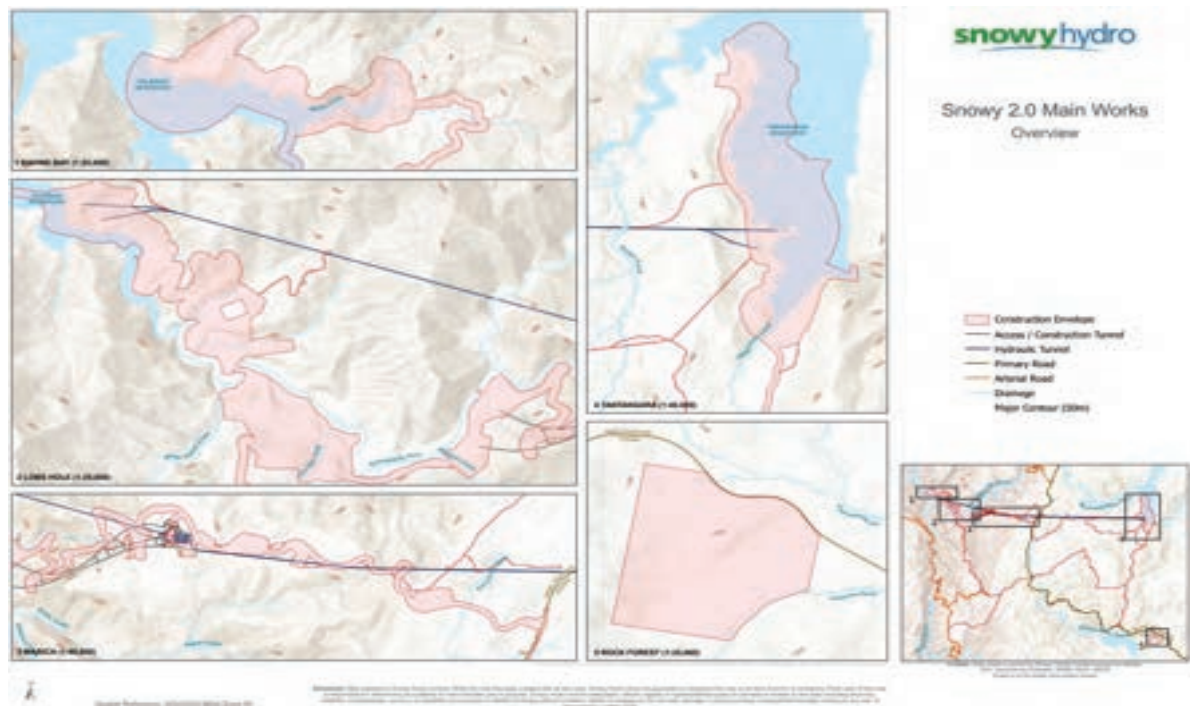


Figure 4.1: Snowy 2.0 Project Areas.

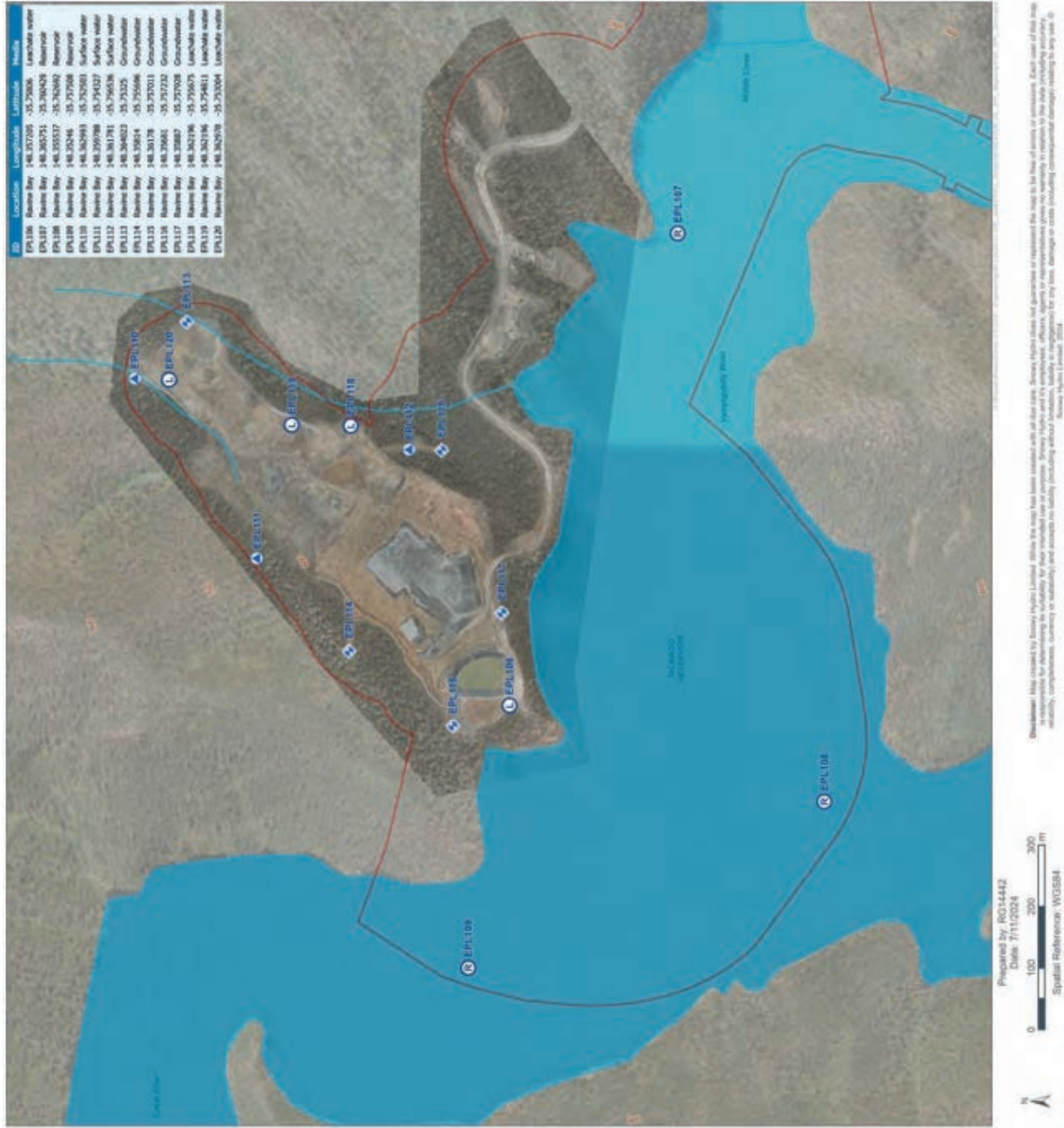
5. GIS Maps

To depict the EPL points with clarity, the five areas detailed in Table 3.1 (above) have been distributed across eight ArcGIS maps in sections 4.1 to 4.8 (below). These are:

1. Lobs Hole
2. Ravine Bay
3. GF01
4. Tantangara
5. Tantangara Emplacement
6. Marica
7. Nungar Creek
8. Rock Forest



5.2. Ravine Bay EPL Location Map



EPL Locations
Ravine Bay

- Groundwater
- Surface water
- Leachate water
- Reservoir
- Construction Envelope
- Access / Construction Tunnel
- Hydraulic Tunnel
- Primary Road
- Arterial Road
- Drainage
- Major Contour (50m)



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EPL Locations
GF01

- Construction Envelope
- Groundwater
- Surface water
- Leachate water
- Access / Construction Tunnel
- Hydraulic Tunnel
- Primary Road
- Arterial Road
- Drainage
- Major Contour (50m)



Prepared by: RIG14442
Date: 27/11/2024
Scale: 1:500
Spatial Reference: WGS84

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Snowy Hydro Limited, 2024

5.3. GF01 EPL Location Map



EPL Locations
Tantangara Emplacement

- Groundwater
- Surface water
- Leachate water
- Reservoir
- Construction Envelope
- Access / Construction Tunnel
- Hydraulic Tunnel
- Primary Road
- Arterial Road
- Drainage
- Major Contour (50m)



Prepared by: R014442
Date: 11/11/2024
Scale: 1:1000
Spatial Reference: WGS84

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EPL Locations
Marica

- Groundwater
- Surface water
- Leachate water
- Construction Envelope
- Access / Construction Tunnel
- Hydraulic Tunnel
- Primary Road
- Arterial Road
- Drainage
- Major Contour (50m)



Prepared by: R016442
Date: 27/11/2024
Scale: 1:5000
Spatial Reference: WGS84

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ID	Location	Longitude	Latitude	Height
EPL034	Nungar Creek	146.633218	-35.805054	Surface water
EPL035	Nungar Creek	146.632958	-35.805184	Surface water



EPL Locations
Nungar Creek

- Surface water
- Construction Envelope
- Access / Construction Tunnel
- Hydraulic Tunnel
- Primary Road
- Arterial Road
- Drainage
- Major Contour (50m)



Prepared by: RIG14442
Date: 27/11/2024
Scale Reference: WGS84

Results and Change Insurance from State of New South Wales, represented by the Department of Customer Service, NSW.



EPL Locations
Rock Forest

- Construction Envelope
- Surface water
- Leachate water
- Access / Construction Tunnel
- Hydraulic Tunnel
- Primary Road
- Arterial Road
- Drainage
- Major Contour (50m)



Prepared by: R014442
Date: 5/11/2023
Spatial Reference: WGS84



6. Coordinates and Descriptions

Coordinates tables have been listed in two formats for ease of reference. This first is organised by location, the second is organised in numerical order.

6.1. EPL Points: Coordinates and descriptions by location

Table 6.1: Coordinates by Location

ID #	Location	Longitude	Latitude	Media	Description
TALBINGO RESERVOIR					
EPL010	Talbingo Reservoir	148.379662	-35.772964	Reservoir	Talbingo Reservoir, upstream of Lobs Hole WTP diffuser outlet and water intake point
EPL041	Talbingo Reservoir	148.380829	-35.771967	WTP - Discharge Point	Lobs Hole WTP final effluent quality monitoring point. Downstream of final treatment, prior to discharge to Talbingo Reservoir.
EPL042	Talbingo Reservoir	148.374923	-35.771412	Diffusion Point	<i>This EPL point does not require water quality monitoring for the purpose of EPL21266.</i>
EPL043	Talbingo Reservoir	148.381442	-35.772248	Vol - Outflow	<i>This EPL point does not require water quality monitoring for the purpose of EPL21266.</i>
LOBS HOLE					
EPL001	Lobs Hole	148.413333	-35.792081	Groundwater	Monitoring well, Wallace Creek Bridge west of ECVT portal
EPL002	Lobs Hole	148.413343	-35.792036	Groundwater	Monitoring well, Wallace Creek Bridge west of ECVT portal
EPL004	Lobs Hole	148.415133	-35.788102	Groundwater	Monitoring well, Wallace Creek Bridge west of MAT portal
EPL005	Lobs Hole	148.416258	-35.785457	Surface water	Yarrangobilly River, upstream of the exploratory tunnel and construction pad
EPL006	Lobs Hole	148.412070	-35.792601	Surface water	Wallaces Creek, upstream of the confluence of Yarrangobilly River and Wallaces Creek
EPL008	Lobs Hole	148.401199	-35.789194	Surface water	Yarrangobilly River, downstream of Lick Hole Gully
EPL009	Lobs Hole	148.386762	-35.782321	Surface water	Yarrangobilly River, downstream of the accommodation camp and upstream of Talbingo Reservoir



ID #	Location	Longitude	Latitude	Media	Description
EPL011	Lobs Hole	148.374568	-35.770686	Reservoir	Talbingo Reservoir, downstream of Lobs Hole STP/WTP diffusion monitoring
EPL012	Lobs Hole	148.414102	-35.789259	Surface water	Yarrangobilly River, immediately downstream of portal pad
EPL014	Lobs Hole	148.404957	-35.794010	Surface water	Yarrangobilly River, upstream of MY/LHG PSE
EPL015	Lobs Hole	148.403901	-35.792462	Surface water	Yarrangobilly River, upstream of MY/LHG PSE downstream?
EPL016	Lobs Hole	148.392736	-35.785488	Surface water	Yarrangobilly River, upstream of MY/LHG PSE downstream?
EPL024	Lobs Hole	148.388545	-35.779893	Surface water	Unnamed tributary downslope of GF01 PSE
EPL025	Lobs Hole	148.415198	-35.788038	Groundwater	Monitoring well, downslope of MAT portal
EPL044	Lobs Hole	148.417439	-35.787129	Vol - Inflow	This EPL point does not require water quality monitoring for the purpose of EPL21266.
EPL045	Lobs Hole	148.392697	-35.783244	STP - Inflow Vol	This EPL point does not require water quality monitoring for the purpose of EPL21266.
EPL047	Lobs Hole	148.392000	-35.783000	Vol - Inflow	This EPL point does not require water quality monitoring for the purpose of EPL21266.
EPL080	Lobs Hole	148.399849	-35.792176	Groundwater	Monitoring well, upgradient to Lick Hole Gully
EPL081	Lobs Hole	148.401436	-35.790078	Groundwater	Monitoring well, downgradient to Lick Hole Gully
EPL082	Lobs Hole	148.396579	-35.791820	Groundwater	Monitoring well, upgradient from Main Yard emplacement area
EPL083	Lobs Hole	148.399201	-35.787649	Groundwater	Monitoring well, downgradient from Main Yard emplacement area
EPL084	Lobs Hole	148.398896	-35.788017	Leachate water	Main Yard leachate basin
EPL085	Lobs Hole	148.401224	-35.790453	Leachate water	Main Yard leachate basin MY07
EPL086	Lobs Hole	148.402909	-35.791298	Leachate water	Lick Hole Gully leachate basin LHG01
EPL087	Lobs Hole	148.393426	-35.784759	Groundwater	Downgradient from Main Yard spoil emplacement area
EPL088	Lobs Hole	148.396466	-35.786256	Groundwater	Downgradient from Main Yard emplacement area
EPL089	Lobs Hole	148.403978	-35.791055	Groundwater	Lick Hole Gully groundwater monitoring downgradient from GF01 emplacement area
EPL121	Lobs Hole	NA	NA	NA	Groundwater seepage point below LHG Note: Location does not exist yet TBC with EPA



ID #	Location	Longitude	Latitude	Media	Description
RAVINE BAY					
EPL106	Ravine Bay	148.357205	-35.758060	Leachate water	Leachate basin 1
EPL107	Ravine Bay	148.365751	-35.760429	Reservoir	Reservoir water – Yarrangobilly Upstream
EPL108	Ravine Bay	148.355537	-35.762692	Reservoir	Reservoir water – Yarrangobilly centre of PSE
EPL109	Ravine Bay	148.352460	-35.757508	Reservoir	Reservoir water – Yarrangobilly Upstream
EPL110	Ravine Bay	148.362993	-35.752503	Surface water	Upstream from spoil emplacement area
EPL111	Ravine Bay	148.359788	-35.754327	Surface water	Upstream from rock mattress at spoil emplacement area, rock mattress
EPL112	Ravine Bay	148.361781	-35.756536	Surface water	Downstream from rock mattress at spoil emplacement area, rock mattress
EPL113	Ravine Bay	148.364023	-35.753250	Groundwater	Monitoring well, upstream east of emplacement area
EPL114	Ravine Bay	148.358140	-35.755696	Groundwater	Monitoring well, upstream west of emplacement area
EPL115	Ravine Bay	148.361780	-35.757011	Groundwater	Monitoring well, downstream east of emplacement area
EPL116	Ravine Bay	148.356810	-35.757232	Groundwater	Monitoring well, downstream west of emplacement area
EPL117	Ravine Bay	148.358870	-35.757928	Groundwater	Monitoring well, downstream of emplacement area
EPL118	Ravine Bay	148.362196	-35.755675	Leachate water	Leachate Basin 2
EPL119	Ravine Bay	148.362196	-35.754811	Leachate water	Leachate Basin 3
EPL120	Ravine Bay	148.362978	-35.753004	Leachate water	Leachate Basin 4
GF01					
EPL052	GF01	148.388006	-35.778141	Leachate water	Talbingo Reservoir, upstream of GF01 emplacement area - GF01 Basin
EPL053	GF01	148.391374	-35.774478	Surface water	Upstream East of GF01 spoil emplacement area
EPL054	GF01	148.389043	-35.775550	Surface water	Upstream west of GF01 spoil emplacement area
EPL055	GF01	148.387530	-35.778434	Surface water	Downstream of GF01 spoil emplacement area - Confluence



ID #	Location	Longitude	Latitude	Media	Description
EPL056	GF01	148.391504	-35.774757	Groundwater	Upstream east from GF01 spoil emplacement area
EPL057	GF01	148.389143	-35.775432	Groundwater	Monitoring well, upgradient west from GF01 spoil emplacement area
EPL058	GF01	148.388008	-35.778606	Groundwater	Downgradient from GF01 spoil emplacement area
EPL090	GF01	148.386253	-35.778407	Groundwater	Downgradient from GF01 spoil emplacement area
EPL091	GF01	148.386839	-35.779461	Groundwater	Downgradient from GF01 spoil emplacement area
EPL092	GF01	148.387379	-35.777690	Groundwater	Downgradient from GF01 spoil emplacement area
EPL093	GF01	148.387746	-35.777780	Groundwater	Downgradient from GF01 spoil emplacement area
EPL094	GF01	148.387769	-35.777789	Groundwater	Downgradient from GF01 spoil emplacement area
EPL095	GF01	148.388054	-35.778647	Groundwater	Downgradient from GF01 spoil emplacement area
EPL096	GF01	148.389189	-35.777734	Groundwater	Downgradient from GF01 spoil emplacement area
EPL097	GF01	148.390030	-35.778508	Groundwater	Downgradient from GF01 spoil emplacement area
EPL098	GF01	148.388009	-35.778392	Surface water	Rock blanket diversion monitoring under GF01 liner
EPL122	GF01	148.385177	-35.780204	Surface water	Previously EPL 55b - GF01 Drainage line
TANTANGARA					
EPL028	Tantangara	148.653607	-35.747597	Reservoir	Upstream in the mouth of the Murrumbidgee River.
EPL029	Tantangara	148.652978	-35.793034	Reservoir	Downstream of works area and upstream of lower Murrumbidgee River
EPL030	Tantangara	148.652001	-35.801362	Surface water	Kellys Plain Creek, downstream of accommodation camp and laydown areas
EPL031	Tantangara	148.648474	-35.806315	Surface water	Kellys Plain Creek, upstream of accommodation camp and laydown areas
EPL032	Tantangara	148.658771	-35.789504	Reservoir	Tantangara intake, downstream of construction works
EPL033	Tantangara	148.664114	-35.795317	Surface water	Murrumbidgee River, downstream of Tantangara reservoir outlet



ID #	Location	Longitude	Latitude	Media	Description
EPL038	Tantangara	148.652978	-35.769468	Reservoir	Between the emplacement area and the ancillary facilities for emplacement activities - Location variable dependant on reservoir levels
EPL039	Tantangara	148.639317	-35.761213	Surface water	Confluence of Nungar Creek and Tantangara Reservoir, upstream of construction works - Location variable dependant on reservoir levels
EPL040	Tantangara	148.622654	-35.754604	Surface water	Confluence of the upper Murrumbidgee River and Tantangara Reservoir, upstream of works - Location variable dependant on reservoir levels
EPL046	Tantangara	148.657000	-35.795000	Diffusion Point	This EPL point does not require water quality monitoring for the purpose of EPL21266.
EPL048	Tantangara	148.656000	-35.802000	STP - Inflow Vol	STP Inflow Volume Monitoring Point. This EPL point does not require any water quality monitoring for the purpose of EPL21266.
EPL049	Tantangara	148.650000	-35.791000	WTP - Inflow Vol	WTP Inflow Volume Monitoring Point. This EPL point does not require any water quality monitoring for the purpose of EPL21266.
EPL051	Tantangara	148.659112	-35.794459	Reservoir	Tantangara Reservoir downstream of Tantangara STP/WTP diffusion monitoring of diffusion point EPL046
EPL059	Tantangara	148.644450	-35.761807	Leachate water	Leachate basin Tan-SW-SB1
EPL060	Tantangara	148.644730	-35.760387	Leachate water	Leachate basin Tan-SW-SB2
EPL061	Tantangara	148.648002	-35.760057	Leachate water	Leachate basin Tan-SW-SB3
EPL062	Tantangara	148.649503	-35.761683	Leachate water	Leachate basin Tan-SW-SB4
EPL063	Tantangara	148.649257	-35.762963	Leachate water	Leachate basin Tan-SW-SB5
EPL064	Tantangara	148.648720	-35.763713	Leachate water	Leachate basin Tan-SW-SB6
EPL065	Tantangara	148.648205	-35.764105	Leachate water	Leachate basin Tan-SW-SB7
EPL066	Tantangara	148.650588	-35.763047	Leachate water	Leachate basin Tan-SW-DSE
EPL067	Tantangara	148.642513	-35.759873	Leachate water	Nungar Creek, downstream west from Tantangara spoil emplacement area
EPL068	Tantangara	148.644412	-35.760452	Groundwater	Downgradient east from Tantangara spoil emplacement area



ID #	Location	Longitude	Latitude	Media	Description
EPL069	Tantangara	148.649502	-35.762842	Groundwater	Downgradient west from Tantangara spoil emplacement area
EPL070	Tantangara	148.645177	-35.769867	Groundwater	Upgradient from Tantangara spoil emplacement area
EPL103	Tantangara	148.643670	-35.768424	Groundwater	Groundwater Upstream - West of emplacement area
EPL104	Tantangara	148.647485	-35.766857	Groundwater	Groundwater Downslope - East of emplacement area
EPL105	Tantangara	148.642441	-35.766230	Groundwater	Groundwater Downslope - West of emplacement area
EPL050	Tantangara Reservoir	148.651000	-35.791000	WTP - Discharge Point	Tantangara WTP final effluent quality and volume monitoring point. Downstream of final treatment, prior to discharge to Tantangara Reservoir.
MARICA					
EPL026	Marica	148.488265	-35.794350	Surface water	Eucumbene River, downstream of Marica Road
EPL027	Marica	148.488210	-35.794470	Surface water	Eucumbene River, upstream of Marica Road
EPL071	Marica	148.452542	-35.786057	Surface water	Downstream from Marica spoil emplacement area
EPL072	Marica	148.464127	-35.786946	Groundwater	Upgradient from Marica spoil emplacement area
EPL073	Marica	148.455317	-35.785423	Groundwater	Downgradient from Marica spoil emplacement area
EPL099	Marica	148.463248	-35.785469	Leachate water	Marica Leachate Basin - Turkey's nest
EPL100	Marica	148.461039	-35.785835	Leachate water	Lower leachate basin USS Shaft
EPL101	Marica	148.461624	-35.786252	Leachate water	Leachate basin spoil pad
EPL102	Marica	148.454939	-35.785422	Groundwater	GW Bore on Marica Trail, adjacent MT06.
Nungar Creek					
EPL034	Tantangara	148.633218	-35.865454	Surface water	Nungar Creek, upstream of Tantangara Road
EPL035	Tantangara	148.632658	-35.865164	Surface water	Nungar Creek, downstream of Tantangara Road
ROCK FOREST					



ID #	Location	Longitude	Latitude	Media	Description
EPL036	Rock Forest	148.667625	-35.952408	Surface water	Cameron's Creek, upstream of works
EPL037	Rock Forest	148.675088	-35.947715	Surface water	Cameron's Creek, downstream of works
EPL076	Rock Forest	148.667000	-35.949000	Leachate water	LDP Rock Forest basin
EPL077	~~Rock Forest~~	N/A	N/A	~~Leachate water~~	Proposed location for LDP Rock Forest basin monitoring – as at time of revision (notice 1638603), this location has not been installed.
EPL078	~~Rock Forest~~	N/A	N/A	~~Leachate water~~	Proposed location for LDP Rock Forest basin monitoring – as at time of revision (notice 1638603), this location has not been installed.
EPL079	~~Rock Forest~~	N/A	N/A	~~Leachate water~~	Proposed location for LDP Rock Forest basin monitoring – as at time of revision (notice 1638603), this location has not been installed.

6.2. EPL Points: Coordinates and descriptions in numerical order

ID #	Location	Longitude	Latitude	Media	Description
EPL001	Lobs Hole	148.413333	-35.792081	Groundwater	Monitoring well, Wallace Creek Bridge west of ECVT portal
EPL002	Lobs Hole	148.413343	-35.792036	Groundwater	Monitoring well, Wallace Creek Bridge west of ECVT portal
EPL004	Lobs Hole	148.415133	-35.788102	Groundwater	Monitoring well, Wallace Creek Bridge west of MAT portal
EPL005	Lobs Hole	148.416258	-35.785457	Surface water	Yarrangobilly River, upstream of the exploratory tunnel and construction pad
EPL006	Lobs Hole	148.412070	-35.792601	Surface water	Wallaces Creek, upstream of the confluence of Yarrangobilly River and Wallaces Creek
EPL008	Lobs Hole	148.401199	-35.789194	Surface water	Yarrangobilly River, downstream of Lick Hole Gully
EPL009	Lobs Hole	148.386762	-35.782321	Surface water	Yarrangobilly River, downstream of the accommodation camp and upstream of Talbingo Reservoir
EPL010	Ravine Bay	148.379662	-35.772964	Reservoir	Talbingo Reservoir, upstream of Lobs Hole WTP diffuser outlet and water intake point
EPL011	Lobs Hole	148.374568	-35.770686	Reservoir	Talbingo Reservoir, downstream of Lobs Hole STP/WTP diffusion monitoring



ID #	Location	Longitude	Latitude	Media	Description
EPL012	Lobs Hole	148.414102	-35.789259	Surface water	Yarrangobilly River, immediately downstream of portal pad
EPL014	Lobs Hole	148.404957	-35.794010	Surface water	Yarrangobilly River, upstream of MY/LHG PSE
EPL015	Lobs Hole	148.403901	-35.792462	Surface water	Yarrangobilly River, upstream of MY/LHG PSE downstream
EPL016	Lobs Hole	148.392736	-35.785488	Surface water	Yarrangobilly River, upstream of MY/LHG PSE downstream?
EPL024	Lobs Hole	148.388545	-35.779893	Surface water	Unnamed tributary downslope of GF01 PSE
EPL025	Lobs Hole	148.415198	-35.788038	Groundwater	Monitoring well, downslope of MAT portal
EPL026	Marica	148.488265	-35.794350	Surface water	Eucumbene River, downstream of Marica Road
EPL027	Marica	148.488210	-35.794470	Surface water	Eucumbene River, upstream of Marica Road
EPL028	Tantangara	148.653607	-35.747597	Reservoir	Upstream in the mouth of the Murrumbidgee River.
EPL029	Tantangara	148.652978	-35.793034	Reservoir	Downstream of works area and upstream of lower Murrumbidgee River
EPL030	Tantangara	148.652001	-35.801362	Surface water	Kellys Plain Creek, downstream of accommodation camp and laydown areas
EPL031	Tantangara	148.648474	-35.806315	Surface water	Kellys Plain Creek, upstream of accommodation camp and laydown areas
EPL032	Tantangara	148.658771	-35.789504	Reservoir	Tantangara intake, downstream of construction works
EPL033	Tantangara	148.664114	-35.795317	Surface water	Murrumbidgee River, downstream of Tantangara reservoir outlet
EPL034	Nungar Creek	148.633218	-35.865454	Surface water	Nungar Creek, upstream of Tantangara Road
EPL035	Nungar Creek	148.632658	-35.865164	Surface water	Nungar Creek, downstream of Tantangara Road
EPL036	Rock Forest	148.667625	-35.952408	Surface water	Camerons Creek, upstream of works
EPL037	Rock Forest	148.675088	-35.947715	Surface water	Camerons Creek, downstream of works
EPL038	Tantangara	148.652978	-35.769468	Reservoir	Between the emplacement area and the ancillary facilities for emplacement activities - Location variable dependant on reservoir levels
EPL039	Tantangara	148.639317	-35.761213	Surface water	Confluence of Nungar Creek and Tantangara Reservoir, upstream of construction works - Location variable dependant on reservoir levels



ID #	Location	Longitude	Latitude	Media	Description
EPL040	Tantangara	148.622654	-35.754604	Surface water	Confluence of the upper Murrumbidgee River and Tantangara Reservoir, upstream of works - Location variable dependant on reservoir levels
EPL041	Talbingo Reservoir	148.380829	-35.771967	WTP - Discharge Point	Lobs Hole WTP final effluent quality monitoring point. Downstream of final treatment, prior to discharge to Talbingo Reservoir.
EPL042	Talbingo Reservoir	148.374923	-35.771412	Diffusion Point	This EPL point does not require water quality monitoring for the purpose of EPL21266.
EPL043	Talbingo Reservoir	148.381442	-35.772248	Vol - Outflow	This EPL point does not require water quality monitoring for the purpose of EPL21266.
EPL044	Lobs Hole	148.417439	-35.787129	Vol - Inflow	This EPL point does not require water quality monitoring for the purpose of EPL21266.
EPL045	Lobs Hole	148.392697	-35.783244	STP - Inflow Vol	This EPL point does not require water quality monitoring for the purpose of EPL21266.
EPL046	Tantangara	148.657000	-35.795000	Diffusion Point	This EPL point does not require water quality monitoring for the purpose of EPL21266.
EPL047	Lobs Hole	148.392000	-35.783000	Vol - Inflow	This EPL point does not require water quality monitoring for the purpose of EPL21266.
EPL048	Tantangara	148.656000	-35.802000	STP - Inflow Vol	STP Inflow Volume Monitoring Point - This EPL point does not require water quality monitoring for the purpose of EPL21266.
EPL049	Tantangara	148.650000	-35.791000	WTP - Inflow Vol	WTP Inflow Volume Monitoring Point - This EPL point does not require water quality monitoring for the purpose of EPL21266.
EPL050	Tantangara Reservoir	148.651000	-35.791000	WTP - Discharge Point	Tantangara WTP final effluent quality and volume monitoring point. Downstream of final treatment, prior to discharge to Tantangara Reservoir.
EPL051	Tantangara	148.659112	-35.794459	Reservoir	Tantangara Reservoir downstream of Tantangara STP/WTP diffusion monitoring of diffusion point EPL046
EPL052	GF01	148.388006	-35.778141	Leachate water	Talbingo Reservoir, upstream of GF01 emplacement area GF01 Leachate Basin



ID #	Location	Longitude	Latitude	Media	Description
EPL053	GF01	148.391374	-35.774478	Surface water	Upstream East of GF01 spoil emplacement area
EPL054	GF01	148.389043	-35.775550	Surface water	Upstream west of GF01 spoil emplacement area
EPL055	GF01	148.387530	-35.778434	Surface water	Downstream of GF01 spoil emplacement area
EPL056	GF01	148.391504	-35.774757	Groundwater	Upstream east from GF01 spoil emplacement area
EPL057	GF01	148.389143	-35.775432	Groundwater	Monitoring well, upgradient west from GF01 spoil emplacement area
EPL058	GF01	148.388008	-35.778606	Groundwater	Downgradient from GF01 spoil emplacement area
EPL059	Tantangara	148.644450	-35.761807	Leachate water	Leachate basin Tan-SW-SB1
EPL060	Tantangara	148.644730	-35.760387	Leachate water	Leachate basin Tan-SW-SB2
EPL061	Tantangara	148.648002	-35.760057	Leachate water	Leachate basin Tan-SW-SB3
EPL062	Tantangara	148.649503	-35.761683	Leachate water	Leachate basin Tan-SW-SB4
EPL063	Tantangara	148.649257	-35.762963	Leachate water	Leachate basin Tan-SW-SB5
EPL064	Tantangara	148.648720	-35.763713	Leachate water	Leachate basin Tan-SW-SB6
EPL065	Tantangara	148.648205	-35.764105	Leachate water	Leachate basin Tan-SW-SB7
EPL066	Tantangara	148.650588	-35.763047	Leachate water	Leachate basin Tan-SW-DSE
EPL067	Tantangara	148.642513	-35.759873	Leachate water	Nungar Creek, downstream west from Tantangara spoil emplacement area



ID #	Location	Longitude	Latitude	Media	Description
EPL068	Tantangara	148.644412	-35.760452	Groundwater	Downgradient east from Tantangara spoil emplacement area
EPL069	Tantangara	148.649502	-35.762842	Groundwater	Downgradient west from Tantangara spoil emplacement area
EPL070	Tantangara	148.645177	-35.769867	Groundwater	Upgradient from Tantangara spoil emplacement area
EPL071	Marica	148.452542	-35.786057	Surface water	Downstream from Marica spoil emplacement area
EPL072	Marica	148.464127	-35.786946	Groundwater	Upgradient from Marica spoil emplacement area
EPL073	Marica	148.455317	-35.785423	Groundwater	Downgradient from Marica spoil emplacement area
EPL076	Rock Forest	148.667000	-35.949000	Leachate water	LDP Rock Forest basin
EPL077	~~Rock Forest~~	N/A	N/A	Leachate water	Proposed location for LDP Rock Forest basin monitoring – as at time of revision (notice 1638603), this location has not been installed.
EPL078	~~Rock Forest~~	N/A	N/A	Leachate water	Proposed location for LDP Rock Forest basin monitoring – as at time of revision (notice 1638603), this location has not been installed.
EPL079	~~Rock Forest~~	N/A	N/A	Leachate water	Proposed location for LDP Rock Forest basin monitoring – as at time of revision (notice 1638603), this location has not been installed.
EPL080	Lobs Hole	148.399849	-35.792176	Groundwater	Monitoring well, upgradient to Lick Hole Gully
EPL081	Lobs Hole	148.401436	-35.790078	Groundwater	Monitoring well, downgradient to Lick Hole Gully
EPL082	Lobs Hole	148.396579	-35.791820	Groundwater	Monitoring well, upgradient from Main Yard emplacement area
EPL083	Lobs Hole	148.399201	-35.787649	Groundwater	Monitoring well, downgradient from Main Yard emplacement area
EPL084	Lobs Hole	148.398896	-35.788017	Leachate water	Main Yard leachate basin
EPL085	Lobs Hole	148.401224	-35.790453	Leachate water	Main Yard leachate basin MY07
EPL086	Lobs Hole	148.402909	-35.791298	Leachate water	Lick Hole Gully leachate basin LHG01



ID #	Location	Longitude	Latitude	Media	Description
EPL087	Lobs Hole	148.393426	-35.784759	Groundwater	Downgradient from Main Yard spoil emplacement area
EPL088	Lobs Hole	148.396466	-35.786256	Groundwater	Downgradient from Main Yard emplacement area
EPL089	Lobs Hole	148.403978	-35.791055	Groundwater	Lick Hole Gully groundwater monitoring downgradient from GF01 emplacement area
EPL090	GF01	148.386253	-35.778407	Groundwater	Downgradient from GF01 spoil emplacement area
EPL091	GF01	148.386839	-35.779461	Groundwater	Downgradient from GF01 spoil emplacement area
EPL092	GF01	148.387379	-35.777690	Groundwater	Downgradient from GF01 spoil emplacement area
EPL093	GF01	148.387746	-35.777780	Groundwater	Downgradient from GF01 spoil emplacement area
EPL094	GF01	148.387769	-35.777789	Groundwater	Downgradient from GF01 spoil emplacement area
EPL095	GF01	148.388054	-35.778647	Groundwater	Downgradient from GF01 spoil emplacement area
EPL096	GF01	148.389189	-35.777734	Groundwater	Downgradient from GF01 spoil emplacement area
EPL097	GF01	148.390030	-35.778508	Groundwater	Downgradient from GF01 spoil emplacement area
EPL098	GF01	148.388009	-35.778392	Surface water	Rock blanket diversion monitoring under GF01 liner
EPL099	Marica	148.463248	-35.785469	Leachate water	Marica Leachate Basin - Turkey's nest
EPL100	Marica	148.461039	-35.785835	Leachate water	Lower leachate basin USS Shaft
EPL101	Marica	148.461624	-35.786252	Leachate water	Leachate basin spoil pad
EPL102	Marica	148.454939	-35.785422	Groundwater	GW Bore on Marica Trail, adjacent MT06.
EPL103	Tantangara	148.643670	-35.768424	Groundwater	Groundwater Upstream - West of emplacement area
EPL104	Tantangara	148.647485	-35.766857	Groundwater	Groundwater Downslope - East of emplacement area
EPL105	Tantangara	148.642441	-35.766230	Groundwater	Groundwater Downslope - West of emplacement area



ID #	Location	Longitude	Latitude	Media	Description
EPL1106	Ravine Bay	148.357205	-35.758060	Leachate water	Leachate basin 1
EPL1107	Ravine Bay	148.365751	-35.760429	Reservoir	Reservoir water – Yarrangobilly Upstream
EPL1108	Ravine Bay	148.355537	-35.762692	Reservoir	Reservoir water – Yarrangobilly centre of PSE
EPL1109	Ravine Bay	148.352460	-35.757508	Reservoir	Reservoir water – Yarrangobilly Upstream
EPL1110	Ravine Bay	148.362993	-35.752503	Surface water	Upstream from spoil emplacement area
EPL1111	Ravine Bay	148.359788	-35.754327	Surface water	Upstream from rock mattress at spoil emplacement area, rock mattress
EPL1112	Ravine Bay	148.361781	-35.756536	Surface water	Downstream from rock mattress at spoil emplacement area, rock mattress
EPL1113	Ravine Bay	148.364023	-35.753250	Groundwater	Monitoring well, upstream east of emplacement area
EPL1114	Ravine Bay	148.358140	-35.755696	Groundwater	Monitoring well, upstream west of emplacement area
EPL1115	Ravine Bay	148.361780	-35.757011	Groundwater	Monitoring well, downstream east of emplacement area
EPL1116	Ravine Bay	148.356810	-35.757232	Groundwater	Monitoring well, downstream west of emplacement area
EPL1117	Ravine Bay	148.358870	-35.757928	Groundwater	Monitoring well, downstream of emplacement area
EPL1118	Ravine Bay	148.362196	-35.755675	Leachate water	Leachate Basin 2
EPL1119	Ravine Bay	148.362196	-35.754811	Leachate water	Leachate Basin 3
EPL1120	Ravine Bay	148.362978	-35.753004	Leachate water	Leachate Basin 4
EPL1121	~~Leachate~~ Hole	N/A	N/A	~~Surface water~~	Proposed Location. Monitoring of groundwater seepage point below LHG. As at time of revision (notice 1638603), this location has not been installed.
EPL1122	GF01	148.385177	-35.780204	Surface water	Previously named EPL 55b - GF01 Drainage line

ANNEXURE B – GROUNDWATER TARP 1 GROUNDWATER LEVEL



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MANAGEMENT PLAN

SNOWY 2.0 MAIN WORKS – GROUNDWATER TARP 1 GROUNDWATER LEVEL

S2-FGJV-ENV-PLN-0147

REV. I

DECEMBER, 2025

ABSTRACT

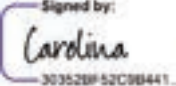
The key objective of this Plan is to detail management measures where groundwater level variation is identified. This Plan is for the groundwater level monitoring network controlled by SHL. The groundwater level network is not regulated or referred to as part of EPL21266.

Revision Record

Rev.	Date	Reason for Issue	Responsible	Accountable	Endorsed
I	13.12.2025	Updated to include EPA comments and in accordance with Schedule 4 condition 4b of the CoA.	S. Lang	E. Porter	D. Drummond F. Lazzarin



Document Verification**RACIE Record**

R esponsible:	Name: Scott Lang Job Title: Environmental Coordinator Signed:  arolina p.p Date: 05 February 2026	
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I nformed:	See distribution list on Page 3.	
E ndorsed:	Name: Fabrizio Lazzarin Job Title: Project Director Signed:  Fabrizio Lazzarin Date: 06 February 2026	Name: David Drummond Job Title: QSHE Director Signed:  JT Date: 05 February 2026

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Revision Tracking

Rev.	Date	Description of Revision
A	29.11.2019	Initial draft for SHL review
B	29.05.2020	Revised to address Infrastructure Approval
C	15.06.2020	Revised to address SHL comments. For consultation.
D	25.06.2020	Update to address Commonwealth conditions of approval
E	06.08.2020	Revised to address stakeholder comments
F	19.09.2020	Revised to address DAWE and DPIE comments
G	28.09.2022	Revised to address annual audit findings and currency.
H	10.07.2025	Updated for currency
I	14.12.2025	Updated to address EPA comments

This groundwater level TARP applies to the Groundwater Level Monitoring Network as described in Section 3.2 of the Groundwater Monitoring Program (S2-FGJV-ENV-PLN-0108).

Table B-1: Groundwater Level TARP

Trigger Level	Trigger	Action	Response
Level 1 (Indicator)	Groundwater level measurements within trigger limits	Continue to monitor levels in accordance with monitoring plan	No response required.
Level 2 (Early warning)	Water level records are trending towards an exceedance (80% of SSTV), but within predicted levels. (SHL controlled bores only)	Continue to monitor levels in accordance with monitoring plan	Conduct preliminary review of activities occurring in vicinity of subject bore(s), including groundwater usage (i.e. Groundwater Usage TARP)/
Level 3a (Exceedance of Threshold Trigger level)	Groundwater level measurements trigger investigation	Engage suitably qualified person ¹ to conduct review of potential Project related impacts.	Report results of trigger investigation to DPHI. If trigger exceedance is determined to be attributable to construction, proceed to Level 3b. If trigger response is determined not to be attributable to construction, review trigger levels and up-date monitoring plan. Report results in Annual Return.
Level 3b (Exceedance identified as related to construction activities)	Groundwater level triggers due to construction activities	Engage suitably qualified person to prepare report and identify potential for impacts on a receptor.	SHL to notify DPHI and NPWS within seven days of the trigger investigation report (Level 3a Report). Provide DPHI and NPWS with a trigger exceedance report within 30 days of notification. Identify mitigation actions or revisions to trigger levels in consultation with DPHI.
Level 4 (Limit Trigger denotes impact on receptor)	Water level drawdown impacts on a receptor (GDE)	Activate mitigation measures ² to remediate impact to receptor	Initiate investigation into reasons for impact on receptor including assessment of environmental harm. Take actions recommended by investigation.

¹ In some circumstances SHL or FGJV staff may have sufficient experience to conduct the investigation. In other circumstances a specialist may be required.

² Mitigation measures as developed at Level 3b

ANNEXURE C – GROUNDWATER TARP 2 GROUNDWATER QUALITY



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MANAGEMENT PLAN

SNOWY 2.0 MAIN WORKS – GROUNDWATER TARP 2 - GROUNDWATER QUALITY

S2-FGJV-ENV-PLN-0148

REV I

DECEMBER 2025

ABSTRACT

The key objective of this Plan is to detail management measures where groundwater quality objective exceedances are identified

Revision Record

Rev.	Date	Reason for Issue	Responsible	Accountable	Endorsed
I	13.12.2025	Updated to include EPA comments and in accordance with Schedule 4 condition 4b of the CoA.	S. Lang	E. Porter	F. Lazzarin D. Drummond



Document Verification

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I nformed:	See distribution list on Page 3.	
E ndorsed:	Name: Fabrizio Lazzarin Job Title: Project Director Signed: DocuSigned by: F.L. 7C8EE8718ACA958... Date: 06 February 2026	Name: David Drummond JUSTIN TANNOCK Job Title: QHSE Director JT Signed: Signed by: JD 179A3387DF36471... Date: 05 February 2026

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Revision Tracking

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C	15.06.2020	Revised to address SHL comments. For consultation.
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E	06.08.2020	Revised to address stakeholder comments
F	19.09.2020	Revised to address DAWE and DPIE comments
G	28.09.2022	Revised to address annual audit findings and currency.
H	31.07.2025	Revised to address annual findings and currency
I	14.12.2025	Updated to address EPA comments

This groundwater quality TARP identified in Table C-1 should be read in conjunction with Section 3.3 of the Groundwater Monitoring Program (S2-FGJV-ENV-PLN-0108).

Table C-1: Groundwater Quality TARP

Level	Trigger	Action	Response
Level 1	Groundwater quality measurements within WQO's	Continue to monitor water quality parameters in accordance with monitoring plan	No response required
Level 2 (Exceedance of Threshold Trigger level)	Groundwater quality analytical results outside WQO	¹Conduct validation sampling within 7 days of review of initial NATA comprehensive results. Validation sampling must be comprehensive and include physiochemical conditions. Conduct assessment to determine the source point of the exceedance. Review ambient waterbody parameters to determine if result is within ambient ranges.	If results of validation sampling confirm initial result, inform SHL of the exceedance. SHL to inform NSW EPA within 24 hours. An initial incident notification is to be issued to SHL within 24 hours of notifying an SHL assurance officer. If exceedance has resulted from Project related activities, proceed to level 3. If exceedance is not to be attributable to the Project, cease investigation and sampling. Report exceedance information in the EPL21266 required Biannual Environmental Monitoring Report and the Annual Return.
Level 3 (Exceedance identified as related to construction activities)	Identification of Project causation.	Conduct location inspection and remove any potential point sources. If required, engage suitable party to undertake remedial and / or validation assessments.	SHL to notify NSW EPA within 24 hours of becoming aware of Project impact. A further detailed investigation report is to be issue to SHL within 3 days of notification. SHL must provide written details of the notification to the NSW EPA within 7 days of the date on which they became aware of the incident. Weekly Basic and Comprehensive sampling to cease after 2 months unless identification of inconsistent data variation.

Level	Trigger	Action	Response
			Identify mitigation actions or revisions to trigger levels in consultation with NSW EPA.
Level 4 (Limit Trigger denotes Impact on receptor)	Water quality changes impacts on a receptor (GDE)	Activate mitigation measures to remediate impact to receptor ² Engage suitably qualified person to prepare report and identify potential for impacts on a receptor.	Initiate investigation into reasons for impact on receptor, including assessment of environmental harm. Take actions recommended by investigation.

1 All sampling and analysis must be done within 14 days of the event commencing (where safe and practicable to achieve). Reporting is to align with the most recent EPL 21266 variation at the time of incident.

2 Mitigation measures as developed at Level 3.

ANNEXURE D – GROUNDWATER TARP 3 GROUNDWATER INGRESS



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MANAGEMENT PLAN

SNOWY 2.0 MAIN WORKS – GROUNDWATER TARP 3 - GROUNDWATER INGRESS

S2-FGJV-ENV-PLN-0149

REV. H

DECEMBER, 2025

ABSTRACT

The key objective of this Plan is to detail management measures where groundwater ingress is identified.

Revision Record

Rev.	Date	Reason for Issue	Responsible	Accountable	Endorsed
H	06/45/2025	Revised to address annual findings and currency	S. Lang	E. Porter	D. Drummond



Document Verification

RACIE Record

R esponsible:	Name: Scott Lang Job Title: Environmental Coordinator Signed:  Carolina p.p Date: 05 February 2026
A ccountable:	Name: Ellen Porter Job Title: Environmental Manager Signed:  Ellen Porter Date: 05 February 2026
C onsulted:	See distribution list on Page 3.
I nformed:	See distribution list on Page 3.
E ndorsed:	Name: Fabrizio Lazzarin Job Title: Project Director Signed:  Fabrizio Lazzarin Date: 06 February 2026 Name: David Drummond Job Title: JUSTIN TANNOCK Signed:  Justin Tannock Date: 05 February 2026

RACIE Terms

R	Responsible The person who actually produces the document.
A	Accountable The person who has the answer for success or failure of the quality and timeliness of the document.
C	Consulted Those who must be consulted before the document is published.
I	Informed Those who must be informed after the document is published.
E	Endorsed Those who must approve the document before publication.

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Revision Tracking

Rev.	Date	Description of Revision
A	29.11.2019	Initial draft for SHL review
B	29.05.2020	Revised to address Infrastructure Approval
C	15.06.2020	Revised to address SHL comments. For consultation.
D	25.06.2020	Update to address Commonwealth conditions of approval
E	06.08.2020	Revised to address stakeholder comments
F	19.09.2020	Revised to address DAWE and DPIE comments
G	28.09.2022	Revised to address annual audit findings and currency.
H	31.07.2025	Revised to address annual audit findings and currency

This groundwater ingress TARP identified in Table D-1 should be read in conjunction with Section 7.2 of the GMP (S2-FGJV-ENV-PLN-0012)

Table D-1: Groundwater Ingress TARP

Level	Trigger	Action	Response
Level 1 (Indicator)	Groundwater take within license allocation	Continue to monitor levels in accordance with monitoring plan	No response required
Level 2 (Early warning)	Groundwater use trending to exceeding 80% of allocation	Identify major contributor to water usage and feasible actions to prevent usage exceeding allocation	Conduct review of groundwater usage, recent groundwater level monitoring results (i.e. Groundwater Level TARP) and determine drivers for identified trend and potential for recurrence Identify availability of additional water from relevant water source on the water market Investigate water ingress reduction measures Review recent groundwater level monitoring
Level 3a (Exceedance of Threshold Trigger level)	Groundwater usage exceeds 80% of allocation	Implement actions identified above if forecast indicates usage will exceed 100% of allocation	Report results in Annual Review. Initiate purchase of additional water entitlements if reduction measures are unsuccessful.
Level 3b (Exceedance identified as related to Main Works activities)	Groundwater modelling predicts usage will exceed 100% of allocation in the future	Initiate purchase of additional water from relevant water source on the water market	Report results in Annual Return.
Level 4 (Limit Trigger denotes Impact on receptor)	Water usage exceeds 100% of allocation	Formalise purchase water entitlements to account for exceedance	Initiate investigation into reasons for exceedance and report reports in Annual Review. SHL to notify NSW EPA, NRAR and/or DPIE Water Group as per regulatory requirements. An incident report detailing the cause, impact, and corrective actions taken to address the exceedance must be provided to the regulatory bodies (via SHL) within the specified statutory timeframe. Take actions recommended by investigation to prevent recurrence.